Gary L. Comstock
Editor

Life Science Ethics

Second Edition

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Springer

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Dedicated to my brother Doug and the memory of his beloved wife, Emily Goyer Comstock, whose grace was exceeded only by her courage

Acknowledgments for the Second Edition

The second edition would not have been possible without the support of three organizations.

The National Science Foundation supported three projects leading to this publication. The "Advanced Bioethics Ethics Institute" (award #0234227), or Advanced Life Science Ethics Institute (ALSEI), helped to sponsor international workshops in Lisbon, Seville, Raleigh, Hannover, and Moscow. Participants developed pedagogical materials in Portuguese, Spanish, German, and Russian based on materials found in the first edition of *Life Science Ethics*. NSF also sponsored "A Model Curriculum for Land Grant Universities in Research Ethics" (LANGURE, award #0530217) and "Extend and Assess Research Ethics Education" (EAREE, award #0734919), grants that have underwritten the revising, soliciting of new articles, and editing of the second edition. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

The National Humanities Center and its Director, Geoffrey Harpham, launched a project in 2005 to explore challenges to the humanities in the new life sciences and technologies. During the 2007–09 academic years, the editor enjoyed a research assignment as one of the Center's ASC (Autonomy Singularity and Creativity) Fellows. Of the many debts I owe to the Center, I express just one: to the exceptional staff, including librarians Eliza Robertson, Jean Houston, and Josiah Drewry; copyeditor, Karen Carroll; and digital media producer, Phillip R Barron. Along with their skilled colleagues at the Center, they made the completion of this book possible and pleasurable.

The Kenan Institute for Engineering, Technology and Science at North Carolina State University under the direction of Ruben Carbonell sponsored a seminar called the Life Science Ethics Triangle Workshop in 2004–05. The Kenan Institute's participation achieved several objectives, including helping to create synergies between the NSF and NHC projects.

It is a pleasure to acknowledge these sources of support.

Finally, I thank Drew Comstock for proofreading the galleys.

Acknowledgments for the First Edition

This book is one of the products of National Science Foundation (NSF) grants SBR-9254504 and SES-9906244, grants that supported the "Iowa State University Model Bioethics Institutes." The Iowa State University Model Institutes are faculty development workshops for life scientists that began in 1991 at Iowa State. In the last decade, the Institutes have visited five other U.S. campuses: the University of Illinois, Michigan State, Purdue, North Carolina State, and Oregon State. In the year 2000, they expanded to reach an international audience, with Institutes at the Foundation for Luso-American Development (FLAD), in Lisbon, Portugal. We are grateful for FLAD's support, and specifically for the contributions of FLAD's forward-looking director, Dr. Charles Buchanan.

The majority of this book's chapters grew out of papers originally presented at one ISU Model Institute or another. Almost all the case studies in Part III began their lives as drafts produced at an Institute.

Deeply grateful to NSF for its support, we hasten to offer special recognition of Dr. Rachelle Hollander, Director of NSF's Ethics and Values Studies Program. Dr. Hollander has exhibited extraordinary vision and courage in her efforts to stimulate the integration of discussions of ethics into the life science curriculum. Were it not for her efforts in championing a broad range of highly successful research and teaching projects in the area of science and values, the gap between the so-called "two cultures" would, alas, be wider than it is.

The editor was able to finish the project thanks to grant support from the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, under agreement 00-52100-9617. The USDA requires us to add: "Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture."

Finally, speaking personally, I wish to acknowledge the active support of Patricia B. Swan, formerly Vice-Provost for Research at Iowa State University. Not only did Dr. Swan rigorously guard the autonomy and health of the ISU Bioethics Program during her tenure as Vice-Provost from 1990–2000, she also powerfully shaped the future of biological education by first suggesting the outlines of what would become the ISU Bioethics Institute.

Introduction to the Second Edition

Life science ethics remains a relatively new field in practical ethics. It addresses moral concerns surrounding nonhuman life forms, agriculture, and the environment. Addressed in the first edition of *Life Science Ethics*, these issues grow increasingly critical even as they draw an expanding international audience. As scientific discoveries and cultural developments bring our nations closer together, the ethical questions surrounding the biological sciences gather urgency.

This updated edition continues the original focus of the first edition while presenting a new chapter on animals in research; a revised version of Charles Taliaferro's essay on "Farms," now coauthored with Stephen Carpenter; an additional essay by the editor on "Genetically Modified Foods;" new chapters on climate change and nanotechnology; and a revised set of case studies in Part III. The revision of Part III streamlines the number of cases to make them easier to use and expands their scope by adding four topics:

- Genetically modified foods
- Animals in research
- Climate change
- Nanotechnology

The reader will now find essays on each of these topics in Part II and matching case studies in Part III.

A word about the international scope of our concerns is in order. After the first edition appeared, the National Science Foundation joined the Foundation Luso-American Development (FLAD) and the Orient Foundation in Lisbon to announce a transatlantic initiative, the Advanced Life Science Ethics Institute (ALSEI). From 2003 to 2007, ALSEI sponsored conferences in Portugal, Germany, Spain, and Russia with the intent of publishing teaching materials on this subject in non-English languages. The meetings featured presentations by Humberto Rosa on "Biodiversity"; Susan Wolf on "The meaning of life"; Gary Varner on "Animals and ethics"; Douglas MacLean on "Environmental ethics and cost-benefit analysis," and "The meaning of life and its implications for life science ethics"; and Rachelle Hollander on "Priorities and perspectives on ethics and science." Professors Isabel L. Calderon, Jorge Casanova, and Roçio Fernández Alés (Spain); Andreas Briese, Gerhard Wiegleb, Hans Werner Ingensiep, and Heike Baranzke

(Germany); and Marina Martynova, Ruben Apressyan, Andrei Prokofiev, and Andrey Sychev (Russia) led work groups.

Within 2 years of ALSEI's start, a Portuguese volume appeared, edited by Humberto Rosa: *Bioética para as Ciências Naturais* (Lisboa: Fundação Luso-Americana, 2004). Rosa's book contains two parts, one part presenting ten essays on life science ethics and a second offering seven case studies. A German volume followed in 2008 from Gerhard Wiegleb and Andreas Briese, editors: *Ethik in den Lebenswissenschaften* (Münster: Verlag Monsenstein und Vannerdat, 2008). Spanish and Russian volumes are planned.

Students in the life sciences face increasingly complex ethical issues in their careers. These students, tomorrow's professionals, need preparation to recognize ethical issues, to reason carefully about them, and to make responsible decisions in the face of difficult dilemmas. This new edition of *Life Science Ethics* will help them prepare to address these problems. By studying its pages, they not only will be exposed to the analyses of experts taking aim at ethical problems of global scope. They will also be introduced to a group of thinkers whose international work is pointing toward solutions.

Introduction to the First Edition

Life science ethics is the normative evaluation of human actions affecting living things. We affect living things in virtually everything we do, from drinking water to cooking dinner and from sending e-mail to flushing the toilet. Sometimes we pause to reflect about these activities and, when we do, we may ask ourselves some basic philosophical questions. Does nature have intrinsic value? Should we be doing more to save wilderness and ocean ecosystems? What are our duties to future generations of humans? Do animals have rights? Should scientists sign agreements that prevent them, for a time, from making the results of their experiments known to anyone except the private industry that has funded their research? These are some of the questions we find in life science ethics.

The book is a work of applied ethics and is intended to fill a gap in the ethics literature. The gap concerns moral issues that arise when humans use what Aldo Leopold called "the land" (Leopold 1949). The book has three parts. Part I introduces ethics, the relationship of religion to ethics, how we assess ethical arguments, and a method ethicists use to reason about ethical theories.
Part II demonstrates the relevance of ethical reasoning to six topics:

- The relative moral standing of ecosystems, nonhuman animals, and future human generations
- Our duties to aid the hungry in developing countries
- Obligations to animals used to produce food, fiber, and knowledge
- Public policies to adjudicate conflicting rights-claims among urban consumers environmentalists, and farmers over the use of water and land
- The moral justifiability of genetic engineering as a whole and the patenting of life forms in particular
- The virtues traditionally associated with family farms

Part III offers twelve case studies, two cases for each of the six topics. We have found the cases useful in promoting reasoned discussion of fundamental questions in life science ethics.

A word about our title: One of the branches of life science ethics is *bioethics*, a term that has come to mean the normative evaluation of actions affecting *humans*. Is the fetus a person? Should physicians be permitted to help patients commit suicide? Who should pay for health care for the poor? These are profound and urgent

matters, and a veritable bioethics industry has grown up to reckon with them during the last four decades.

Yet, the prefix *bio* derives from the Greek word *bios*, meaning *all* life, so why restrict our attention to humans? Could *bioethics* not be used in a broader way, to encompass more than human medical ethics? The etymological origins of bio focus on life in all its myriad forms, including animal, plant, microorganismic and ecosystemic life.[1]

To date, professional ethicists have not been inclined to use the term in its original, more inclusive, sense. Representative of the debate, for example, is this call for grant applications written by a well-respected private foundation:

> Through its Interdisciplinary Program in Bioethics, the Foundation provides funding for physicians, lawyers, philosophers, economists, theologians, and other professionals to address micro and macro issues in bioethics, providing guidance for those engaged in decision making at the bedside as well as those responsible for shaping institutional and public policy.

The terms *bedside* and *physicians* clearly convey the assumption of the granting agency: Proposals should focus on the care of humans. Proposals from agronomists and animal scientists focused on ethical issues having to do with the care of plants and animals, endangered species and farm animal welfare are not likely to be considered, much less funded.

A recent experience of the editor of this volume is also telling. There is a widely respected international academic journal with a title that sounds very much like *bioethics*. I suggested to its editor that the journal consider reviewing a new book on the ethical dimensions of agricultural biotechnology. The proposal was rejected on the grounds that the subject matter of the book was not within the scope of the journal.

The narrower understanding of bioethics as medical clinical ethics is currently dominant. Hence, a new phrase is needed to convey the original meaning of the word. We have adopted *life science ethics*.

How should undergraduates be introduced to life science ethics? We have kept this question in front of us, hoping to create a text that will assist its users in sharpening their critical reasoning skills while also providing essential background concepts in moral theory. We intend our essays to be accessible to first-year college students while also introducing cutting-edge philosophical ideas. Authors, therefore, were selected because of their original contributions to ethics scholarship and on the basis of their ability to explain difficult philosophical concepts to novices.

A significant feature of the collection is its case study approach, an innovative pedagogical structure that should make the book particularly appealing to nonspecialists. The book begins with a brief narrative introducing a student, Emily, who must decide whether to cheat. The readers are invited to assess the case for themselves, look into the facts of the case, and reach their own decision about the permissibility of cheating. Emily's case should not only prove entertaining but

[1] It seems that Van Renssalaer Potter II coined the word *bioethics* in 1971 (Potter 1971). As Potter has taken pains to point out, he did not intend the word to refer narrowly to human clinical ethics, but rather to the wide range of problems associated with the global survival of all life forms (Potter 1996).

should provoke energetic and reflective classroom discussion of topics such as the following: What is ethics? How does ethics differ from custom, law, science and religion? Is there anything objective about ethics? Succeeding chapters introduce the concepts of moral reasoning and argumentation, providing students with exercises that they can complete in order to help them master the skills of critical reasoning (in Parts I and II, these exercises are located in the book's appendix), and follow Emily's story as she confronts other critical questions.

The contributors shared five objectives in writing the cases that introduce each chapter in Part II:

Accessibility: The majority of students encountering this book will not have had a course in philosophy. The cases and essays are written in such a way that these students will be able to understand them.

Plausibility: The cases are not factual because they involve imaginary characters, but they are plausible, with a high degree of verisimilitude. Ideally, they are based on actual incidents and describe situations students may face.

Philosophical fecundity: With the right tools and careful guidance, philosophical novices can be led to discuss ethical issues with a high degree of sophistication. The cases provide an introduction to key terms and ideas by which instructors can lead classes in in-depth discussions. Discussion of the cases that open the chapters in Part II (with help from the discussion questions found in the book's appendix) may be further developed by close reading of the essays that follow.

Drama: We have constructed the cases to appeal to the imagination, using narrative and dialog to heighten interest.

Coherence: We introduce a cast of characters taking a university course called "Agricultural Ethics." We follow them throughout the book, presenting a single narrative plot that builds on previous cases, lending coherence to the whole.

Each case study in Part II is accompanied by a set of discussion questions located in the book's appendix. These questions are meant to elicit conversations about the issues taken up in the essays that follow.

Each essay begins with the author discussing a new development in the Ag Ethics class and returns to the case at the end. Each essay surveys the philosophical literature, introduces different answers that have been given to the discussion questions, and leads the student through relevant philosophical topics. Each author also suggests the outlines of his or her own position on the central questions.

Our over-arching goal is to improve the students' skill in analyzing ethical arguments, and to help them discover which argument they have the best reasons to believe and act upon. Is it possible to achieve this goal? Research suggests that students can "make substantial gains in moral reasoning skills" (Garrod 1993). Teachers of critical thinking have created and tested various methods to improve these ethical capacities (Bebeau & Thoma 1994). And there is some reason to think, perhaps a bit optimistically, that as we improve our reasoning abilities in the area of ethics, we also improve our behavior.[2]

[2] "The link between moral reasoning and moral behavior is well established" (Thoma 1994).

What should university students be able to do when they have completed a science curriculum enriched with an ethics component? They should be able to speak and write with discernment and good reasoning. We will know they are discerning if their discourse evidences the ability to recognize issues as moral issues; articulate and apply moral principles, values, and approaches; and analyze cases in a self-reflective way. We will know they can reason well if their discourse evidences knowledge of the accepted moral standards within their field; knowledge of key ethical arguments, figures, and texts; the ability to speak and write in a way that is logical, complete, consistent, and clear and that can recognize potential objections to one's position.

Students need to be able to discern and reason if they are to live a good life, the life of a reflective, mature citizen and a morally responsible professional. Science graduates will enter a workplace in which many issues once thought to be purely technical, scientific, or legal now clearly have an ethical dimension. The challenges they face as professionals will increasingly be challenges their mentors have not faced. Consequently, students may find themselves having to say something intelligent, perhaps with a television camera in their face, without having had a chance to discuss the question with peers.

We can assist these students by helping them to recognize, organize, and evaluate moral arguments; by creating a learning environment that fosters cooperation, analysis and criticism; by introducing them to moral arguments relevant to their disciplines; by modeling proper scientific conduct; and by providing them with case studies that raise relevant ethical issues. We hope this book will help achieve at least some of these goals.

Contents

List of Figures

List of Tables

Contributors

Deb Bennett-Woods is Chair and Associate Professor of Health Care Ethics and Director of the Center for Ethics and Leadership in the Health Professions at Regis University. She formerly directed the Department of Health Services Administration and has a background in health care management and leadership. The author of *Nanotechnology: Ethics and Society* (CRC 2008) and a variety of other publications, she is a frequent speaker at conferences and public forums on various issues related to bioethics, health care policy, strategic leadership and management development. She is currently interested in the impact of emerging technologies on both the moral and practical dimensions of health care.

Stephen Carpenter is a practicing lawyer in Minnesota and has worked as an attorney on behalf of family farmers since 1993. He has written often on family farmer legal issues, including in the *Drake Journal of Agricultural Law* and in *Clearinghouse Review: A Journal of Poverty Law*. He also contributed a chapter to *Challenges to Equality: Poverty and Race in America*, and has spoken across the country to lawyers, farmers, and farm advocates on legal issues affecting the rights of family farmers. He has taught at Boston University and is a graduate of Stanford Law School, where he served as Executive Editor of the *Stanford Law Review*.

Gary L. Comstock is professor of philosophy at North Carolina State University and was Autonomy Singularity Creativity Fellow of the National Humanities Center, 2007–09. His research focuses on ethical issues in biology. The author of *Vexing Nature? On the Ethical Case Against Agricultural Biotechnology* (Kluwer 2000), he has published more than 50 articles and book chapters and edited the volumes *Is There a Moral Obligation to Save the Family Farm?* (Iowa State 1987) and *Religious Autobiographies* (Wadsworth 2003). Editor-in-chief of two online seminars – *OpenSeminar on the Human* and *OpenSeminar in Research Ethics* – Comstock is currently exploring the idea that humans are a singularity, a group whose members are morally superior to animals and machines.

Stephen M. Gardiner is associate professor of philosophy at the University of Washington, Seattle. His main areas of interest are moral and political philosophy, especially as they concern global environmental issues. He is currently writing a book on ethics and climate change, entitled *A Perfect Moral Storm* (Oxford

forthcoming). He is also the editor of *Virtue Ethics, Old and New* (Cornell 2005), and coeditor (with Simon Caney, Dale Jamieson, and Henry Shue) of *The Ethics of Climate Change* (Oxford 2009). He has also written articles on the precautionary principle, Aristotle's account of the reciprocity of the virtues, Seneca's doctrine of moral rules, and Socrates' politics.

Fred Gifford is professor of philosophy, associate of the Center for Ethics and Humanities in the Life Sciences, and director of the Graduate Specialization in Ethics and Development at Michigan State University, and was the on-site coordinator for the 1995 and 1996 Bioethics Institutes at MSU. His articles on bioethics and philosophy of science appear in *Biology and Philosophy*, *Bioethics*, *Journal of Medicine and Philosophy*, *Theoretical Medicine*, and *The Hastings Center Report*. He developed and coteaches a course in horticulture on ethics in agricultural biotechnology, and developed and teaches a Study Abroad course on development and health care in Costa Rica.

Richard Haynes is emeritus associate professor of philosophy at the University of Florida. He is founding editor of the journal *Agriculture and Human Values* and current editor of the *Journal of Agricultural and Environmental Ethics*. He is also executive secretary of the Agriculture, Food, and Human Values Society. He is author of *Animal Welfare: Competing Conceptions and Their Ethical Implications* (Springer 2008). His areas of research and teaching include philosophy of law, social political philosophy, environmental ethics, and applied ethics.

Christopher M. Kelty is an associate professor at the University of California, Los Angeles. He has a joint appointment in the Center for Society and Genetics and in the department of Information Studies. His research focuses on the cultural significance of information technology, especially in science and engineering. He is the author most recently of *Two Bits: The Cultural Significance of Free Software* (Duke 2008), as well as numerous articles on open source and free software, including its impact on education, nanotechnology, the life sciences, and issues of peer review and research process in the sciences and in the humanities.

Hugh LaFollette is Cole Chair in Ethics at the University of South Florida, St. Petersburg. His most recent book is *The Practice of Ethics* (Blackwell 2007). He is currently editing the *International Encyclopedia of Ethics*, a 10+ volume reference work to be published in 2011 by Wiley-Blackwell. He is author and editor of other books and articles, including *Oxford Handbook of Practical Ethics* (Oxford 2003), *Blackwell Guide to Ethical Theory* (Blackwell 2000), *Ethics in Practice*, second edition (Blackwell 2001) (with Niall Shanks) *Brute Science: Dilemmas of Animal Experimentation* (Routledge 1996), and (with W. Aiken) *World Hunger and Morality* (Prentice-Hall 1996).

Larry May is professor of philosophy at Washington University in St. Louis. He has three recent authored books and several recent anthologies. The authored books are *Crimes Against Humanity: A Normative Account* (Cambridge 2005), *War Crimes and Just War* (Cambridge 2007), and *Aggression and Crimes Against Peace*

(Cambridge 2008). The most recent anthologies include *War: Essays in Political Philosophy* (Cambridge 2008) and *Philosophy of Law: Classical and Contemporary Essays* (Blackwell 2009). He is also the author of *The Morality of Groups* (Notre Dame 1987), *Sharing Responsibility* (Chicago 1992), and *The Socially Responsive Self* (Chicago 1996). He has a law degree as well as a doctorate in philosophy.

Lilly-Marlene Russow is professor of philosophy at Purdue University, with an appointment in the Department of Veterinary Pathobiology. She is coauthor with Martin Curd of *Principles of Reasoning* (St. Martin's 1989), and she wrote the seminal, often reprinted article, "Why Do Species Matter?" She has also authored numerous articles on philosophy of mind, environmental ethics, and ethics and animals. A special interest in the treatment of laboratory animals is reflected in several articles in scientific journals, and in her work with national groups such as the Scientists' Center for Animal Welfare (SCAW). She directed three Bioethics Institutes at Purdue University, two of which were sponsored by NSF Grant SBR-9601759. Parts of her contributions here were results of the Institutes.

Charles Taliaferro is professor of philosophy and environmental studies at St. Olaf College. He has contributed to the journals *Environmental Ethics* and *Agriculture and Human Values*, and addressed environmental concerns in contributions to *Environmental Virtue Ethics, The Companion to Environmental Philosophy*, *The Agrarian Roots of Pragmatism*, and his book *Consciousness and the Mind of God* (Cambridge 1994). Taliaferro is a member of an Agricultural Concerns Group in Northfield, Minnesota, and active in the Land Stewardship Project, based in Boston, Massachusetts.

Paul B. Thompson holds the W. K. Kellogg Chair in Agricultural, Food and Community Ethics at Michigan State University. He has published dozens of articles on the ethics of food and agricultural technology, as well as several books including *Sustainability and Agrarian Ideals* (Kentucky forthcoming). He served as President of the Society for Philosophy and Technology and the Agriculture, Food and Human Values Society, and was twice the recipient of the American Agricultural Economics Association Award for Excellence in Communication. Most recently, he has edited a collection of essays entitled *The Ethics of Intensification: Agricultural Technology and Cultural Change* (Springer 2008), in which a distinguished group of international authors review and discuss contributions from the Food and Agricultural Organization series of Ethics Papers.

Gary Varner is associate professor of philosophy at Texas A&M University. His book *In Nature's Interests?* (Oxford 1998) provides an original analysis of what it means to have morally significant interests and examines the alleged divide between animal rights views and sound environmental policy. His published papers cover related topics in medical research, cloning, animal agriculture, and human nutrition, as well as philosophical issues associated with the National Environmental Policy Act, the Endangered Species Act, and the property takings debate. His current work focuses on applying the two-level (or "Kantian") utilitarianism of R. M. Hare to questions about the moral and legal status of animals.

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Part I
Ethical Reasoning

Chapter 1
Ethics

Gary L. Comstock

Abstract An introduction to ethics as the study of arguments about which actions one has the best reasons to undertake.

Keywords Ethics • Morality • Reasons • Custom • Law

Case: Emily the Student

Emily is starting her sophomore year at a large state university. Having not yet decided on a major and still trying to decide which courses to take during her second year, she consults her friend Doug. He tells her that his courses are largely determined by the Department of Agricultural Economics in the College of Agriculture. Thinking that she might like to take a class with Doug, she asks him what he's registered for. On his list is "Agricultural Ethics." Intrigued by the title, not to mention the possibility of hours in the library with Doug, Emily decides to enroll. She figures that she already knows a thing or two about ethics, and if she needs assistance with the agricultural stuff, Doug will be there to help out.

The week before classes are to begin, Doug calls her to say that he is going to miss the first day of classes because his father needs help putting up hay on their dairy farm. Would she take extra-careful notes in Ag Ethics and share them with him? No problem; she's glad to help. On the first day, the instructor passes out a 20-page syllabus, and Emily takes an extra for Doug. The instructor, Dr. Wright, without taking roll, reads through the syllabus and then discusses its contents with the 44 students in the class. Sitting in the back row, Emily is surprised by the last two sentences:

> On the first day of class you will read the syllabus, discuss it with the instructor, and have an opportunity to ask any questions; then you will be tested over the contents. You may not make up this quiz if you miss the first day of class.

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When discussion subsides, Wright puts three quiz questions on the board. Emily is relieved to see immediately that the answers are obvious and she quickly writes them down. While other students are finishing, Emily starts to wonder about Dr. Wright's own ethics. Is it fair to give a test on the first day and not let people make it up? Doug is absent for good reasons, reasons beyond his control, and he is a good student. Is it right for instructors to penalize absent students without first giving those students a chance to explain themselves?

Emily notes that Doug will be forced to start the semester behind the rest of the class simply because he missed the first day. Then an odd thought strikes her. She is proficient at disguising her handwriting by using her left hand and a neat, back slanting, script. Dr. Wright cannot see her behind all these people. Feeling loyal to Doug and skeptical about Wright, she quietly pulls out a second piece of paper, puts Doug's name at the top with her off hand, and writes another set of answers to the three questions. She leans back, wondering whether she ought to hand it in. Questions flood her mind. She thinks: Is this the right thing to do? Maybe not; maybe so. Doesn't it all, ultimately, come down to this: Who is to say what's right and wrong? Okay, so there is a university rule against cheating. But is that rule a good one? Was it meant to apply to my particular case? Did the people making the rule know Doug's particular circumstances? And isn't it true that other universities, like other cultures, have different rules about cheating? So maybe it is permissible to cheat – in a global, moral, sense – even if it is against the local, legal, rules. Why should I feel compelled to obey a particular, localized, version of rules when other people see things differently?

Emily wonders, What's the difference between this university's customs and morality, anyway? Is there any difference between morality and the law? Or religion? Is there anything objective about morality? It seems so subjective, so dependent on people's emotions and feelings. Morality does not seem like science at all, in which there are right and wrong answers and a method for figuring them out.

As she reflects on these perplexing questions, Emily hears Dr. Wright ask for the papers to be handed in.

Case: Discussion Questions

Turn now to the Appendix and perform Exercises 1.A and 1.B. Then, return to this chapter and continue reading.

Discussion of Issues

Should I cheat? Emily's question is one all students have faced, and nearly all have recognized that it should be answered negatively. Cheating is wrong for a variety of reasons. It is a case of breaking an implicit promise, a promise we have made to

our teachers and peers not to take advantage of each other. It is a case of unjustifiable deception; Emily would be lying to her instructor were she to put Doug's name on the piece of paper. And it is an action with potentially deleterious consequences, because in misleading Dr. Wright, Emily may be developing undesirable character traits that will diminish her reputation in the future.

In this particular instance, Emily is contemplating an action that, harsh as the word seems to us, is *immoral*. She ought to resist it. That said, you might think we are moving too fast. We can imagine cases in which the immorality of Emily's act might not be obvious. What if Emily were Dr. Wright's graduate assistant and the two of them were conducting an experiment to see whether anyone sitting around Emily would turn her in? Or, less plausibly, what if Doug were dying and his last wish was for Emily to turn in her paper as his? You may be able to think of other scenarios in which we would not automatically judge that Emily would be doing something immoral. If we hesitate to embrace the judgment that it is morally wrong for Emily to write someone else's name on work she completes, the reason may be that we fear we do not yet have all of the morally relevant facts. There might well be extenuating circumstances inclining us to approve of Emily's "cheating."

One way to navigate these potentially murky waters is to keep separate cases separate. Try the following exercise. Describe a different set of circumstances in which Emily's "cheating" would not be cheating at all. Let your imagination run here. For example, you might suppose that Emily attends a European university at which professors do not give grades to students, and for a professor even to try to give students a grade on the first day would be unimaginable, an offense against good judgment and convention. Or, you might imagine that Emily comes from a culture in which, no matter which university a student attends, students are *expected* to put others' names on papers under these conditions. Or, you might suppose that the world is very different from the one we live in and an evil god has arranged things as follows. If Emily does not put Doug's name on the paper, the entire city of Wheaton, Illinois, will blow up. Emily, knowing about the arrangement, regretfully decides to cheat rather than be responsible for the destruction of an entire town.

Let us call the entire class of imaginative cheating cases "*other* cheating cases." Call Emily's case, and every case like it, "*ordinary* cheating cases." In general, as *other* cheating cases show, we should not rush to moral judgments because we may be in the dark about important facts. That is, we may not be dealing with an ordinary case. Therefore, we must always strive to collect *all* of the information relevant to a case before deciding that some action is immoral. Caution clearly is a virtue when doing ethics.

For present purposes, assume no hidden agenda or unusual context exists here. Assume that Emily's case is simple, straightforward, and mundane. It is a situation that thousands of students face every day. And thousands of students know, as Emily does, what the right thing is to do. We do not cheat. (Or, we cheat knowing that what we are doing is wrong.) We are making moral decisions and, insofar as we successfully resist temptation, our decisions are *correct* decisions.

The problem is that when people mention *ethics*, they are not ordinarily referring to easy questions like Emily's. They are thinking of the tough questions. Should we eat veal from calves kept in anemic conditions in small confinement crates? Should we allow doctors to help people in untreatable pain end their lives? Should we engage in premarital sex when our religious faith proscribes it? Should we allow the Boy Scouts to bar gays from leadership roles? Should we allow genetic counselors to recommend abortion to patients carrying fetuses with very severe genetic abnormalities? When someone says, "Now there's an ethical issue," the statement almost always means, "Now there's a controversial case."

It is important, however, that we not let contentious issues (about which we disagree) blind us to the broad range of uncontroversial moral judgments (about which we agree). The fact seems to be that regardless of the culture, religion, or time period, people everywhere converge on a vast number of particular values, and honesty is one of them. Let us therefore try to formulate and make more precise some of the key reasons that cheating is wrong.

First, it fails to show respect. When we enroll in a class, we enter an implicit social contract, an unwritten agreement that we will do our own work, assume responsibility for our own grades, and not appropriate the work of others as our own. Not to fulfill these implied promises is to disrespect others in the class.

Second, it leads to bad consequences. It cheapens the value of the grade one earns in the class; it poisons the classroom atmosphere, causing people to guard their work and mistrust others; and it increases the likelihood that the cheater will break promises and plagiarize the work of others in the future. If cheating were to become widespread at an institution, the value of the degrees granted by that institution would also be diminished. Cheating has many negative and few positive effects.

Third, cheating undermines a sense of community. Universities are, on the whole, civil places where diverse people pursue goals of a better life while being exposed to ideas and traditions unlike those with which they were raised. If Emily could guarantee that no one would ever discover her deception, she might not be guilty of threatening this spirit of cooperation and working together to mutual advantage. But Emily cannot make that guarantee; she cannot ensure that others will never find her out. And if they find her out, they may cheat. If they cheat, others may cheat as well. Eventually, the spirit of trust and collegiality essential to university life will be badly frayed.

To reason about the intrinsic nature of the act of cheating and its potential consequences is to do ethics. Here are some frequently asked questions about ethics, and some very brief answers.

Frequently Asked Questions About Ethics

Q: What is ethics?

A: Ethics is a branch of philosophy. Philosophy has other branches, which include the following: Logic (the study of principles of good reasoning); epistemology (the study of how and what we know); metaphysics (the study of reality, e.g.,

minds, brains, souls); philosophy of religion (the study of supernatural beings). The branch of philosophy called ethics involves the study of arguments and theories about what actions are right (or wrong) and which states of affairs are good (or bad).

Q: What are the major theories within the study of ethics?

A: Utilitarianism, Deontology, Virtue Ethics, Feminism, Ethical Relativism, Natural Law, and Divine Command Theory

Q: Who are the major figures known for their contributions to ethics?

A: Deontology: Immanuel Kant (German, d. 1804); Utilitarianism: Jeremy Bentham (d. 1832) and John Stuart Mill (d. 1873), both English; Virtue Ethics: Alasdair MacIntyre and Carol Gilligan (Americans); Relativism: Gilbert Harman (American); Divine Command Theory: Karl Barth (Swiss, d. 1968)

Q: What's the study of ethics good for?

A: Answering questions about what's morally right, wrong, good, and bad.

Q: Does it hold any answers?

A: Yes! However, we don't yet know all the answers (or questions).

Q: Where does the study of ethics fit within history?

A: The religious traditions of various cultures have historically been the primary teachers of virtue and morality. Major religious figures, therefore, are important, including Moses, Jesus, Muhammad, Confucious, and Buddha. In the modern period and especially since the Enlightenment, the secular study of ethics has gained prominence, and ethics in the contemporary university often proceeds with little reference to theological claims.

Two theories are widely discussed in contemporary secular ethics: utilitarianism and rights-based theories. Utilitarianism is a form of consequentialist reasoning in which an action is judged to be right if it leads to the greatest balance of good consequences over bad consequences. Rights-based theories, on the other hand, judge actions to be right if they respect persons, regardless of consequences.

More recent developments include a movement to downplay the importance of ethical theory (*anti-theory*), and one to merge feminist and ecological thought (*ecofeminism*).

When we "do ethics," we are trying to reach a conclusion about how we ought to act by examining the reasons for and against each of our options. We think about as many of the morally relevant features of the act as possible and then figure out which option has the strongest set of reasons to support it. As we are conducting this procedure, we try to adopt what is called "the moral point of view."

Philosophers are divided about what exactly are the constituents of the moral point of view. But in general they agree that, unusual circumstances aside, we should try to reason impartially, without undue bias or prejudice. We should try to put ourselves in the position of each of the parties who will be affected by our eventual decision; then we ask ourselves whether we would be helped or harmed by each decision. Thomas Nagel calls the moral point of view "the view from nowhere"; Henry Sidgwick called it "the point of view of the universe"; and

Charles Taliaferro calls it the view taken by an "ideal observer," or God (Sidgwick 1907; Nagel 1986; Taliaferro 1997). As mentioned, it is a matter of controversy just what the moral point of view is and, even more so, to which particular moral judgments it leads. But moral reasoning is distinguished by all comers from narrowly self-interested, purely emotional, or money-grubbing forms of reasoning.

In ethics we inquire into a wide range of difficult questions, such as: Is it moral to place conditions on food aid to the starving? Should we develop biotechnologies that will displace large numbers of workers? When, if ever, is it permissible to place an embargo on grain exports in order to keep the price of domestic food low? Which uses of animals in research are acceptable and which are not? Applied ethics is what we do when we try to figure out the correct answers.

As previously noted, ethics often is interpreted to mean hotly disputed matters. And sometimes it does mean that. When it does, we must think carefully about our response. But ethics is not always, not only, an attempt to figure out answers to new and puzzling questions. It is sometimes an endeavor in which we simply try to articulate, and remind ourselves of, deeply shared values.

Sophomores often doubt whether there really are any shared values. Are there? To make some progress on this question, turn now to the Appendix and complete Exercise 1.C ("Shock Treatment for Naïve Relativism").

If we collect all of our claims, we will have begun a fairly substantial list of particular moral judgments on which we agree. Consider that:

It is morally right, all other things being equal, to:

1. Rescue your 2-year-old cousin who is drowning
2. Feed your sister's cat while she is gone on vacation
3. Help a blind person who has asked for assistance in crossing a busy intersection
4. Give your students the grades they deserve on exams

It is morally wrong, all other things being equal, to:

1. Drown the 2-year-old cousin you have been asked to babysit
2. Poke needles in your sister's cat's eyes to see whether the cat will squirm
3. Push blind people into busy intersections
4. Give students grades far below the grades they have dutifully earned

Few would disagree with these claims, unless they were working hard to surround the claims with very unusual circumstances. In that case, they would no longer be thinking of *our* eight claims at all; they would be thinking of different claims, that is, "other" cases.

Okay, someone objects, so there are a few moral judgments held in common. But there are not many judgments of this sort. You can count them on two hands.

How would you reply to this challenge? One way would be to ask the objector to perform the following thought experiment. Leaving everything else the same

in proposition (1), substitute various ages for the 2-year-old cousin. Won't we all agree that it is morally right to rescue a drowning cousin irrespective of their age, irrespective of whether the cousin is 1 year old, 2.5 years old, 3 years old, 30 years old, or 60 years old? By simply substituting various ages, we can generate dozens of new particular moral judgments on which we agree.

Still confining our attention to proposition (1), substitute various relations for cousin. Won't we agree that it doesn't matter whether the person drowning is our cousin or sister, brother or mother, father, grandparent, friend, or teacher? Perhaps we might agree that we should rescue the person even in the event that she is a total stranger, but I hesitate to suggest this possibility (because it would probably generate debate). Depending on how active our imaginations are, we can quickly generate hundreds of noncontroversial moral judgments.

Imagine, further, doing similar thought experiments with (2) through (8). Substitute various animals for the cat, various physical challenges for the blind person, various social relations for the teacher-student relation. In a matter of minutes we will have thousands of particular moral judgments on which we all agree, using nothing more than the eight judgments I suggested off the top of my head.

It is important to begin ethics with a robust sense of our common moral judgments. If we gathered answers to the shock treatment exercise from everyone and then expanded them in the way just suggested, chances are that the class could easily fill up an entire wall by writing on it "things it is always absolutely, positively ethically wrong to do," and another wall with "things it is always absolutely, positively ethically right to do." The walls of our classroom, appropriately filled with noncontroversial dos and don'ts, would provide all the evidence we need for the following claim: We share a vast number of uncontroversial, particular moral judgments about right and wrong.

We can now offer a first, provisional, definition. *Ethics* is the branch of philosophy that studies morality. Ethics has two tasks. One task is to try to provide reasoned answers to difficult moral dilemmas. We do this, in part, by trying to form an ethical theory, a clear, noncontradictory, comprehensive, and generalizable set of rules intended to govern all human behavior and resolve conflicts among values. We then apply that theory to the question at hand. A second task is equally important, however. In ethical pedagogy, we teach our children, and remind ourselves, of the particular moral judgments we hold in common. And we encourage others to try to form their lives by these judgments, a task easier said than done.

If ethics is the study of morality, what is morality? Sometimes it seems to be indistinguishable from a society's customs. Sometimes it seems to be the same thing as the law. Many people think that it derives from religion. And many think that *ethics*, the branch of philosophy that studies the justification of morality, is not at all objective, not at all like science. Here I take up the relation of morality to custom and then to law. I will wait until the next chapter to investigate the relation of morality to religion.

Are Morality and Custom the Same Thing?

When we use the word *morality* we mean different things by it. Sometimes we mean the various sets of rules that implicitly guide the conduct of some group or other.[1] With this interpretation, a variety of "moralities" exist because different groups have different sets of rules. Think about the different attitudes toward animals found in various societies. Jewish cultures traditionally encourage animal husbandry: the selective breeding, raising, and slaughtering of animals. Jews see this practice as justified by a divine mandate that instructs humans to try to perfect the world by cooperating in God's creative activity. Although Judaism permits the killing and eating of some animal species, however, it prohibits the killing and eating of others, such as mollusks. And it prohibits the consumption of blood.

On the other hand, Jain cultures in India have markedly different attitudes toward animals. Whereas Jains agree with Jews that killing mollusks and consuming blood are wrong, Jains further believe that killing any animal whatsoever is wrong. By extension, they do not use traditional methods to selectively breed cattle. Holding that all life is sacred, Jains think that animals should be left alone, that we should no harm to animals. In their view, animals and humans are linked through the cycle of karma and reincarnation, so that all living things are interdependent parts of one another. Animals, therefore, are entitled to live out their normal life spans without being exploited by humans.

Jews have one "morality," Jains have another "morality," and Christians have a third. Christians historically have encouraged the breeding, raising, and slaughtering of food animals and the eating of shellfish, and have not felt bound by the Hebrew proscription that outlaws the consumption of animal blood. Christians believe that God revealed the goodness of all life and its fitness to be eaten in a vision given to St. Peter recorded in the Book of Acts. This is the most permissive dietary morality of the three religions just introduced.

If ethics meant nothing other than the study of these different customs, the ultimate goal of the study of ethics would be an empirical, descriptive, project: to survey and articulate the various moral codes of the world. Such a survey, however, would reveal a striking fact: that the moralities conflict. Most Christians think it permissible to kill and eat animals; Jains do not think it permissible. Shouldn't ethics help us answer the tougher question, Who is right?

Indeed it should, and ethicists (people who do ethics) give different answers to that question. Those we might call naïve cultural relativists answer that both the Jains and Christians are right. The moral code of the Jains is true for Jains, and the moral code of the Christians is true for Christians. Such relativists grant that the codes appear to conflict and that the conflict would be a problem. However, the conflict is, for the relativist, merely an appearance and, therefore, not a problem at all.

[1] A very useful introduction to these matters is (Rachels 1993). I also must acknowledge the patient advice and instruction of Margaret Holmgren, whom I was lucky to count as a colleague at Iowa State University.

How so? Because moral codes do not make truth claims. Relativists, intent on honoring differences among the world's cultural and religious traditions and fearful of dominant societies aggressively imposing their values on others, resist cultural, political, and moral imperialism. They conclude that moral rules are simply expressions of people's feelings. What's morally right for George is morally right for George. But the same thing may be morally wrong for Jorge. For relativists, *there is no absolute universal moral code, no truth in ethics*. Therefore, one society's moral codes can't conflict with another's.

A relativist might respond to Emily's case in the same way, saying that although it may be wrong for Emily to cheat, it is not necessarily wrong for someone else to cheat. Emily has her morality, you have your morality, and I have my morality. Don't try to impose your values on me and I won't try to force mine on you.

These attitudes sound admirable on the surface because they recommend tolerance and acceptance. But appearances can be misleading. In fact, naïve cultural relativism is indefensible. Notice, first, that the relativist will have trouble securing any kind of respect for tolerance, period. To argue for relativism on the basis that it is more respectful of differences among cultures is already to assume that respect is a universal moral good. But relativism insists that no such nonrelativized moral goods exist, revealing a deep and objectionable internal inconsistency. How can someone be proud of his or her view because it is so tolerant when tolerance itself is not tolerated by some societies?

We can go on to ask whether relativism itself really is so tolerant. Just how tolerant is it to insist that all those people who think that one single objective morality applies universally are wrong? Is a position truly tolerant if it has no room for objectivists and absolutists? Relativism seems inconsistent here a second time because it cannot make good on its desire fully to honor every culture's morality.

Some cultures hold that a single universal moral code exists: Jews, Jains, and Christians all believe this. If, however, Jain morality holds that there is truth in ethics, and that there are, for example, right and wrong ways to treat animals, then it follows that part of Jain morality contradicts part of Christian morality. Jains do not believe that animal life is intrinsically valuable only to Jains; they believe that animal life is intrinsically valuable to everyone. Were naïve relativism true, then Jains would be mistaken in this belief, because relativism holds that Christian morality is true for Christians, yet Christian morality denies the intrinsic value of animal life. (Or, to be more precise, most Christian ethicists in the past denied the intrinsic value of animal life; there are a few, more recent, Christian theologians who defend, for example, vegetarianism.)

If Jains and Christians disagree about this matter, then one of three things must be true. Either relativism must be false because it denies the possibility of disagreement, or the Jains must be confused about Jain values, or the Christians must be confused about Christian values. The latter two options seem difficult to accept, however. Who knows more about Jain values, Jains or naïve relativists? And who knows more about Christians values, Christians or naïve relativists? The best answer, therefore, must be the first one: Naïve relativism is false.

To summarize. Christians think they are right and Jains wrong about killing and eating animals. Jains, in turn, think they are right to place a high value on animal life and Christians are wrong not to. If relativism were true, this situation would be a mirage because there could be no grounds on which Jains and Christians could disagree. Both would have to be right. Yet, both *cannot* be right since they disagree with each other. So, the relativist's interpretation of the disagreement between Jain and Christian morality fails to account for the explanations given by Jains and Christians of their own morality. In short, relativists cannot honor the morality of Jain and Christian cultures because these cultures are absolutist and anti-relativist. The relativist can hardly say, "Yes, there is merit in these cultures' absolutist views, and I accept them both, as I accept all views." The reason is that in agreeing with any one absolutist morality, the relativist is either renouncing the basic relativist principle (there is no truth in ethics) or imposing a relativistic interpretation on a culture that emphatically denies being relativistic. So much the worse for cultural relativism, which cannot make good on its promise fully to honor every culture.

It is tempting to adopt a position of naïve relativism in part because the study of ethics is hard work. How easy is it seriously to engage foreign cultures, examining their arguments and traditions, comparing their theories with theories from other cultures, all the while subjecting every value one finds to critical scrutiny? It is a challenging task, to say the least, to set out to find the correct view. In the face of all this complexity, history, and conflict, articulating a generalizable and impartial set of rules is no easy matter. True, the very thought that rules might exist that apply to anyone at any time in any place is an idea fraught with the danger of imperialism and colonialism. We do not want to force our values down others' throats. And how do we know which of two conflicting moral positions is the right one? These are critical questions. Yet the ethical journey is one we must take, despite its many pitfalls. Committing to set out upon the ethical journey represents our best hope for resolving cultural conflicts in a peaceful, just, and impartial manner.

Here then is a second, more precise, definition of ethics. *Ethics is the intellectual attempt to decide which action one has the best moral reasons to undertake, irrespective of one's inherited traditions*. On this definition, a difference exists between the "moralities" we have been discussing – moralities that reflect the customs of various societies – and what we might call (admittedly grandiosely) "true" morality, which is universal, impartial, and applies to everyone. On this definition, "true" morality does not instruct George that it is permissible to kill a cow in circumstances *q*, *r*, and *s*, while telling Jorge that it is impermissible to kill the same cow in the same set of circumstances.

Distinguishing between moralities, which can vary, and true morality, which cannot vary, provides us with one conceptual tool with which to try to explain what Jains are doing when they criticize Christians for undervaluing animal life. Jains are disagreeing *ethically* with Christians; they are claiming that Christians have the best reasons to undertake actions that highly value animal life *even though* this attitude is not part of the morality the Christians inherited.

Distinguishing between "moralities" and "true morality" helps to bring into focus the difference between ethics and custom. We sometimes perform actions out

of habit that are not ethically justifiable. Some taxi drivers customarily give blank receipts to their fares on the understanding that the person will inflate the price paid, receive a higher amount in reimbursement from his or her company, and pass a bit along to the taxi driver. The mere fact that drivers and customers act this way does not make it right for them to do so, just as the fact that some people beat their horses does not make it right to torture animals. Then again, separating moralities from ethics (true morality) allows us to observe that some actions that are not customary are not necessarily unethical. We do not usually explain the sordid details of a recent divorce proceeding to strangers who casually ask us how we are doing, but it is not immoral to do so. There appears to be a real difference between customs, on the one hand, and ethically justifiable customs on the other. True morality and custom, therefore, are not the same thing.

If real conflicts exist among the world's moralities, they cannot be settled by turning to one tradition's inherited customs. How then can they be settled? Perhaps by turning to the law.

Are Morality and the Law the Same Thing?

Some hold that a society's morality is reducible to whatever laws a society adopts for itself. Law is indeed not only a body of rules governing how people ought to behave but also a tutor, helping to instruct and encourage good behavior. But here again, a problem arises in conflating morality with a close neighbor. Societies can adopt laws that are clearly unethical (for example, requiring African Americans in Alabama to sit in the back of a bus), and societies can fail to classify as illegal actions that are clearly immoral (for example, allowing cruel psychological abuse of a child or spouse). Therefore, some things are legal but clearly unethical, and some things are illegal but not necessarily immoral. While communities should strive to form laws in accordance with ethical standards, we should not automatically assume that the one can be collapsed into the other. As with ethics and customs, a gap exists between ethics and the law. Morality and the law, therefore, are not the same thing.

If we do not find out what ethics requires by consulting customs or laws, how do we find out? In the United States, a very common response is: God's will. Let us now turn our attention to that answer.

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Chapter 2
Religion

Gary L. Comstock

Abstract An introduction to the similarities and differences between religion and ethics.

Keywords Ethics • Religion • Divine command theory • Natural law • Tradition

Case: Rich the Atheist

Students in Emily's "Ag Ethics" course are still discussing cheating during a class several days later. Emily hesitates to get drawn in, but eventually cannot stop herself from raising her hand to say that one of the reasons that she decided not to cheat is that she is a Christian. Honesty, honor, love, and respect are central virtues of the Christian faith, she explains, and cheating seems distinctly un-Christian to her.

Rich, who sits in the front row and has already distinguished himself as an active participant in discussions, loses no time.

"Dr. Wright, I mean no disrespect to those with religious beliefs, but we aren't going to get involved in this class with questions about what the Bible says, and what God wants, or what the Pope thinks, are we?"

"Well," the professor replies, "You raise some good questions. But why do you ask?"

"Because I don't think religious discussions ever get anywhere when it comes to talking about morality. First, not everyone in the discussion believes in God, so why should atheists be forced to adhere to standards that they don't agree with? Second, even those people who do believe in God don't agree about morality. Liberal Protestants say abortion is okay under virtually any circumstances; traditional

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Catholics say it isn't permissible under any conditions; and you have the full spectrum of views in between. Third, how can anyone know what God commands people to do? The Bible is full of contradictions, isn't it?"

Emily squirms a bit in her seat.

"Wait a minute," she replies. "There are methods in my religious community for determining better and worse interpretations of Scripture; there isn't that much disagreement among Christians on abortion – well, at least not in *my* church; and everyone, sometime, has to adhere to standards he or she doesn't agree with. So I don't see why religious arguments should automatically be excluded from the conversation. Religious traditions are important in teaching values, and they can help us to form our children and our communities in the right way."

Dr. Wright responds by saying that the class will not be able to spend a great deal of time on the subject of religion, but it must consider one ethical theory that depends heavily on religious belief. That theory is the Divine Command Theory, in which moral standards are thought to be necessarily related to God's will.

"But isn't the Divine Command Theory simply false?" Rich persists.

"Let's withhold judgment on the matter until we have at least had time to get the theory out on the table," says Dr. Wright. He looks around the class. "Any other questions?"

The classroom is very quiet. No hands are raised, and everyone seems to be avoiding eye contact with everyone else. As the bell rings, Emily rises from her seat feeling alone. Outside the building another student, Dawn, approaches her.

"Hey, I just wanted you to know that I'm a Christian, too," says Dawn. "And I support you 100 percent. But we have a problem; we don't know how to talk about our religious convictions in this class. It doesn't seem that the instructor, or this campus, is very open to honest discussion of beliefs in anything supernatural."

"Oh, thanks so much for telling me," says Emily.

"If it's any comfort, I would guess that the majority of the students in the class feel the same way that you and I do. We're all kinda religious, but we're also kinda intimidated by the secular atmosphere of the university. We want to learn how to talk about our religious beliefs—we want to learn what we believe!—but it's pretty clear that our instructors are not very friendly to belief."

Case: Questions

1. Do you consider yourself religious?
2. If you answered the first question *yes*:
   (a) Do you feel comfortable discussing your religious beliefs with others in general? Why or why not?
   (b) Do you feel comfortable discussion your religious beliefs in university classrooms? Why or why not?
3. If you answered the first question *no*:

(a) Do you feel comfortable discussing the religious beliefs of others in general? Why or why not?
(b) Do you feel comfortable discussing the religious beliefs of others in university classrooms? Why or why not?

4. Do you agree with Rich that discussion of religion should be limited in university classes devoted to ethics? Why or why not?
5. If you know what the Divine Command Theory is, please explain it.

Discussion of Issues

Rich's comments direct attention to the source of ethical values. In the previous chapter we observed that ethics is not derived from custom or law. From whence does it come? Perhaps the right answer is Emily's answer: God's will. Because religion is so powerful and its relationship to ethics so complex, the relation between the two subjects deserves thorough investigation.[1]

Are Morality and Religion the Same Thing?

Some hold that moral systems may be reduced to the values of a society's religion. This is an important point because those of us in the United States live in a very religious culture. Harris polls show that more than 75% of all U.S. college students believe in God.[2] In 2008 according to the Harris Interactive Poll 70% of Americans said that they believed that Jesus was resurrected from the dead and that Heaven exists (Harris 2008). The United States has some 900,000 religious fellowship groups; on average, that amounts to 20,000 religious groups in each of the 50 states (Wuthnow 1994, p. 11).

Where we find religion we typically find instruction in morality. Although the aberrant, hateful religious organizations are the ones that make headlines, the truth about religion is more mundane and hopeful. It is a rare religious community that does not teach honesty, integrity, love, reciprocity, caring for others, and civility. According to Nancy Rosenblum, the influence of religion permeates our entire culture, creating the general "expectation that our pain and indignation at day-to-day unfairness and abuse will not be met with indifference, and thus [religious belief] may cultivate the iota of trust necessary for democratic citizens to speak out about ordinary injustice".[3]

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[1] I presented versions of this chapter between 1994 and 1998 at Bioethics Institutes at the University of Illinois, Michigan State University, Purdue University, Iowa State University, North Carolina State University, and Oregon State University. Many thanks to the participants of those institutes whose questions and criticisms helped me to refine the presentation.

[2] Note that the number of U.S. college students who said that they believed in God in March 1965 was more than 97% (Nielsen Survey Collection 1994).

[3] Rosenblum (1998) refers to Wuthnow (1994).

Historically, the ethical values of cultures have resided within religious traditions.[4] The faith traditions have been the primary incubators and champions of virtue and character, whether you think of Jews, Muslims, the Nuer in Africa, the ancient Greeks and Romans, or the Lakota Sioux. In these traditions, rules about permissible and impermissible behaviors are closely aligned with religious beliefs. Morality is intimately tied up with religious beliefs about the power of deceased kin, the whims of capricious gods and goddesses, the will of a single omnipotent deity, or the power of the karma of one's past volitions.

Because religion both teaches moral rules and provides motivation for adhering to them, it cannot help but be a close neighbor to ethics. So close a neighbor that we sometimes fail to distinguish between them. As James Rachels points out, when New York Governor Mario Cuomo appointed a special panel to advise him on medical ethics, he did not select professors of ethical theory or trained applied ethicists (Rachels 1993, p. 45). He chose Christian clergy and a Jewish rabbi. We commonly think of spiritual people as moral experts, and we commonly resort to our religious traditions when trying to decide about contentious moral issues.

Religion is not only a close neighbor but also a powerful one. The price of sin and moral transgression is not only the sanction of God but also the disapproval of one's religious community. The power of religion and its proximity to ethics is especially critical today, when most Americans are concerned that the nation is going down the tubes morally. In a 1996 poll, more than 85% of Americans believed that "something is fundamentally wrong with America's moral condition," citing as proof the prevalence of "teen-age pregnancy, unwed childbearing, extramarital affairs, easy sex as a normal part of life" (Institute for American Values 1998). (It is worth noting that Americans, ironically, do not seem to think that racism, sexism, speciesism, environmental degradation, and the growing income gap between rich and poor are further evidence of this moral decay. Indeed, one might interpret the following fact as underscoring the possibility that the typical American's worries about "moral decay" are *not* connected to issues of race, equality, and distributive justice: Twice as many Americans believe that " 'lack of morality' is a greater problem in the United States than 'lack of economic opportunity' " [Eberly 1996]).

[4] Apart from the modem Western period in which the morality called secular humanism has developed in explicit opposition to religion, the only historical exception to the rule that morality develops within religion is probably Confucianism in China. According to many interpreters, Confucius (d. 479 BCE) did not believe in supernatural phenomena and denied the reality of one's dead ancestors, yet Confucius developed a very clear moral system based on the principle of *ren,* or benevolence. Ren is "the attitude and habit of reciprocity in moral thinking." Confucius once summarized ren as "Do not do to others what you would not like yourself." In the ethic of self-discipline and justice that characterized the Chou political court, we have an example, if my interpretation is correct, of a morality that did not rely on the sanction of transcendental beliefs or religious authorities. In our culture, secular humanism is a twentieth-century manifestation of a similar phenomenon.

Americans appear to be very interested in spirituality, and concerned with the moral state of their country. Curiously, however, we seem not to be particularly skilled at analyzing our problems in religious language. Consider the behavior of various U.S. leaders. Almost every recent president – George W. Bush, Clinton, Bush Sr., Reagan, Carter – all claimed to be devout Christians and most of them went regularly to church. Each one consulted with the evangelist Billy Graham. But, in public, the most sophisticated theological pronouncements they seem capable of making is the puzzling phrase they repeat over and over: "God bless America." A masterful expression, but one not particularly well suited to subtle theological analysis of complex public policy.

Because morality and religion are proximate, powerful neighbors, those of us who are religious as well as those of us who are not need to think carefully about their relation. I begin with a definition of religion.

Defining Religion

It helps to have some paradigmatic cases before us when we try to define a term. Representative religions include Judaism, Christianity, Islam, Hinduism, Buddhism, Taoism, Confucianism, Sikhism, the Ojibwa and Sioux of North America, and the Yoruba and Ibo of Nigeria. Religions are complex and consist of many different components. They contain narratives, such as the Yoruba creation story, the synoptic narratives of Jesus's suffering, death, and resurrection in the New Testament, and the autobiographies of individual believers. They feature rituals, such as the Christian Eucharist, baptism, and last rites, the Jewish bar mitzvah, and the Lakota Sun Dance. They include institutions, such as the universal Roman Catholic Church, the local Foursquare Gospel prayer meeting, a neighborhood ladies missionary circle, and Jewish synagogues. And there are beliefs, I argue, about the supernatural, immaterial places, states, or beings whose effects, powers, or actions are not explicable in terms of material causes and effects. The supernatural is anything to which people refer when they use other-worldly terms such as God, Krishna, Yahweh, Allah, Creator, karma, ancestral spirits, the All, the One, the Divine, miracles, heaven, hell, nirvana, damnation, salvation.[5] I summarize this discussion by offering a definition.

> Religion is that complex dimension of human activity involving beliefs about the supernatural, beliefs that are expressed in propositions and narratives and enacted in rituals and institutions. These beliefs authorize the group's moral code and answer the question, What is the best way of life overall?

[5] By "transcendent," I mean supernatural, not simply a mental realm that exists outside the body. One may be an atheistic mind-body dualist, such as Descartes would have been had he not been a theist, and not believe in the transcendent in the sense I am using it here. Atheists may believe that human identity consists of something more than the material transactions happening in our brains, but that does not make them believers in "transcendence," at least as I am using the term here.

Note that this is a substantive rather than a functional definition of religion. It is a substantive definition because it insists that a religion must contain beliefs about the supernatural. Social theorists such as Emil Durkheim and Clifford Geertz proceed differently, using a functional definition. They note that social order is required in order for any people to live together, and they call whatever glue that ultimately binds a group together that group's religion. Functional definitions therefore don't require a religion to include supernatural beliefs. A religion is anything that *functions* in a certain way to bind a culture together. For a functionalist, Confucianism in China counts as a religion, even though Confucius himself did not believe in supernatural phenomena and explicitly denied the reality of ancestral spirits. For a functionalist, certain atheistic forms of Buddhism in China and India count as religions, as do communism and secular humanism in the West.

But we may ask: *Should* these traditions, which deny the existence of the supernatural, count as religions? Are they not instead cultural traditions? Perhaps we should reserve the term *religion* for those forms of Confucianism, Hinduism, Buddhism, Christianity, and Judaism that contain not only a cultural binding force but also a belief in the extraworldly. I have argued elsewhere that functional definitions of religion are not particularly helpful because they exclude nothing (Comstock 1995).

A substantive definition of religion, by contrast, provides a good tool to think through the relationship of religion and ethics. Every religion has certain moral rules, such as "Treat others in the way you would like to be treated," and "Do no harm to any living creature." These rules are sometimes implicit and unarticulated, but they are sometimes explicit, worked out in treatises such as the Catholic Church's encyclical "Culture of Death," the Pope's attack on the permissibility of abortion, capital punishment, and euthanasia in modern Western culture.

Clearly, moral rules and ideals are found in religious traditions. But if we assume that not every tradition or person is necessarily religious, then moral rules and ideals can exist apart from religion as well. Many people do not qualify as adherents of religion, and yet they have moral principles and lead lives of moral integrity. I think of atheist colleagues I admire who teach philosophy or religious studies, of the members of the society of secular humanists, of the liberal Jews and Protestants who do not believe in a transcendent being and yet live lives of courage, decency, tolerance, and love. It appears impossible to insist that true morality, thought of as good behavior, is the exclusive property of religious people.

Assuming that religion refers to human activities involving beliefs about the supernatural and that people can be virtuous even if they do not believe in the supernatural, then morality can be independent of religion. To help us keep this fact in mind, I will use the phrase *rational morality* for the next few pages to refer to any institution of morality that exists separately from religion. I use the phrase *rational applied ethics* to refer to all non-theologically based attempts to develop general public policies, that is, public policies meant to apply to everyone, whatever their religious tradition. When we do ethics with the intent of influencing public policy, one of our most important jobs is to study arguments: premises, conclusions, and the validity of moving from premises *a*, *b*, and *c* to conclusion *d*. You will learn how to evaluate moral arguments in the next chapter.

As noted in Chapter 1, applied ethics has two tasks. One is to try to answer difficult moral dilemmas. The other is to remind ourselves of the astonishing number of particular moral judgments we hold in common. Religions typically help to teach these common values by offering their members moral instruction. Now, some religions teach values not found in rational applied ethics. For example, Jain morality teaches that one should not kill insects, while Christian morality teaches that one should love one's enemy. It is difficult to find justification for these judgments on rational grounds. But these values are the exception rather than the rule. More commonly, the world's religions teach their youngsters what I have called the moral truisms, the lists of rights and wrongs we have previously generated in our thought experiments: Do good, avoid evil, seek justice, honor your mother and father, help the needy.

Religion, in sum, is one vehicle through which children learn right and wrong. To put it another, perhaps more controversial, way: Religion teaches rational morality. But, of course, religion is not necessary in order to teach moral truisms or to explore ethics. Consider one anecdotal piece of evidence for this claim. Religion plays at best a marginal role in ethics courses offered at U.S. state universities, and virtually no role at all in ethics discussions in Europe. Typically, philosophy instructors spend at most 1 or 2 days on the Divine Command Theory (discussed later), and that is the extent of the treatment of religious approaches to ethics. Moreover, philosophy instructors typically conclude discussion of the Divine Command Theory with the claim that the theory is false. Indeed, it is not unusual for ethics professors to issue explicit disclaimers that appeals to religion will not be allowed to settle matters in the class. As a result, religion appears very little, either in classroom discussions or in the papers submitted by students. In my experience, nuanced and careful talk about religion is about as prevalent in university ethics courses as it is in public political discussion in France and Sweden, where it is virtually nonexistent. So, ethics is being taught without religion.

A religious person might think this an objectionable state of affairs. But is it? Consider three points.

First, it may be that at least some basic moral values can be justified rationally, without drawing on religious premises. This discussion explores this point in more detail soon with the Divine Command Theory.

Second, religious people have several basic values, often including religious freedom: the right of each individual to behave and believe religiously in the way dictated by his or her conscience. The beliefs and rituals of one religion should not be imposed on those who do not share those beliefs, and no one should be forced to worship one way or another. In a democratic setting that contains a plurality of religions, all people, and especially the very devout, have good reasons not to impose their beliefs on others.[6]

[6] Unfortunately, philosophy instructors often presume that helping students learn to reason for themselves requires that one talk dismissively about religion. The best kind of reasoning includes reasoning about matters near and dear. Perhaps professors need to worry less about stopping religious students' illegitimate appeals to authority and worry more about enabling religious students' attempts to draw legitimately on religious traditions as moral sources.

Third, we can reason *impartially* about our values, developing policies that apply not only to the members of our own religious community but also across the board. University classrooms often include students who do not accept the beliefs of any religious community. Which moral principles will they consent to? To answer this question is to begin to reason impartially.[7]

One feature of morality distinguishes it from economic calculations of costs and benefits, from prudential calculations of what will best serve one's own interests, and even from religious considerations about revealed truths. Morality has the quality of *overriding* these other considerations. The overridingness of morality is the feature of ethics that insists that the right thing to do is not determined by the polls, our preferences, economic utility, or the results of democratic votes. The right thing to do is determined by the actions we have the best reasons to perform. Whatever is the ethical thing to do is the thing we *ought* to do; the right thing trumps all other choices.

Even religious choices? We should do the right thing rather than what God tells us to do? This is a sensitive and controversial issue because God apparently sometimes has told individuals (Abraham) to do the wrong thing (kill his innocent son Isaac). But such instances are extraordinarily rare. In the ordinary case, and in the public secular arena, we place higher value on the dictates of morality than we place on the freedom of religious thought. Consider one example. Rational morality tells us that difficult cases in which young children with treatable leukemia whose parents refuse medical treatment for them on religious grounds should be settled in favor of saving the child's life rather than sacrificing the child to respect the parents' religious beliefs. When it comes to life and death issues, courts in Western culture insist on doing the right thing. When in such cases the dictates of rational applied ethics override fundamental spiritual convictions, we see – for better or worse – that religion is marginalized in secular courts.

The marginal character of religion is underscored when people review the particular moral codes specific to their professions. A *professional ethical code* is a summary of the rules regarding what is considered to be right and wrong in a profession, such as the National Cattlemen's Association's code of ethics and the Veterinarian's Oath. Such codes typically articulate noncontroversial and widely held beliefs about the responsibilities that attach to one's role. Veterinary scientific and cattle associations all disavow dishonesty, fraud, and disrespect for the law. All commend the use of professional skills for the benefit of society. Religious leaders make up a profession, and there are ethical standards that apply to them. In the Evangelical Covenant denomination, for example, male pastors are strongly discouraged from meeting alone in counseling sessions with women parishioners.

How is religion related to professional ethical codes? To my knowledge, and apart from the codes of the clergy, no twentieth-century professional ethical code

[7] University instructors may need to be reminded of the possibility that some rationally justifiable ethical principle or other may best be disseminated, as a practical matter, through the resources of some religious community or other. To imply that students should cut themselves off from their theological resources is unnecessarily to constrain not only moral development but ethical reasoning.

makes reference to a supernatural power. The Hippocratic Oath (*c.*370 BCE) invokes Apollo and Panacea and "all the gods and goddesses" as witnesses, but the American Medical Association's code has discreetly dropped such references. The Boy Scout's oath refers to God, but Boy Scouts are not professionals. Religion, then, is nearly nonexistent when it comes to the official ethical statements of today's professional associations. Of course, religious beliefs and traditions may be the basis of moral thinking for many individuals within the professions, even though these beliefs and traditions do not appear in their official codes.

I have noted that morality seemingly can be taught without religion. But is this correct? Does morality not need religion in order to be justified? To answer this question we must do some work in *ethical theory*, the philosophical study of what makes things good or bad and actions right or wrong. Theorists inquire into questions such as: What is the standard for judging things to be moral? Is it God's will? Individual rights? Pursuit of the greatest good? What is the relationship between moral and nonmoral explanations? Can moral language be reduced to naturalistic language? How should ethical theories be constructed and justified? On certain rational or religious foundations? Or by a process of comparative reasoning that considers our intuitions, scientific knowledge, and moral principles?

How is religion related to ethical theory? Two possible answers exist: necessarily and not necessarily.

Necessarily

The idea here is that moral laws logically must derive from divine commands. This idea is found in the Divine Command Theory, which holds that *an action is right if and only if God commands it*. A classic exposition of this theory is given by C. F. H. Henry, who writes that biblical ethics discredits rational morality. Biblical ethics is superior because it

> gives theonomous ethics its classic form—the identification of the moral law with the Divine will. In Hebrew–Christian revelation, distinctions in ethics reduce to what is good or what is pleasing, and to what is wicked or displeasing to the Creator God alone.… The good is what the Creator-Lord does and commands. He is the creator of the moral law, and defines its very nature. (Henry 1957)

The virtue of this theory is that it renders morality objective, absolutist, and enforceable. Ethics is not a matter of etiquette, feelings, evolutionary adaptation, or do-what-you-will. Things are not right or wrong based on what you happen to think about them; they are *objectively* right or wrong, and there are moral facts about whether it is right to rape and steal. A standard exists by which we can tell what is good and bad. The Ten Commandments, for example, is one statement of the standard. Notice, too, that this theory carries with it a police force and judge as well as sanctions for disobedience. We ought to be moral on pain of punishment on Judgment Day. The theory also has the theological virtue of respecting God's omnipotence and sovereignty. God is the creator of rational morality, and

God's actions are not constrained by a law higher than God. The slogan here might be that no ethical theory exists without religion.

Two of the most prominent German theologians of the twentieth century, Karl Barth and Emil Brunner, both argued for this theory. It has at least three interpretations:

1. "Morally right" means "commanded by God."
2. No moral reasons exist for acting one way or the other that may be known independently of God's will.
3. Morality logically must originate with God.

Each of these interpretations has problems.

I begin with the first interpretation. Whenever anyone says "*x* is morally right," what the person really means is that "*x* is commanded by God." But it does not seem correct to say that this is what people mean who do not believe in God. If proposed as an explanation of what people everywhere mean when they use moral terms, then the Divine Command theory seems obviously false. Now, someone could argue that we should just stipulate that this is what morally right means, and that whenever we use the term this is what we mean. But this strategy would beg the question, rendering our inquiry pointless. Why try to find out *whether* rational morality requires religion if we are simply going to assert from the very start that it does? This move certainly will not settle the question of whether morality requires religious justification. So the first interpretation is defective.

Now consider the second interpretation of the Divine Command Theory. If no moral reasons exist for acting one way or the other that may be known independently of God's will, then the claim, "God is good," becomes meaningless. On the Divine Command Theory, to say that "God is good" is redundant; it is to say the equivalent of "God is God." The reason is that the statement "God only does what is good" comes to mean "God does whatever God wants to do," and the statement "God commands us to do what is good" is reduced to the tautology "God commands us to do what God commands us to do." But when we say, "God is good," we do not generally think that we are uttering an empty tautology; we think instead that we are ascribing a property to God. Furthermore, it seems that even in the absence of divine revelation, people can and do know that it is wrong to poke pins in cats' eyes and right to assist the needy. (The Catholic theologian St. Thomas Aquinas argued as much.) Therefore, the second interpretation seems unsatisfactory.

Finally, regarding the third interpretation of the Divine Command Theory, if morality originates with God, then what is right is reducible to what God says is right. But if whatever God says is right, then moral norms become arbitrary and unreliable. This is the problem we know from the ancient Greek philosopher Plato (d. 347) who, in a dialog called The Euthyphro, asked whether something is good because God wills it or whether God wills something because it is good (Rachels 1993, p. 48). God commands us, for example, not to starve our children to death not because God is capricious and happens to decide at the moment that murdering children is distasteful. Rather, murdering children is wrong, and God, being omniscient, knows that it is wrong. Being omnibenevolent as well, God is good and

commands us not to do what is wrong. *God is a good God*. That's an informative sentence, not a tautology. Indeed, we can imagine good gods and bad gods; bad gods are those who command us to do evil. We would not be able to imagine evil gods were it the case that whatever the gods command is necessarily what ought to be done.[8]

To see the concern that philosophers have come to call "the Euthyphro problem," we must use our theological imaginations and be willing to entertain different possibilities in our idea of God. The traditional God of Western religions, of course, is omnipotent, omniscient, and omnibenevolent. But it is not a logical fact that God must have these characteristics, and other cultures have had, and continue to have, very different pictures of the deity. For example, the ancient Greeks believed that before the Olympian gods came to power, the Titans ruled the heavens. What if God were not the loving God of Western religions but rather Cronus, the giant Titan god who castrated his father, married his sister, Rhea, and killed and ate his children. If the universe is ruled by Cronus and if the Divine Command Theory is true, then castrating your father, having sex with your sister, and killing babies are good things. Why? Because whatever God wills is good, and Cronus – who, we are imagining, is God – wills these things. Consequently, having sex with our sisters is not only permissible but also something we ought to do. But that seems wildly counterintuitive and offensive.

Obviously, what is right or good is not necessarily the same as what any particular religion teaches. A religion that taught obedience to Cronus would teach prejudice, rape, discrimination, and murder. This fact would not make prejudice and rape right.

There is another problem with the third interpretation of the Divine Command Theory. If God can make morally good what seems morally heinous, then the right theory of ethics seems to be that might makes right: whoever is at the moment the most powerful gets to declare what is right. In other words, if morality originates with God and there is no independent standard by which we can judge God to be a good or a bad God, then our moral standards are completely at the mercy of divine whims and we may think that abhorrent actions are good actions.

Consider three defenses of the Divine Command Theory.

First, some writers, such as G. E. M. Anscombe and Fyodor Dostoevsky, believe that people will not behave morally unless they believe that bad behavior will be sanctioned – punished – by a divine lawgiver. With regard to civil laws, people must believe that an authority will punish them if they break the law or else they will not obey it. Without sanctions, laws lack teeth. Indeed, without sanctions, laws may not even count as laws; they may function only as suggestions or requests.

[8] Taliaferro (1997) articulates an ethical theory in which normative judgments are hooked into the concept of an ideal observer. Morality, in his view, may depend metaphysically on such an ideal observer and, because such an observer bears many similarities to standard Western conceptions of God, Taliaferro's proposal might be construed as a defense of a (modified) Divine Command Theory.

So it is with moral laws. If no divine authority enforces it, agents will not experience the law as binding. Just as civil laws demand police forces and judges, so moral laws demand a divine police force and lawgiver. Kant held that in order for morality to inspire adequate motivation for compliance, a God must exist who enforces the law and who rewards and punishes us in the afterlife. Anscombe, a twentieth-century British philosopher, basically argued that rational ethics makes no sense. And in the *Brothers Karamazov*, the Russian novelist Dostoevsky had his character Ivan Karamazov assert that "If God doesn't exist, everything is permissible." If morality has reason alone as a basis, then morality fails to account for the overridingness of moral values, is uninspiring, and fails to tell us why we should be moral.

All the writers just mentioned were theists who sought to underwrite rational morality by giving it a religious foundation. Another philosopher, who held that God is dead, agreed with part of what these theists believed. That philosopher, Nietzsche, thought, however, that rational morality, like God, ought to be dismissed, and he sought to undermine morality, which he viewed as prophylactic principles invited by the huge numbers of society's weakest members to protect themselves from willful and strong individuals. Ironically, atheistic nihilists such as Nietzsche share this belief with Divine Command theorists: that religion is essentially related to ethics. If religion disappears, so does morality.

Problems are identifiable here. Are there really no sanctions other than the deity for our actions? The following, if they exist, might all exercise a powerful influence dissuading us from bad behavior: conscience, moral facts, cultural taboos, the evolutionary advantageousness of altruistic behavior. In ethical theory, God is not the only possible psychological enforcement mechanism for morality. So it seems that this first line of defense of the Divine Command Theory fails.

A second line of defense argues that rational ethical theory ignores the twin facts of sin and forgiveness. Selfishly egoistic actions and attitudes offend God, but a nontheologically-based ethical theory has nothing to say about those people on whom God has mercy, even though they commit moral transgressions.

Here is a response: In order to believe in sin and divine forgiveness, one must believe in God because sin is not just any moral transgression; it is, rather, a moral transgression against a supernatural power. However, can we believe in *sin* or *divine forgiveness* unless we first believe in the existence of God? It would not seem possible. And yet the point of our inquiry here was to figure out whether ethics needs God in the first place. So to object that rational morality ignores sin is to beg the question of whether there is a God.

A third line of defense proposed by Robert Merrihew Adams responds to the charge that the Divine Command Theory makes morality arbitrary. Adams argues that the nonarbitrariness of divine commands is ensured by God's character. God's character is not that of a mercurial, evil-minded arbitrary being; God is a constant loving Parent who wants the best for us.

My response is that Adams's argument seems only to push the problem back a level. What does it mean to do something that is "loving?" On Adams's Divine Command Theory, it must mean "to do whatever God commands," because no

independent standard exists of what is loving or hateful. Therefore, to say that "God commands what is loving" is to say that "God commands what God commands." Are we not stuck in the same quandary noted previously in response to interpretation (3)? On Adams's account, the problem seemingly has only been transferred from the term "good" to the term "loving."

We might conclude, therefore, that religion is not essentially or necessarily related to ethics. Fortunately, there is another way to construe the relationship.

Not Necessarily

Having considered the ways in which religion might be necessarily related to ethical theory, I turn to the other alternative: not necessarily. The idea here is the following. If divine commands exist, they are always issued in accord with moral laws so that when God commands something, God commands it because it is good. Humans, therefore, can discover what God wills in the moral realm by consulting our conscience, reason, intuitions, and sense of justice. The theory of natural law holds that moral principles are rational and that our faculty of reason is the divine image within us. Morality is given by God but it is discoverable within the bounds of reason alone. Even on this Thomistic view (that is, a view inspired by the medieval Catholic theologian Thomas Aquinas), however, agents can discover what is morally right or wrong without special revelation so that Natural Law Theory does not require a divine command giver.

Now, some will object that if moral standards exist that are independent of God's being, then monotheism is compromised because something exists that God did not create. Even worse: If moral standards exist independently of God's will, then God is not the author of morality; something exists that God did not create and God is not free to make God's own laws. Rather, God must obey the laws of morality.

The answer to this worry is that even God seems to be bound by certain laws, such as the laws of logic and morality. God cannot make a married bachelor or a color that is simultaneously red and green. There appear to be some things that God cannot do: God cannot make it the case that God does not exist. God cannot both love us and hate us simultaneously, or call an action that is clearly evil a good action.

To conclude, then, it seems that what is right or good is not necessarily identical to what a particular religion teaches. There is the Cronus problem, that some religions teach prejudice and discrimination, and there is the Euthyphro problem, that God commands something because it is right. To put it another way, morality is independent of God's will. Therefore, we should not conflate the spheres of piety and morality.

Good reasons exist to separate public policy decisions and the revelations of particular faiths, and not only because religious people disagree among themselves about what is right. Countries that try to separate church matters from matters of state attempt to make regulations and laws not on the basis of sacred truths revealed to a few but rather on the basis of broader principles upon which people from

diverse religious backgrounds – and no religious background – can agree. Reaching a consensus about moral issues is possible without invoking religious authorities. Consider one example: In the United States, many people once believed that allowing women to vote was morally wrong. Some traditions thought it imperative on biblical and theological grounds to keep women out of the public sphere, whereas other traditions supported the suffrage movement on grounds that were equally theological and biblical. However, after the culture removed the issue from the sphere of religion and looked at the facts about women, it could not justify its view that women should not vote. The general population came to a consensus that the policy should be changed because *justice* demanded it. There was no need to settle the vexing theological questions; the question was settled, and in the right way, on nonreligious grounds. Strictly put, then, morality is not the same thing as religion.

Before ending this discussion, please notice three implications that do not follow from my argument:

- It does not follow that God does not exist. Nothing I have said should raise any doubts in your mind about the existence of God. Other things may be able to raise these doubts, but I have not said them here.
- It does not follow that the moral teachings of Christianity, Judaism, Buddhism, or any other religion are incorrect or faulty. To the contrary, I think it is clear that our religious traditions have through time been the repositories and incubators of some of our highest ideals.
- It does not follow that people do not need religion nor that secular philosophy can tell you all you need to know about how to lead your life. Morality is only part of human life. It does not do everything. It does not, for example, reward us if we try to worship it (Wolf 1982, Adams 1984). Nor does it seem to touch upon all aspects of our life. Many dimensions of life do not necessarily have anything to do with morality: the beauty of a cello concerto, the drama of an NCAA basketball game, the complex history of the Lewis and Clark expedition, the meditative quality of a Cormac McCarthy novel, the silence of prayer, the difficulty of spiritual repentance, the sculpture of an unplowed tall-grass prairie.

We are multifaceted beings. If an omnipotent and benevolent God created us, then it may well be our primary end in life to worship and enjoy that being. In that case, religious activity is a vehicle by which the various dimensions of our lives are given coherence, our discordant activities harmonized. If our chief purpose is to glorify God, then religion is unlike morality in important ways. Religion's primary role is not to answer questions about what is morally right and wrong but to answer questions about how in general we ought to live. Which activities should be subordinated to others? What is the relative importance of parenting, prayer, esthetic experience, professional obligation, and worship?

Returning to the ideas raised in the case study at the start of this chapter, Rich may justifiably believe that religion *is not* a necessary part of ethical theory. Emily may justifiably believe that religion *may be* necessary for full human flourishing. In other words, anyone may without contradicting themselves believe both of the following propositions:

We can know what is morally right or wrong independently of religion.
We cannot live a complete human life independently of religion's beatific vision.

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Chapter 3
Reasoning

Lilly-Marlene Russow

Abstract An introduction to the analysis of ethical arguments, including differences between premises and conclusions, validity and soundness.

Keywords Ethics • Arguments • Premises • Validity • Soundness

Case: Karen the Ethicist

Rich, Dennis, Ken, and Karen are heading for the cafeteria after class. Rich says, "I hope Wright doesn't intend to waste any more time talking about religion."

Ken responds, "Yeah, I want to talk about real issues, like how we can protect the environment."

"Is there anything in the syllabus about that?" asks Karen.

"Yes ma'am," answers Dennis, brightly. "Looks like we'll be going beyond the ordinary stuff we talked about in high school, about preserving endangered species and wilderness."

Ken says, "People say the environmental movement has gone too far. But they don't realize that the ozone layer has not stopped disappearing, that the earth has not stopped getting warmer, that people have not stopped killing whales and seal pups, and that rainforests continue to be cut down. We're part of the problem. I see guys empty soda cans and leave them sitting in classrooms every day. They could easily drop them in recycling bins; they're all over campus, now."

Karen: "I'm a forestry major, and an environmentalist. But sometimes I wonder if I know more about *what* I believe, than about *why* I believe it."

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Ken: “Huh?”

Karen: “And, more importantly, why I think others should accept my goals and practices as their goals and practices.”

Ken looks at Dennis. Dennis grimaces. “I don’t see your point, Karen. And I certainly don’t agree with Green Ken.”

Ken: “What’s your problem?”

Dennis: “My problem is that everybody agrees we ought to use the Earth’s resources wisely. But the reason is that humans need it! We need it for food, for recreation, for oil production, for timber for our homes. And who are we in the rich countries to tell poor people in developing nations to protect endangered species when they’re worried about how to get enough beans on the table to sustain their kids?”

Karen: “That’s my point. There are conflicting views, so we need to figure out not just what we believe, but why.”

Rich: “Say some more about your distinction between *what* and *why*.”

Karen: “Just that I’m not as interested right now in the so-called ‘right answers.’ I’m more interested in how anyone would arrive at them. I want help figuring out what method to use in assessing how concerns for the environment can be balanced against concerns for humans. I don’t feel very skilled at defending my views and, as a forestry major, I am going to have to learn how to do it.”

Dennis: “Eh. Why bother?”

Karen: “In the end, because I want to learn how to convince people to adopt environmentally responsible practices. But, before that, to learn *why* I’m so certain about my values.”

Rich has been quietly putting away his barbecued beef sandwich.

He says, “I understand the conclusions you both *want* to reach. However, neither of you have given me any reasons whatsoever to support one position or the other, and neither of you have cited important factual or empirical data that would be relevant. You also haven’t shown how that information would convince me that your position is right, that your conclusion is true.”

Karen: “Right. Those are the kinds of things I want to investigate. Isn’t the question really one of cost-benefit analysis? If people want to pay enough to preserve a wilderness area or a species, let them do so. Some environmental groups, such as the Nature Conservancy, recognize that economic reality. However, if a community decides that a new more urban development is what they want, and can pay for it, that’s what should be done. The Wise Use movement is trying to do just that: encourage development and use, but do so wisely.”

“Very nicely put, Karen.” It’s Dr. Wright. He has just come through the cafeteria line, and asks if he can join them.

“Only if you promise to answer Karen’s question,” Rich says, laughing.

“Which is?”

Karen repeats what she has just said.

Wright responds: “Well, let’s start with the meaning of words. What does the Wise Use movement mean by ‘wise?’ And why does it focus on ‘use?’ Is it possible that the environmentalists and the developers may have different meanings of ‘wise’ in mind?”

Karen: “So, is that one of the first steps in ethical analysis? Getting clear about the meaning of the words we use?”

Wright: “Yes. And from there we begin to use those words to figure out what arguments someone is using to support their view. For example, Emily might believe that the Bible is the source of morality, and that it tells us to have dominion over the Earth. Meaning, we should use natural resources for our benefit. But Ken might think that this argument is not a sound one, because the Bible says many things about nature, and one should look at the whole text rather than just pick out specific passages. He might accept the Bible, but think that it leads to environmentalist values. Emily and Ken would now have to analyze not only the meanings of their words, but the reasons and arguments each of them have for their conclusions.”

Karen: “I see. Get clear about the words we’re using, reconstruct the arguments and reasons that we string together, and then try to decide which reasons take priority, which arguments are better than others.”

Wright: “You’ve got it.”

Rich: “But how do we do that? Is there some ethical method for telling good arguments from bad ones?”

Wright: “Well, yes, actually. We can first distinguish factual reasons from philosophical reasons, and then test the factual reasons scientifically to see whether they’re true.”

Dennis: “I think I know how to test scientific claims, but how do you test philosophical claims?”

Wright: “Various ways, depending upon what the claim is. If it’s a moral principle, then we can try to imagine all of its various implications. If some of its practical implications are simply unacceptable to everyone, then we have a principle with ‘counterintuitive implications.’ This result gives us good reasons for doubting the validity of the principle. If the claim is an argument, on the other hand, then you examine the argument to see whether its conclusion follows from the various premises. If the reasoner has cheated in stating the conclusion, then we have found an invalid argument. If the argument is invalid, we have a good reason to reject it.”

Karen: “And if it’s valid?”

Wright: “We ask whether it’s sound.”

Karen: “A sound argument is different from a valid argument?”

Wright: “That’s correct. And it’s a very important difference in ethics.”

Karen: “How do you tell?”

Wright: “If it’s valid, you simply ask whether all of the factual premises are true and all of the normative premises are justifiable.”

Karen: “Sounds complicated.”

Wright: “It is. But these are the basic skills involved in rigorous moral thinking, and we will spend the next few days working to develop them.”

Karen: “I said it sounds complicated, but I didn’t mean to imply that I wasn’t interested. It’s actually very exciting. It’s exactly what I took this class for.”

Case: Questions

1. Do you think there are right and wrong answers to ethical questions?
2. Have you ever diagrammed arguments?
3. Do you understand the difference between valid and sound arguments?

Discussion of Issues

Claims about what we should or should not do, moral precepts, and general claims about what is right or wrong need not be arbitrary.[1] They can and should be supported by reasons. It is therefore important to understand how we can evaluate those reasons, or to distinguish good and bad arguments. This chapter is intended to provide some insight into the process of evaluating arguments and developing good arguments for claims about ethics. Since moral reasoning is a special case of reasoning in general, we will begin with a general look at critical thinking, and then consider some special features of moral reasoning. Although many of the examples involve the analysis of someone else's reasoning, it is essential to realize that the same principles apply to one's own moral reasoning.

Section I: Identifying Reasons and Conclusions

Philosophers and logicians apply the term 'argument' to any group of statements some of which (the premises, or reasons) are intended to help convince us that one or more of the statements (the conclusion(s)) are true. Thus, an argument need not involve a dispute or disagreement. In many cases, the argument structure is clear; we can easily pick out the premises and conclusions, and see how they are supposed to fit together.

Thus, consider the case of Sam, who has volunteered to work for a private environmental group working to preserve natural parks and other important habitats in Hawaii. Upon his arrival, he learns that one of his duties will be to set snare traps to catch feral pigs living in these delicate ecosystems. His supervisor explains that it is necessary to get rid of the pigs because they are a non-native species, descended from domestic pigs escaped from European settlers who introduced them as farm animals, they have no natural predators, and are rapidly destroying endangered plants and the habitat and nests of native birds. Although snare traps cause more

[1] Materials for Sections 1–2 have been adapted from (Russow and Curd 1989), and from material prepared by Martin Curd for the 1996 Iowa State University Model Bioethics Workshop at Purdue University.

suffering than most other forms of trapping, the supervisor tells Sam that it is important for the health of the ecosystem to get rid of the pigs, and that all other forms of capturing the pigs have proven to be ineffective. Sam tells his supervisor that he will accept the assignment, but in fact (a) sets his traps in ways that are designed to fail, (b) deactivates other snare traps, and (c) notifies local and national animal rights organizations in the hope that they will organize protests against the policy.[2] Sam thinks to himself, *I should not use traps to kill pigs because it will hurt them.*

Sam has provided us with an example of moral reasoning because he has been thinking of an argument. What is an argument? It would not be correct to say that he has been "arguing with himself." When we say that someone is "having an argument" (with themselves or others) we mean that there is heated debate going on, or an expression of disagreement, whether or not it involves any reasoning. This is *not* the sense of "argument" that interests us. Throughout this book the term "argument" refers to something else, something produced through reasoning.

An argument is simply a collection of statements in which someone reaches a conclusion by relying on a reason, or reasons. How did Sam reach his conclusion? We do not know for certain, but let us suppose that he reasoned that the trapped pigs would suffer. We can articulate that argument by placing Sam's premise in (1) and his conclusion in (2).

(1) Using snare traps to kill feral pigs will cause suffering to the pigs.
(2) Causing suffering to the pigs is morally wrong.

Sam has wrapped (1) and (2) into a single sentence, demonstrating that moral arguments are sometimes found in very simple expressions: *I should not use traps to kill pigs because it will hurt them*. Arguments are often complex, however, and single sentences cannot express all of their components. Arguments usually consist of several premises, some for and some against a particular idea. They often contain chains of premises, with some arguments leading to ideas that serve as parts of another argument. For example, a statement might be the conclusion of one argument and then be used a premise in another.

The conclusion of an argument and each of its premises must be a **statement** or a group of statements. Statements are either true or false; they assert, either truly or falsely, that something is the case. Statements are expressed either by uttering a string of words or by writing them down in **sentences**. For example, the sentence "Pigs can feel pain" expresses a statement because it makes a claim that is either true or false.

Not all sentences express statements. For example, genuine questions are not statements, nor are commands such as "Do not feed the elephants!" Genuine questions must, however, be distinguished from **rhetorical questions**, which are not questions at all, but statements. For example, "Who can deny that torturing little kittens is morally repugnant?" is not a request for information but a forceful way of

[2] This example can be adapted for use as a case study, a topic which will be discussed later.

asserting that torturing animals is morally repugnant. Similarly, in certain cases, commands and exhortations should be interpreted as statements when they appear as the conclusions of arguments. For example, the exhortation "Vote for Brown because she is the best candidate for mayor!" is really an argument in which the conclusion is the statement "You should vote for Brown." The premise in this argument, of course, is: "Brown is the best candidate for mayor."

Of particular importance in arguments are sentences that use "either … or …" and "if … then …" The sentence "Either Sam is out on the trail or he is at the beach," expresses a single statement. It does not assert that Sam is on the trail, nor does it assert that he is at the beach; it states only that one or the other of these alternatives is the case. Similarly, "If Brown receives the backing of the labor unions, she will win the election," asserts only a single conditional statement about what will happen if Brown is supported by the labor unions. Finally, an argument can be expressed by a single sentence if the sentence contains at least two appropriately linked statements, for example, "This law must be struck down since it discriminates against the handicapped."

Arguments are meant to support their conclusions, and thus *rationally* motivate us to accept their conclusions *as true* – to believe them. They purport to represent good reasoning that is a reliable decision-making process. Giving an argument is thus distinct from following hunches or intuition, trying to persuade through emotional appeals or trickery, simply stating one's opinion, however forcefully or eloquently, and merely describing the position one wishes others to adopt without providing any supporting reasons.

A hunch or intuition stands alone. To call something a hunch implies that one has no evidence for it and it is not the result of reasoning. Trickery or emotional appeals may lead someone to accept a statement, but they work by short-circuiting the reasoning process. Mere descriptions or statements of opinion simply put forward a point of view without any reasons or evidence. Since these procedures are irrelevant to the truth of statements, they are unreliable. By contrast, arguments aim to give reasons in the premises that *are* relevant to the truth of their conclusions. Thus, if an argument is good, it can rationally motivate us to accept its conclusion on the basis of its premises.

Deciding whether a piece of writing constitutes an argument, or contains one, is sometimes quite difficult. Practice your skills in identifying arguments by working through the following examples.

Exercise

Decide whether each of the following examples is or is not an argument. Briefly explain your judgment. If the example **is** *an argument, underline the reason that is given for the conclusion. If the example is* **not** *an argument, indicate whether it is: an intuition, an emotional appeal, a mere description of some state of affairs or someone's beliefs, a question, or an exclamation forcefully stating one's personal belief or opinion.*

A. You have argued that moral rights do not come from God, the Congress, or evolution, so where do they come from?
B. Mountain biking is good for the soul because it connects you with nature.
C. Wendell Berry believes that our community is disintegrating because it has lost the necessary understanding of the relations among materials and processes, principles, body and spirit, city and country, life and death, and civilization and wilderness.
D. Agrarianism represents a great good and requires our allegiance.
E. Soil and water are crucial to agriculture. Since whatever is crucial to agriculture ought to be preserved, soil and water ought to be preserved.
F. I have this intuition that Congress should do all it can to save the family farm.
G. Living on a family farm is the best way to live because it teaches self-reliance and appreciation for plant and animal life. Therefore, Congress should pass legislation to save the family farm.
H. If farmers can profit in the short term from depleting soil and water resources then they have an interest in exploiting the land in this way. Future generations may not need soil and water if future generations can find alternative ways of feeding themselves. Taken together, these reasons lead to this conclusion: Farmers have no moral duty to farm in an ecologically sustainable way.

Philosophers typically express arguments in a particular form. We list the premises, then draw a line, and then list the conclusion. Obviously, some arguments are good arguments and some arguments are bad arguments. Here is a bad argument, written in standard philosophical form:

(1) There are not many family farms any more.
(2) I would like to see Congress save the family farm.

———————

(3) (Therefore) living on a family farm is the best way to live.

This is a bad argument because premises (1) and (2) do not give us good reasons to believe (3). While the first two premises mention family farms, they do not mention reasons to believe that living on family farms is the best way to live. They mention interesting claims about family farms, but these claims are irrelevant to the specific claim made about family farms in the conclusion.

Here is an even worse argument:

(4) There are not many family farms any more.
(5) Madonna is not married to the artist formerly known as Prince.

———————

(6) (Therefore) we should not buy clothes made in China.

Obviously, (4) and (5) have nothing to do with each other, much less with the alleged conclusion (6). Later, we will discuss the elements of a good argument. For beginning purposes, however, it is useful simply to recognize the parts of an argument, apart from the argument's validity.

Exercise

Make up two terrible arguments, the worst or silliest you can think of. Write them here. Make sure to include two premises, and a conclusion that clearly does not follow from those premises.

I. 1.

2.

3.

II. 1.

2.

3.

Notice now that some arguments are *moral* arguments and some are not. Moral arguments typically support conclusions that claim that someone *ought* or *ought not* do something, or that a certain sort of action is either *right* or *wrong*, or that a certain sort of thing has *positive* (goodness), or *negative* (badness) moral value. One rough way to tell whether an argument is a moral argument is to figure out whether some human or animal might suffer if the argument's conclusion were sound. Situations in which someone may be *harmed* are almost always moral situations. So if an argument concerns potential harms to pigs, farmers, young people who wish to drive, or even, perhaps, island ecosystems, then the argument is a moral argument.

Exercise

Indicate which, if any, of the arguments in A–H, (on p. 37, above), are **moral** *arguments.*

Section II: Getting to the Point: The Conclusion

The purpose of an argument is to give reasons for thinking its conclusion is true. Thus, to evaluate how good an argument is, we must begin by identifying its conclusion, that is, what is being argued for. The more lengthy or unclear the argument,

the harder this first step becomes. This is especially true when one is dealing with a **complex argument** or **argument chain** consisting of several **intermediate steps**. Each of these steps might be an argument with a conclusion of its own. These **intermediate conclusions** then combine to support the **final conclusion**.

There are three general rules to follow in looking for the *final conclusion*:

1. Ask yourself what the main idea is. What is the author trying to establish or work toward?
2. In a complex argument or argument chain, determine what the intermediate steps point to. Do the intermediate conclusions contribute to the support of one overall idea? More generally, which statements lead to or support other ideas?
3. Look for **clue words** that indicate the author's organizational scheme.

When presenting an argument of your own, you can use **clue words** to direct attention to your conclusion. The following words are often used to signal that a conclusion follows:

Consequently	It follows that
Therefore	Suggests that
This proves that	Points to the fact that
So	Entails
Since this is so	Implies
Hence	Thus

In arguments which use no clue words, we must rely on the first two rules. In complex arguments or argument chains that do contain clue words, the clue words might signal the conclusion of an intermediate step, thus directing our attention away from the final or main conclusion. For this reason, even when clue words are present, it is advisable to test the use of the third rule with the other two rules. To illustrate this point consider argument 1:6:

1:6. Age discrimination is often fostered by economic motives, since younger workers generally have less experience, and hence can be hired more cheaply.

The clue word "hence" directs our attention to the claim "[Younger workers] can be hired more cheaply," but this is not the final conclusion. If we look for the main idea, we see that it is the first statement, "Age discrimination is often fostered by economic motives." The claim

"[Younger workers] can be hired more cheaply,"is the conclusion of an intermediate step in the chain of reasoning.

To see how the three rules operate in a more complex argument, consider example 1:7, in which each sentence has been numbered for ease of reference.

1:7. (1) Should you repeal the present 55 mph speed limit? (2) This question cannot be decided on economic grounds alone. (3) Raising the speed limit to, say, 70 mph will save time in transporting goods and hence tend to reduce costs. (4) But it is unlikely that this will result in a significant economic benefit, since driving at higher speeds consumes more fuel. (5) Even critics of the present speed limit concede that it has helped to reduce the number of deaths and injuries in automobile accidents.

> (6) The vast amount of money we spend on health care shows that saving lives is more important to us than saving dollars. (7) The 55 mph speed limit saves lives, and the economic advantages of changing it are uncertain. (8) So it should be retained.

The first rule directs us to look for the main idea. At first we might think that the main idea is expressed in the second sentence, but, reading further, we see that the overall point the author is trying to establish comes right at the end of sentence 8.

The second rule serves as a check on the first. Having picked out "It [the 55 mph speed limit] should be retained" as the final conclusion, we now go back to see which of the other statements point toward the idea and support it. The statements that support the final conclusion most directly are "Saving lives is more important to us than saving dollars" (from sentence 6), "The 55 mph speed limit saves lives" (from sentence 7), and "The economic advantages of changing it are uncertain" (from sentence 7). The first two of these are intermediate conclusions that work together to support the final conclusion. Each of these, in turn, is supported by further statements in sentences 5 and 6. The main support for regarding the economic advantages of a change as uncertain comes in sentence 4.

The third rule is the simplest, but needs to be applied thoughtfully. Argument 1:7 contains three different clue words or phrases which signal that a conclusion follows: "hence" (in sentence 3), "shows that" (in sentence 6), and "so" (in sentence 8). Only the last of these indicates the final conclusion, and might conceivably have been omitted. "Shows that" signals an intermediate conclusion in the overall argument. "Hence" points to the conclusion of an entirely separate argument.

Sometimes a conclusion is signaled not by using clue words, but by **juxtaposition**. It is a common practice to make a claim (the conclusion), and then follow it with a statement of the evidence that is supposed to support it (the premises).

Finally, some arguments have final conclusions that are not explicitly stated at all. The arguments have **implicit conclusions**, since it is often rhetorically effective to let readers "draw their own conclusion." In these cases the premises are usually presented in such a way that there is only one "obvious" conclusion to draw from them. Thus, readers are not really drawing their own conclusions but merely making explicit the implicit conclusion the author intended.

Exercises

For each of the following arguments, state the final conclusion in your own words. Is the conclusion explicit or implicit? Put brackets around any clue words that indicate conclusions and identify the ones that indicate the final conclusion. Where possible, underline the portion of the passage that comes closest to stating the final conclusion.

1. If you want effective relief, buy Bayer. Bayer contains the ingredient doctors recommend most.
2. This object must be a diamond, since it will scratch glass.
3. This object is a diamond. Therefore, this object will scratch glass.

4. By voting themselves a hefty pay raise, congressmen proved that they are not interested in fighting the budget deficit.
5. Pit bulls are dangerous dogs. According to the Humane Society of the United States, in the 4 years since July 1983 pit bulls have been responsible for 20 of the 28 deaths after dog bites in the nation, including 5 in 1987. The breed accounts for no more than 1% of all dogs in the nation.
6. Linus Pauling told his audience that vitamin C must be taken in doses much higher than those recommended by the FDA. This contrasts with the way therapeutic drugs act. He said: "The large a dose, no matter how useful the drug, can be deadly. Vitamins, however, are natural substances, and mankind has become accustomed to them through the ages, so one can't take too much vitamin C."
7. Chimpanzees learn language much more slowly than people, and require special tutoring. So with chimps we can get a better perspective on both the factors that facilitate the learning and the factors that interfere with the learning. For example, we can completely control their training. We can make the chimps proficient in some areas of language, but not in others; we can systematically emphasize certain aspects of their language learning.

Section III: Giving Reasons: The Premises

The premises of an argument are those statements that lend support to the conclusion. From our earlier discussion of arguments, it is clear that the support we are looking for is of a special kind. We want reasons that point to the truth of the conclusion. Thus, reasons or premises must be distinguished from the following sorts of statements that often occur in the course of a discussion:

1. Introductory remarks that merely mark out the topic, set the context, or explain why someone might be interested in the issue.
2. Comments that merely restate or elucidate a position without giving reasons that support it.
3. Mere persuasion, such as use of emotional language or seductive appeals that are not evidence for the truth of the conclusion.
4. Disclaimers, that is, remarks that discount a statement or possible criticism without actually providing an argument, such as "One might think that taxes should be increased, but I oppose any such measure."

Consider the following pair of examples:

1:8. Many of the biologists in the environmental movement support left-wing causes.
1:9. Since none of those who declare that nuclear power plants are safe is willing to live within a mile of one, we should be skeptical of such claims.

Unlike 1:8, 1:9 is clearly an argument. In 1:9 there is a conclusion and a statement, which is a reason, however weak, for thinking that the conclusion is true. On the face of it 1:8 is just a single statement, and hence not an arguments. But if we

encountered 1:8 in the context of a debate over which scientists we should trust on environmental issues, we might be justified in regarding it as an argument with the implicit conclusion that we should ignore the views of many biologists in the environmental movement. But the only reason given for this implicit conclusion is that these biologists are supporters of left-wing causes, which is irrelevant to its truth. Thus, if 1:8 is an argument it is a very bad one.

Examples like 1:8 raise difficult issues about when something should be considered an argument. If it is clear from the context that someone has reasoned, however poorly, from one statement or statements to another, then we should treat those assertions as an argument, adding the implicit conclusion, if necessary.

Just as there are words that signal a conclusion, there are also terms that are often used to identify premises. The clue words on the following list may be introducing a premise. If you area presenting an argument, you can use these signals to help your audience identify your premises more readily:

Since	For the reasons that
Because	May be deduced from
As shown by	Follows from
Seeing that	May be inferred from
Is proved by	Is suggested by

As with clue words for conclusions, you should not rely blindly on these signals. Check to make sure that what you have identified is actually a premise. For example, the word "since" does not always indicate a premise, since it can be used in a temporal sense (e.g., "Personal computers have become much more powerful since they were first introduced in the 1970s"). "Because" is sometimes used in stating a claim about the cause of something rather than stating a reason for thinking a statement is true (e.g., "The car stopped because it ran out of gas").

To sum up. The first step is to ask whether we have an argument at all. If there is a conclusion, we must locate the premises. The premises are those statements that provide evidence that the conclusion is true; other statements might "color," explain and clarify, or set the stage for the conclusion without giving reasons, but these are not premises. These remarks apply to both the constructive and analytical enterprises.

When trying to create or evaluate an argument, we must direct our attention to the premises or reasons, and refuse to be distracted by the other sorts of statements. Clue words often help us to identify the premises.

Exercises

In each of the following examples, decide whether reasons (premises) are being given to support the truth of a conclusion. Identify the premises (if any), being careful to distinguish them from introductory remarks, restatements or elucidations of a position, mere persuasion, and disclaimers. Briefly justify your answer.

1. Quite simply: This Eiderdown Comforter is the showpiece of our collection! Like a rare antique, Eiderdown is of superior quality, and is coveted by connoisseurs around the world.
2. Pigs are quickly replacing dogs as laboratory animals because their use provokes less of an outcry from the public.
3. Since people who can handle poison ivy with no ill effects can lose their immunity at any time, they should avoid unnecessary contact with the plant.
4. If we are to regain our position as a scientifically advanced nation, we must increase aid to elementary schools, for lack of basic education at the earliest stages can never be overcome.
5. Humans are higher than animals, but humans should not exploit animals. In the Christian tradition, the lower creation should serve the higher creation, yet God does not want humans to kill animals because Christ's death puts an end to the need for blood offerings. As a higher life form, God, condescended to a lower life form, humans, in the person of Jesus Christ, so humans, a higher life form, should condescend to a lower life form, animals, by loving the animals.
6. Stealth's invisible. Enemy radar can't see it. And, it's the newest electronic marvel to come off the drawing board. Now, you may be thinking that there's not much in common between a Stealth Bomber and an automated cassette deck. After all, a Stealth Bomber can't fly backward. But wait, before you decide. This automated auto-reverse deck has a "radar avoidance system" called dbx. No, it's not an MX missile. But if the Stealth Bomber is invisible to radar, wait until you hear how "invisible" tape hiss will become to your ears with this dbx deck. [From DAK Industries Inc. Winter 1986 catalog.]
7. People cooking live lobsters believe that dunking arthropods in boiling water does not cause them pain. This common view of pain in invertebrates has now been challenged, at least with regard to spiders. Honeybee venom and wasp venom injected into the leg of some types of spider cause the spider to detach the affected leg. Because the response is so swift, the venom has little chance to read the spider's body. Spiders that do not discard their legs when stung in the leg usually die. Thus, discarding the leg has definite survival value. [Adapted from *The Science Almanac: 1985–1986 Edition*, ed. by Bryan Bunch (Garden City, NY: Anchor Books, 1984), p. 169.]

Notice that many of the arguments we have been discussing, including Sam's argument about the trapping pigs in Hawaii, are far too brief, as they stand, to work as complete arguments. The reason they are incomplete is because there are other, unstated or *implicit*, premises that must be identified and stated before we can understand the argument.

It is quite common, and not necessarily a flaw, to leave some premises of an argument unstated. However, when we want to evaluate an argument, we will need to state those premises explicitly. The guiding idea here is the **Principle of Charity**: try to find the most reasonable statement, or the statement that is most reasonable from the arguer's perspective, that will complete the argument. Consider the following two possible additions to Sam's argument:

(4) Causing suffering to animals is always wrong.
(5) Causing avoidable suffering to animals without overriding justification is wrong.

Unless there is strong evidence to the contrary, the principle of charity suggests that we should choose (5) rather than (4) because it is the most plausible and lends the most support to Sam's case.

The principle of charity applies to attempts to reconstruct any argument, but this example illustrates two features that are distinctive of moral reasoning. The first is that a complete moral argument will almost always involve at least one premise that makes a factual or empirical claim, and at least one that appeals to a general moral principle. We can refer to factual claims as **empirical premises** and premises which talk about what is right or wrong, what we should or should not do, what is good or bad, as **normative premises**. When we are analyzing, developing, or evaluating a piece of moral reasoning, we should look for both these parts, and make them explicit or more precise if necessary.

Here is another example, drawn from an article by Peter Singer. If we were to summarize Peter Singer's argument about famine relief, we would get something like:

(1) Death by starvation is a very bad thing.
(2) By sending substantial amounts of money for famine relief, we can prevent death by starvation without sacrificing anything of comparable moral worth.
(3) If we can prevent something very bad from happening by doing X, and if we can do X without sacrificing something of comparable moral worth, then we have a moral duty to do X.

———————

(4) (Therefore) we have a moral duty to send substantial amounts of money for famine relief.

(1) and (2) are empirical premises; although (1) seems obviously true, there is some debate about (2). (3) is a normative premise, and that, too, would need closer scrutiny. Some statements in an argument seem to combine elements of empirical and normative premises. In those cases, it is helpful to rephrase the argument to separate and identify the premises, since there are important differences in the ways in which empirical and normative premises are evaluated.

The second important feature of moral reasoning, whether we are evaluating an argument like Sam's or Singer's, or constructing arguments to support our own conclusion, is to consider whether the empirical premises are complete enough, i.e. whether all the relevant known facts have been included, and also whether there are other normative premises that would either strengthen or weaken the argument. What other facts might be relevant to Sam's decision, and are there other moral principles that should be weighed? Is (2) in Singer's argument true, and again, are there other relevant moral principles that should be factored in.

In a subsequent section, we will discuss ways of determining whether this is a good argument. The point to keep in mind when developing or evaluating a an example of moral reasoning is that it must contain both factual claims – the first

two premises – and a general moral principle, e.g. the one stated in (3) of Singer's argument.. When considering an example of moral reasoning, we need to look for both of these, and make them explicit if they are not already stated.

Exercise: Incomplete Arguments[3]

Here are some incomplete arguments. Your task is to add the necessary premise (or premises) that will make the premises of the argument support the conclusion. Do not concern yourself with whether you agree with the premises or conclusions. Your only job is to add the missing premise that will make the premises support the conclusion.

(1) Premise: Non-human animals suffer, have thoughts, and feel pain.
Conclusion: Therefore, killing non-human animals is morally wrong.
Missing premise: _____

(2) Premise: It's morally wrong to treat human beings as mere objects.
Conclusion: So, genetically engineering human beings is morally wrong.
Missing premise: _____

(3) Premise: The state ought to license all activities that can cause great amounts of harm.
Conclusion: So, the state ought to require a license for all agricultural biotechnology.
Missing premise: _____

(4) Premise: It is biologically natural for humans to eat animal flesh.
Conclusion: Therefore, it is morally permissible for humans to eat animal flesh.
Missing premise: _____

(5) Premise: For transnational corporations to patent genes taken from developing countries is a form of theft.
Conclusion: For this reason, it is morally wrong for transnational corporations to patent genes taken from developing countries.
Missing premise: _____

(6) Premise: It is our moral duty to provide food for future generations.
Conclusion: It follows that it is our moral duty to genetically engineer crops.
Missing premise: _____

(7) Premise: It is morally wrong to engage in activities that undermine the natural order of things.
Conclusion: Hence, genetic engineering is morally wrong.
Missing premise: _____

[3] Adapted by Gary Comstock from an exercise written by Michael Bishop, Philosophy and Religious Studies, Iowa State University.

(8) Premise: Making transgenic animals fails to maximize the balance of happiness over unhappiness.
Conclusion: Thus, it is ethically unacceptable to make transgenic animals.
Missing premise: _____

Another basic question to consider when reconstructing, developing, and identifying arguments is that one must decide whether the argument is intended fully to establish the truth of the conclusion, or merely show that it is more probable that the conclusion is true. More precisely, we need to consider whether the argument is intended to be understood such that if the premises were true, the conclusion **must** also be true, or instead, merely that if the premises were true, the conclusion is **more likely** to be true. This marks the difference between deductive and inductive arguments. Inductive arguments come in many forms; generalizations, predictions about the future, and inferences to the best explanation are familiar types. Although many moral arguments are inductive, both of the arguments reconstructed so far are deductive, and this will determine how we evaluate them. We will discuss the difference between inductive and deductive reasoning in detail later in the chapter, but it is useful to be aware of the distinction at the outset, as we try to determine the precise content of the argument, and how it should be interpreted.

Section IV: Outlining the Structure of Arguments

Whether we are evaluating an argument, or developing one of our own, one technique that is sometimes helpful is outlining an argument. Its usefulness is limited by the following considerations:

- Sometimes arguments are so short or simple that outlining is unnecessary: the structure of the argument is already clear.
- Some presentations are so dense that it is easier to paraphrase the main points rather than try to sort through all of the author's statements.
- Some arguments are so incompletely stated that an outline does not give much sense of the fully reconstructed argument.

Even with those caveats, outlining is a good discipline for helping to ensure that you have correctly identified and understood an argument. It is also often useful in constructing your own arguments. The basic technique involves three steps:

1. Find the final conclusion, underline it, and put brackets around it. If the final conclusion is implicit or if it has not been appropriately stated, write out the conclusion in your own words.
2. Enclose each separate premise in brackets, and assign each a number. If you are not sure whether or not something is a premise, go ahead and give it a number, but be prepared to leave it out later, if it should turn out not to be a premise. Take care to separate each distinct thought, but do not break up a single idea. If the conclusion has also been bracketed, give it a number.

3. Draw an outline of the argument by writing down the number assigned to the conclusion (or, where appropriate, the letter "C"), and arrows pointing from the numbers of statements that directly support the conclusion. Continue adding arrows and plus signs, where appropriate, as explained below.

   Here is an example of a very simple argument:

   Animals feel pain just as people do; therefore, it is wrong to torture them.

   And here is how we would apply our outlining technique to it:

   [[1]Animals feel pain just as people do]; {therefore,} [[2]it is wrong to torture them].

   And here is how we would diagram it (Fig. 3.1):

Fig. 3.1

The conclusion is: "It is wrong to torture them (animals);" the clue word "therefore" introduces this conclusion. The only other statement is a premise which points to the conclusion, and this is indicated by the arrow in the outline which points from 1 to 2. Before going on to consider more complicated arguments and their outlines, a few potential difficulties should be noted.

First, the conclusion is not always stated, or it may be stated in the form of a rhetorical question or in some other oblique way. In these cases, formulate a statement of the conclusion in your own words and make a note of it. Thus, if the argument had as its second sentence; "Why, then should we feel we can torture animals without justification?" instead of the original version, you could rewrite the conclusion as: "We should not feel that we can torture animals without justification."

The second difficulty actually includes two things, both connected with the problem of bracketing individual statements correctly. Statements will not always coincide with sentences, and so if a sentence contains two distinct statements connected by "but", "and", or a similar conjunction, we should distinguish the statements, and give each its own number. Thus, the sentence "All citizens of a country have an obligation to obey the laws of that country, but this obligation does not override the greater duty to do no wrong" should be broken up into two distinct statements, separated by the word "but:"

[[1]All citizens of a country have an obligation to obey the laws of that country] {but}
[[2]This obligation does not override the greater duty to do no wrong].

The second consideration when bracketing statements is that we must be careful not to break up statements that are unified. This temptation is especially strong in cases where we are dealing with a complex sentence which has the form "if …, then …" , or the form "either … or …", or some form equivalent to either of these two. The sentence "If animals feel pain the same way humans do, then it is wrong to torture them" does not contain two separate statements, one to the effect that animals feel pain, and the other claiming that it is wrong to torture them; the sentence remains neutral as to whether they do feel pain, and as to whether it is wrong to torture them. Rather, it expresses a relation between two factors; it presents the idea that feeling pain and the wrongness of torture are linked in some way. So, it would be wrong to break these two factors apart. We must enclose the whole statement in a single pair of brackets, and give it one number. The same holds true of the following examples:

- Either you donate some money to Oxfam, or you spend it in other ways.
- You cannot save endangered species unless you protect their habitat.
- When it snows, elk migrate to lower elevations.
- He who hesitates is lost.
- If family farms are to survive, they will need government support.
- If family farms are to survive, and large corporate farms will not profit unfairly, regulations controlling government support will have to be rewritten.
- A species can survive only if it has a sufficiently heterogeneous gene pool.

The general principle is to watch for statements that express a relation between two or more factors, and **not** break them up. These relations are most commonly found in "if … then …" statements, "either … or …" statements, or variations of these forms.

More complex arguments require more complex outlines. We might, for example, have an argument chain, in which case one of our statements may be the conclusion of a preliminary argument, and serve as a reason for the final conclusion (Fig. 3.2).

[1 Decisions about water rights are often fostered by economic rather than environmental motives,]

{since}

Fig. 3.2

[2 larger corporations have more money to hire lobbyists,] and

{hence}

[3 corporations can exert more influence on legislators].

Many arguments will give more than one premise for a conclusion. Frequently, the conclusion is dependent on both premises taken together. Sometimes, but not always, this connection is signaled by a conjunction like "and." The fact that two premises are dependent on one another is indicated in the outline by a plus sign between the numbers of the two statements, as shown in the following example:

[1 Animal research needs to be continued] {because} [2 there are many serious diseases that still need to be understood and [3 animal models are the only way of conducting rigorously controlled studies].

The point to note is that neither (2) by itself nor (3) by itself gives any reason for the conclusion. It is necessary to combine them before they are relevant to (1). Thus, the outline should look like this (Fig. 3.3)

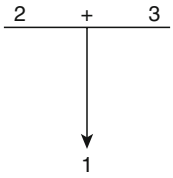

Fig. 3.3

It makes sense to have an arrow leading from a plus sign to a number, because that indicates that combining two statements produces something which supports the conclusion. We will never have an arrow pointing to a plus sign. An arrow must always point to a conclusion, either an intermediate conclusion or the final one.

Alternatively, we may have arguments in which two premises work independently to support the conclusion. Each one, taken in isolation, lends at least some support to the conclusion. The following example and its outline show how this is handled (Fig. 3.4):

[1 Family farms promote traditional virtues] and [2 are generally more environmentally friendly than large corporate farms] {so} [3 Federal policies ought to promote family farms.]

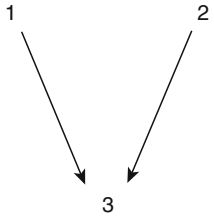

Fig. 3.4

In complex arguments, we may have several of these things going on at once, but the outlining method remains basically the same. In an argument with more than two or three statements, it may be easier to start with a small chunk here and there, before trying to combine all the various pieces into one outline. This step-by-step process is illustrated in the following example:

> The widespread alarm about use and abuse of drugs in sports probably arises from some genuine, and perhaps rational, concern; but [1 It is difficult to discern the basis for that concern in present policies and discussions.] [2 If it is based on unfairness, it is irrational.] {For} [3 there are far greater sources of unfairness.] And [4 whatever is due to drugs can be neutralized by a system that allows all athletes equal access to drugs.] [5 If it is based on paternalism, it is disingenuous and misplaced.] {For} [6 the risks of sport itself far exceed the demonstrated risks of those drugs that arouse the greatest concern.] [7 If it is based on some notion of naturalness, we need more conceptual work to tell us why synthetic vitamins are considered natural, and naturally occurring hormones are considered unnatural.] [8 We are not even clear on the moral difference, if any, between a food and drug,] [9 nor is there a clear understanding of those terms.] (From Norman Fost, "Banning Drugs in Sports: A Skeptical View," Hastings Center Report, August, 1986.)

After picking out and underlining the conclusion, and bracketing and numbering the various statements, you might notice a few of the closer connections.[4] Thus, Stage 1 of the outline might be rather fragmented, representing those connections that are easier to spot, e.g. (Fig. 3.5):

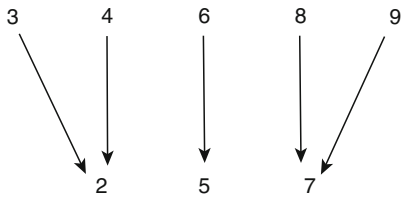

Fig. 3.5

Once we have done this, it becomes easier to see how these various pieces can be combined to make up the full outline (Fig. 3.6):

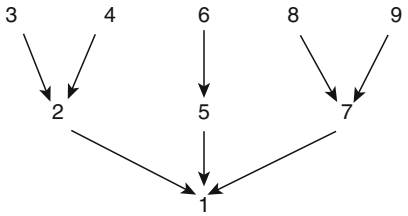

Fig. 3.6

[4] You may wonder why the last sentence has been divided into the two statements 8 and 9. Does this not violate our rule that we should never break up an "either … or …" statement? The answer is "No." In this example, "nor" means "and it is not the case that …." In general, "neither A nor B" means "A is not the case, and B is not the case."

The outlining technique is useful in another way. It can help you plan and organize your own arguments, by making you think about the connections between ideas before trying to construct a full argument. It also helps identify and correct **pincushion** arguments. These are arguments that contain many unrelated and undeveloped reasons for a conclusion: the result is a diagram that looks like a pincushion (Fig. 3.7).

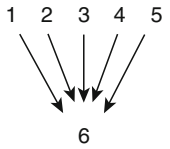

Fig. 3.7

The outlining technique is the same as the one used earlier to analyze someone else's argument: arrows run from reasons to the ideas that they support, reasons can work independently or despondently, and we might have argument chains. The only difference is that you will be supplying the claims that are organized by the outline.

Often we argue for a conclusion simply by giving a single reason. For example, if a person is asked whether she thinks a university ought to adopt a policy of not buying athletic equipment from firms that rely on child labor, she might say "Yes, because that would encourage companies to treat employees more fairly." If we number the two ideas, we get:

(1) Universities should not buy equipment from companies that rely on child labor
(2) Boycotting a company can force it to change its labor policies.

Since there are only two statements here, there is not much to organize (Fig. 3.8).

Fig. 3.8

People who disagree with the conclusion stated in (1) might list their reasons as follows:

(3) Child labor is often a necessary source of income for families living in poverty.
(4) Companies who employ children are often helping entire families to raise their standard of living.

Once these reasons have been articulated, we can step back and ask how they are best related to the conclusion (unstated: that we ought to continue buying

from companies that use child labor) and to each other. Upon examination, the first claim, (3), seems to support the second (4), which in turn leads to this conclusion:

(5) We ought not to concern ourselves with labor practices in companies from which we purchase goods.

So, our outline would look like this (Fig. 3.9):

Fig. 3.9

The conclusion in (5) would lend support to those who oppose (1). If further reasons are thought of and incorporated into the argument of (3) and (4), we may want to refine the conclusion. Eventually, we might reach a conclusion that is the exact opposite of (1), such as:

(6) Universities *should* buy equipment from companies that rely on child labor.

So far, however, there is no explicitly stated normative premise in (3)–(6), so we would need to use the principle of charity to determine how the normative premise should be formulated.

This procedure for creating an argument can be summarized as follows:

1. Try to develop a preliminary statement of the conclusion, of what you are arguing for. As you think about the subject more, do not hesitate to go back and change this statement to make it clearer, more precise, or a more accurate representation of the position you want to defend.
2. Make a list of the ideas that you think are relevant to that conclusion and assign each a number. At this stage, do not worry about connections or development; that will come later. In the case of moral reasoning, remember that you will need at least one empirical premise, and at least one normative premise.
3. Try to find an outline that reflects the natural or intuitive connections between these ideas; in doing so, you may find yourself adding ideas to the list in order to fill out the outline.

This procedure, like outlining a very short argument of someone else's, is not really needed if you have come up with only one or two ideas. (Even here, though, it gives

you time to stop and think whether your numbered statements really point to or support your conclusion, and whether they work together or independently.) In cases where you have come up with a longer list, the outlining technique allows you to break down the task of organizing your thoughts into more manageable parts. It's also a good idea to try to develop the strongest argument you can think of *against* the conclusion you are defending; that will help you spot gaps or weaknesses in your original argument. Consider the following list of reasons for advocating special support for family farms:

(1) Children on farms will learn the importance of caring for animals in a humane way.
(2) Family farmers are sensitive to environmental issues
(3) Family farms are not under the control of large corporations that lack understanding of local conditions.
(4) Family farms involve close contact with crops, water, and livestock.
(5) Large corporate farms are more likely to use chemical controls such as pesticides and antibiotics on a routine basis.
(6) Families are more likely to care about preserving land for future generations.
(7) Large industries tend to emphasize short-term profits.

Since this list moves from one strand of thinking to another, we would like to organize these ideas into an argument that is more focused and easier to follow. To do this, we need to organize some of the subsections, and then to tie the subsections together. Noting that some of the statements have to do with reducing the negative effects of farming owned or controlled by large companies, while others emphasize the positive value of the family farm, we might begin with one of those areas.

If we look for the positive side, we note that (1), (2), (6), and possibly (4) emphasize the positive value of the family farm, rather than worrying about defects in alternative farming methods. Since the statements are just meant as starting points, there are many other equally good ways of grouping them. Remember that you are trying to develop an organizational pattern, not discover one that is already determined. Thus, the reason for saying that (4) might *possibly* fall into this group is to indicate that, by itself, (4) is rather cryptic, and there are several ways in which this line of reasoning might be developed. In the complete argument, we will probably want to add statements to link it more clearly with the other parts of the argument within which we choose to locate it, such as:

*(8) People who are in close contact with the land are better able to perceive the impact of different farming practices.

You can begin the outline, then, by focusing on the benefits of family farms, looking for links between the points we have already formulated and introducing other statements that might help to clarify the points you are trying to convey. You can mark these additions with an asterisk if you find that doing so makes keeping track of them easier. Thus, a preliminary attempt to outline the positive part of the argument might look like the argument in Fig. 3.10.

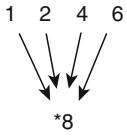

Fig. 3.10

As noted previously, this is a creative process, so other organizational plans would also yield effective arguments. If you choose a different plan, keep in mind the potential need for additional premises that will help clarify the argument, as I did by adding statement (8).

Going back to the list, note that several of the statements, namely (3), (5), and (7), have to do with the bad effects of large corporate farms but that you have no general statement that conveys the broader objection.[5] So, you add to the list.

*(9) Corporate farms are more likely to adopt practices that degrade the environment.
*(10) State and federal policies should encourage family farms rather than large corporate farms.

These additions allow you to organize a second part of the argument, with an outline similar to Fig. 3.11.

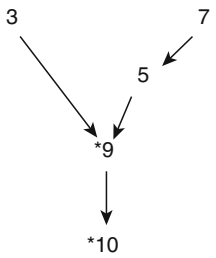

Fig. 3.11

The negative effects mentioned in *(9) are a reason for thinking that conclusion *(10) is true.

Although it has not happened in this particular example we often find that one or more of the statements on our initial list have not yet been used in this stage of the outlining process. Depending on our goal and audience, we may decide to pursue this missing topic by adding further ideas to our list, and formulating a new section of the outline, or we may decide to abandon it as unhelpful. Whichever we do, we must eventually try for a final formulation of our position, and bring together all the sections of the argument. In doing so we may notice other connections

[5] When we do this, we revise the emphasis of some of our original statements. The basic idea is the same; we can worry about precise formulations once we have decided how the argument should be organized.

between statements in different subsections; for example a statement in favor of family farms might also be used as a reason against promoting large corporate farms. These can also be indicated on the outline (Fig. 3.12).

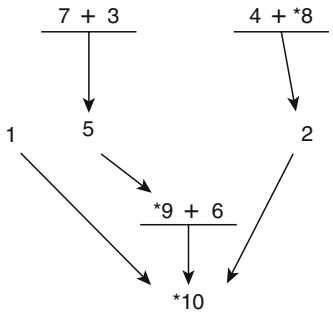

Fig. 3.12

If you now wanted to present your argument in words, you could simply begin at the top of one branch of the outline and follow it down step-by-step, reformulating your numbered statements to make their place in the development clearer. When one branch is complete, you move to another, until the entire argument has been followed through to its final conclusion.

This sort of outline can help you see how the arguments that are implicit in the outline can be constructed in the strongest possible way. The outline helps you recognize what sorts of evidence might be relevant, how the premises must be formulated, what needs to be added or deleted, and so on. It helps you group related ideas together, and gives you time to think about the relations between these ideas – which ones lead to what, and how they fit together. They help you locate gaps, and give you an opportunity to supply missing pieces. By allowing you to work out the pattern of the argument before you state it in final form, you can offer your ideas (which started off as numbered statements formulated in no particular order) in a way that shows your audience how they fit together. This ability to develop a clear and well-organized argument provides a firm foundation for learning how to reason correctly. When outlining an argument that has been presented to you, you also complete an essential first step in evaluating the effectiveness of that argument.

Section V: Validity and Soundness

The main goal of critical thinking is to evaluate arguments, either our own or those offered by others seeking to persuade us. The first steps towards this goal are locating the conclusion, finding the premises, and outlining the structure of the argument, point covered in the previous section. I now begin discussing the question of evaluation.

Two main factors make an argument good or bad: (1) the relationship between the premises and the conclusion; and (2) the status of the premises. I first concentrate on the relationship between the premises and the conclusion.

We have already noted that **deductive arguments** are intended to show that the conclusion *must* be true, so I shall begin by introducing two concepts for evaluating deductive arguments. The first, **validity**, has to do solely with the relationship between the premises and the conclusion; the second, **soundness**, concerns both the relationship between the premises and the conclusion, and the status of the premises.

In order to understand the concept of validity, we should remember that the purpose of an argument is to present a reliable form of reasoning, and that reliability has to do not merely with usefulness, practicality, or appeal, but with truth. Ideally, we would like arguments that have the following feature: if we start with true premises, they must lead us to us to a true conclusion. In other words, we want our arguments to be truth-preserving. An argument that is truth-preserving in this way is called a valid, or deductively valid, argument.[6] With this in mind, we can define a valid argument in any one of three equivalent ways:

1. An argument is valid if and only if it is not logically possible for its conclusion to be false when all its premises are true.
2. An argument is valid if and only if its conclusion follows logically from (or, is logically implied by) its premises.
3. A valid argument is one in which its premises are related to its conclusion in such a way that if all its premises were to be true, then it would have to be the case that its conclusion is true also.

Though all three of these definitions are equivalent, the first is sometimes more useful, especially when it is not clear to us whether the premises of an argument logically imply its conclusion.

It follows from our definitions of validity that any argument that is not valid is invalid and vice versa: both of these terms are "all or nothing." If an argument cannot *guarantee* the truth of its conclusion on the basis of the truth of its premises, it is simply invalid. There is no such thing as an argument that is somewhat valid, or mostly invalid. We will see later, however, that some invalid arguments are inductively strong. Remember, the terms "valid" and "invalid" describe arguments, not isolated statements. Similarly, the terms "true" and "false" should only be used to describe statements, not arguments.

How do you tell when an argument is valid? Any argument which exemplifies a valid *form* of argument is valid. So, our next question is: How do you recognize a valid form of argument? By a valid form of argument we mean a pattern such that any argument that has that form or follows that pattern exactly will automatically be valid.[7]

---

[6] The terms "valid" and "deductively valid" are equivalent, and can be used interchangeably. The only reason for adding the term "deductively" is to emphasize the difference between deductively valid arguments and inductively strong arguments.

[7] It may be noted that there are many valid arguments according to the fundamental (semantic) definition of validity (definition 1) which do not possess a valid argument form in either categorical or propositional logic. For example, "John runs quickly" validly entails "John runs." Definition 1 guides us in what we recognize as a valid form of argument. Unfortunately, the construction of such systems of logic is still incomplete. So there remain valid arguments which, as yet, are not recognized as instantiating a valid (syntactical) form of argument.

To examine the form of arguments more easily, with fewer distractions, I will frequently substitute symbols or letters for actual words, phrases or statements. Doing so allows you to look at the form completely apart from the specific claims made by the premises. can show, for example, that any argument of the form "All A's are B's, All B's are C's; thus, All A's are C's" is valid, which tells us that whenever we substitute terms for A, B, and C that make the premises true, the conclusion will be true too. Of course, if our substitutions make one or both of the premises false, then anything can happen – the conclusion might be true, or it might be false, even though the argument is still valid.

Exercise

Which of the following examples are **valid** arguments?

(1) All whales are fish, and all fish are cold-blooded; therefore, all whales are cold-blooded.
(2) All whales are fish, and all fish live in water; so, all whales live in water.
(3) All whales are fish. All fish suckle their young. Therefore, all whales suckle their young.
(4) All whales are mammals. All mammals suckle their young. So, all whales suckle their young.

You have, no doubt, correctly seen that each of the arguments in the previous exercise is valid, even though three of them have at least one false premise, and one has a false conclusion. Each argument is valid because if all its premises were true, its conclusion would also have to be true; all four arguments exemplify the same valid form of argument. If a valid argument does have all true premises, the conclusion must also be true. On the other hand, if one or more of the premises of a valid argument is false, the conclusion might be true or it might be false; there is no guarantee either way.

How do we show that an argument is invalid? This can be difficult, since many invalid arguments have true conclusions. The crucial point is to prove that even if all the premises were true, the conclusion could *possibly* still be false. For that reason, paying attention to the form of the argument can help us again. So, we shall begin by learning how to identify an invalid form of argument.

Since an invalid form of argument leaves open the possibility that true premises can lead to a false conclusion, we can show that a form is invalid by constructing an example of an argument following that form in which all the premises are true and the conclusion is false.

Consider the following very simple example:

If we destroy the habitat of a species, then the species will become extinct. We did not destroy the habitat, so the species will not become extinct.

Although this argument may appear to be valid, it is actually invalid, and this can be discovered by examining its form. The form of argument is: "If p then q; not p; therefore, not q." We can show that this form is invalid by substituting statements

for "p" and "q" that make all the premises true and the conclusion false, as in the following example:

> *If Margaret is a Purdue graduate, then Margaret is a human being. Margaret is not a Purdue graduate, and so she is not a human being.*

Given that Margaret is a human being, but not a Purdue graduate, this example conclusively shows that in all arguments of this form, the truth of the premises does not guarantee the truth of the conclusion; therefore, this is an invalid form of argument. We can use the same technique with more complicated arguments.

The second concept, soundness, builds on the idea of validity. A sound argument must satisfy two criteria: it must be a valid argument, and all its premises must be true. If either one of these criteria is not met, the argument is unsound. This definition tells us two things. Like validity, soundness does not admit of degrees – an argument is either sound or it is unsound. Secondly, a sound argument will always have a true conclusion. In order to determine whether an argument is sound (in contrast to determining its validity) we must evaluate both its form and the truth of its premises. This is particularly difficult with normative premises, or premises that make claims about moral principles. In general, our judgments of soundness will be qualified, based on how well the premises can be justified in comparison to alternative principles. However, the fact that a sound argument must have a true conclusion allows us to use a variation of the technique that we used on the previous example. If we want, for example, to criticize Peter Singer's argument described earlier, we might try to show that the argument is unsound by offering something like the following parallel argument:

(1) The illness and death resulting from kidney failure is a very bad thing.
(2) By giving one of our healthy kidney to someone who needs it, we can prevent the illness and death resulting from kidney failure without sacrificing anything of comparable moral significance.
(3) If we can prevent something very bad from happening by doing X, and if we can do X without sacrificing something of comparable moral worth, then we have a moral duty to do X.

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(4) (Therefore) we have a duty to give one of our kidneys to someone who needs it.

Unlike the previous example, this does not provide a conclusive refutation, since we cannot demonstrate with certainty that the conclusion is false. However, since the first two premises are true, the form of the argument is valid and mirrors Singer's, and the conclusion is highly dubious, we are justified in questioning the soundness of the argument, and focusing our attention on the truth of (3). This technique – constructing an argument which (a) is valid, (b) some of whose premises are clearly true, but (c) leads to a conclusion that is false or highly dubious – is known as a **reductio ad absurdum**, or simply a 'reductio argument.'

The second broad category of arguments to consider is that of "inductive arguments"; they play a particularly important role in moral reasoning. Inductive arguments are, by definition, always invalid: true premises make it more likely that the conclusion is

true, but do not guarantee the truth of the conclusion. However, there are criteria for inductive arguments that are similar to the standards of deductive validity and soundness. Inductive **strength**, like deductive validity, looks at the relation between premises and conclusion. An inductively **reliable** argument is an inductively strong argument with true premises. Unlike validity and soundness, however, strength and reliability are always a matter of degree. Moral reasoning often involves inductive rather than deductive arguments, which leads to the fact that we can conclude that a decision about the right or wrong thing to do is probably true, we are less likely to reach a conclusion that we can assert with absolute certainty.

The two most common forms of inductive argument that appear in moral reasoning are **generalization,** and **inference to the best explanation.** Generalizations attempt to identify a common thread running through specific cases, and fit in with goal of 'completeness', discussed more fully in the next section. The goal is to find a broad or general rule that explains why specific action are right, wrong, or acceptable. Here is an example:

(1) Killing off 'capstone' predators degrades the environment.
(2) Polluting streams harms the ecosystem.
(3) Introducing non-native species can have serious negative impact on native species.
(4) All of the previously mentioned effects are undesirable.

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(5) Whenever possible, we should avoid changing a natural ecosystem.

The first three premises are all empirical premises, and should be evaluated in terms of their factual accuracy. (4) is a normative premise. The most important thing to note, though, is that even if all the premises are true, they do not guarantee that the conclusion is true. They make it more probable that the conclusion is true, but either a more narrow conclusion (e.g. artificial manipulations of an ecosystem are wrong) or a broader one (e.g. we should actively prevent any perturbation of an ecosystem) might be better, in the sense that it is more likely to be true, and/or more complete.

When evaluating generalizations, there are two main points to consider. First, the specific examples should cover an appropriate range of cases; the broader the conclusion is, the more different types of examples should be considered. A wider range of premises will make the argument stronger. Second, we need to be scrupulously honest about looking for counterexamples: cases that count against the generalizations. Such examples make the argument inductively weak, and may also suggest ways in which the conclusion should be reformulated. Thus, in the argument discussed above, if we find cases in which introducing a new species has actually benefited the ecosystem (e.g. Canadian wolves in Yellowstone, or ring-necked pheasants all across the U.S., although both cases are controversial) the entire argument would be weaker than it first appears.

A second common type of inductive argument frequently used in moral reasoning is **inference to the best explanation**. It shares certain similarities with generalizations, in that both try to identify a common factor among cases mentioned in the premises. In fact, the line between these two sorts of arguments can get quite

fuzzy. However, generalizations just suggest a broader category into which the cases mentioned in the premises might all be located, while an inference to the best explanation, as the name implies, offers an explanation about what makes the premises true. Thus, it offers a way of identifying, defending, or evaluating moral principles that takes us beyond mere generalizations. Here is an example:

(1) Subjects in experiments should be given enough information about the nature of the project so that they are capable of giving informed consent.
(2) Government policies should allow farmers to decide what sort of crop, and how much, they plant in any given year.
(3) Although we might encourage people to donate money to famine relief efforts, we should not require them to do so.

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(4) Legitimate moral actions should respect the autonomy of moral agents.

As with any inductive argument, even if the premises are all true, they do not guarantee that the conclusion is true. What is distinctive about this form of argument is that it attempts to explain why the premises are true. An inductively strong inference to the best explanation provides a plausible hypothesis, theory, or explanation. It is interesting to note, since many people think that science and ethics employ entirely different forms of reasoning, that inferences to the best explanation are at least as common in science as they are in ethical reasoning.

Section VI: Evaluating Moral Principles and Theories

As noted above, although we cannot demonstrate conclusively the truth of a moral principle or normative premise, we can try to judge whether it is can be better justified than its competitors. In this section, we will examine some of the criteria by which to evaluate the justification of a moral claim. Collectively, these criteria can be called "the Four C's": clarity, coherence, consistency, and completeness. They do not provide a mechanical algorithm for evaluating moral claims – as far as we know, no such algorithm exists – but they do provide an informal checklist which we can use when trying to formulate or evaluate moral claims.

The first step in evaluating a moral claim is to make sure that we understood what it means, and what it applies to. This is the criterion of **clarity**. For example, most of us would quickly agree with the statement "murder is wrong", but the criterion of clarity asks us to take a deeper look. We should try to be clear about what 'murder' means: standard definitions agree that killing in self-defense is not murder, but what about engaging in some action that has death as a predictable side-effect? The same criterion of clarity is relevant to the example of Sam with which we started: is undermining the trapping of feral pigs, when one's primary goal is to avoid causing suffering to and killing sentient creatures, but an inevitable side-effect of which is the degradation of a fragile ecosystem, a case of an irresponsible treatment of the environment? When evaluating the clarity of a moral claim,

we should also consider what it applies to. Staying with claims about killing: do they apply to a fetus? a dog? a species? Plants as well as animals?

It may seem as if questions about clarity are not really criteria for the evaluation of moral claim, but rather raise issues that must be settled before we can decide whether a claim is justified. To some extent, this is true, which is why it is the first criterion. But some claims are simply more carefully formulated and clearer than others. All other things being equal, a clear empirical premise is better than a vague or ambiguous one.

The second criterion, **coherence**, asks whether our moral principles fit together in a reasonable way. A classic example of incoherence is the pairing of the claims (a) it is always wrong to kill a person and (b) convicted murderers deserve to be executed. If we encounter an argument that includes the claims (a) we ought to respect each person's autonomy in all matters which do not involve harming others, and (b) homosexuality is wrong, there is a more subtle coherence problem. It is more subtle because there might be ways of making the two fit together in a more general moral theory, but that would need to be spelled out and evaluated. Coherence is basically a question of how well our moral claims fit together, and goes beyond questions of logical contradiction. In some cases, questions of coherence involve factual matters but more often they direct our attention to the more general moral theory in which a specific claim is embedded. Thus a series of arguments that switches back and forth between utilitarianism and deontological claim would also suffer from a lack of coherence. Generally. then, considerations about coherence require us to move beyond one specific moral claim, and try to formulate the moral theory which supports the claim.

The third criterion, **consistency**, must be applied very carefully, because it has some built-in pitfalls. The criterion asks whether a moral principle conflicts with our basic, deeply held moral intuitions. It is often our most important standard: no matter how clear and coherent a theory or principle might be, if it leads to the conclusion that it's morally acceptable to torture a 2-month old infant because "I wanted to see what it would feel like to do that", we ought to reject it. The pitfall is equally clear: what we think of as basic, deeply held moral intuitions may in fact turn out to be prejudices, or ungrounded values. People who happily eat pork chops, but identify 'it's wrong to eat dogs' as a basic moral intuition, will have to dig a bit deeper.

There are two important tools that can help in testing the consistency of a principle or theory. The first draws on cultural relativism as an **empirical** fact. Even if we reject cultural relativism as a moral theory – the idea that what is right or wrong is simply a matter of one's society and its standards – the fact that different societies do, in fact, disagree about some matters is potentially enlightening. Just being aware that some people eat dogs frequently, and others are revolted by the idea of eating a pig, provides a starting point for examining our own intuitions. The second tool is often called **reflective equilibrium**. It is the idea that although we are aiming at consistency and we want our intuitions and moral theories and principles to be in equilibrium, it is not always the intuitions that remain fixed. Rather, we may have to make adjustments on both sides to find the proper balance or equilibrium.

The last of our "Four C's" is **completeness**. Completeness is a matter of how much of our moral life, moral problems, and moral decisions is covered by the principle or

theory in question. Moral theories usually aim at completeness: utilitarianism offers a standard for determining whether any action is right, wrong, or neutral. Most of the moral principles we use and encounter in arguments are less grandiose, but a principle which applies only in very limited cases should be examined carefully. Someone who relies on very different standards for the treatment of research dogs and pets should think carefully about the criterion of completeness, and ask whether there is a more general (i.e. more complete) principle that covers both cases.

The criteria of completeness, coherence, and consistency together figure in a useful strategy for analyzing theories and principles. This strategy is sometimes called **the argument from morally relevant difference**. The basic idea is that if we think we are justified in assigning different moral evaluations to two different cases, we must be prepared to identify what the difference is between the two cases, and why the difference is morally relevant.

Obviously, then, both general principles of logic and critical thinking, and specific features of moral reasoning, should be employed to fullest extent possible, either when we are trying to understand and evaluate someone's claim about what is morally right or wrong, or when we attempt to formulate our decisions about ethical issues. Practicing these skills should help us avoid succumbing to the myth that ethical decisions are 'just a matter of opinion'. In an academic setting, they can help us formulate more thoughtful responses to case studies. In real life, they may help us reach better decisions about how to act.[8]

Exercises: Arguments for diagramming

1. *Using the numbers indicated, diagram the following arguments.*

   A. [1] If we are to regain our position as a scientifically advanced nation, we must increase aid to elementary schools, for [2] lack of basic education at the earliest stages can never be overcome.

   B. [1] The lower creation was made to serve the higher creation. [2] Humans are the higher creation, and [3] animals are the lower creation. [4] Therefore, humans may eat animals.

   C. [1] People cooking live lobsters believe that dunking arthropods in boiling water does not cause them pain. This common view of pain in invertebrates has now been challenged, at least with regard to spiders. [2] Honeybee venom and wasp venom injected into the leg of some types of spider cause the spider to detach the affected leg. Because the response is so swift, the venom has little chance to reach the spider's body. [3] Spiders that do not discard their legs when stung in the leg usually die. [4] Thus, discarding the leg has definite survival value. [5] Although this behavior in itself does not prove that some spiders feel pain, the components of the venom associated with leg detachment suggest that these spiders do feel pain. [6] Melittin, histamine, phospholipase A, and serotonin, found in the venoms, are known to cause human pain.

[8] Earlier versions of this material were developed with the support of NSF Grant # SBR-9601759.

D. [1] Animal liberationists insist that we have a moral obligation to efficiently relieve animal suffering. [2] The misery of wild animals is enormous. [3] In the natural environment nature ruthlessly limits animal populations by doing violence to virtually every individual before it reaches maturity. [4] The path from birth to slaughter, however, is nearly always longer and less painful in the barnyard than in the woods. [5] Thus, the most efficient way to relieve the suffering of wild animals would be to convert our national parks and wilderness areas into humanely managed farms. [6] It follows, therefore, that animal liberationists cannot be environmentalists since they must be willing to sacrifice the authenticity, integrity, and complexity of ecosystems for the welfare of animals.

2. Supplying your own numbers, diagram the following arguments:

A. Living on a family farm is the best way to live. It would be nice if most Americans could live on family farms. Therefore, the U.S. Congress ought to provide funds so that all Americans can live on family farms.

B. The personality of the farmer is basically healthy. The reason is that he is self-reliant and independent, committed to fairplay, due process, and democratic ideals. But a darker side is characterized by scapegoating, violence, and ideologies that bring few benefits to farmers and, if widely spread, would be disadvantageous to consumers and society as a whole.

C. Farmers have an interest in depleting soil and water resources if they can profit in the short term from exploiting the land in this way. Future generations may not need soil and water if they can find alternative ways of feeding themselves. Taken together, these two reasons lead to this conclusion: Farmers have no moral duty to farm in an ecologically sustainable way.

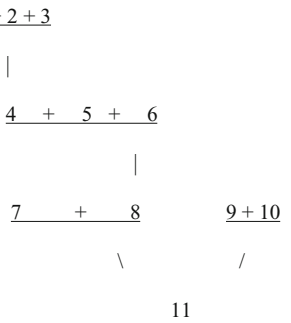
D. It is possible to question whether future generations indeed have a right to food. First, the question of which individuals will make up future generations is unclear. The reason is that the choices we make today affect which individuals are alive tomorrow. Second, utilitarians think that individuals have rights only when doing so produces the greatest good for the greatest number. Third, the greatest good for the greatest number might be obtained by giving everything to the present generation and not worrying about future generations.

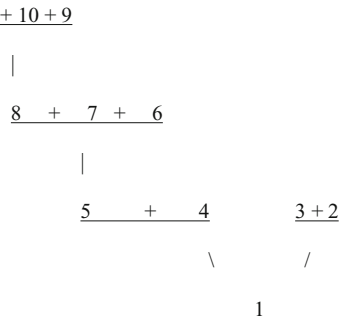
3. *Consider the following argument.*

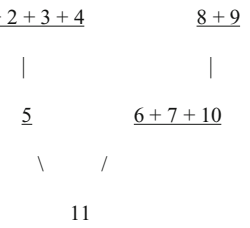
1. Humans are rational creatures.
2. Animals are not rational creatures.
3. Rational creatures are higher than non-rational creatures.
4. Higher creatures may use lower creatures.
5. Humans may use animals.
6. In the course of nature, rational creatures use non-rational creatures for their purposes.
7. In the course of nature, humans raise, kill, and eat animals, and use them in research.
8. God created the course of nature.

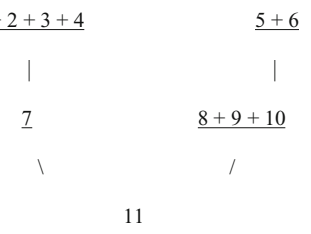
9. What God creates cannot be wrong.
10. Whatever happens in the course of nature cannot be wrong.
11. It cannot be wrong for humans to raise, kill, and eat animals, and use them in research.

Which of the following diagrams most accurately portrays the logic of this argument?

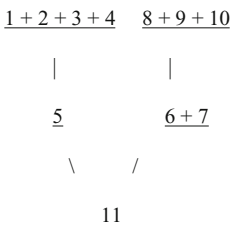
(a) 

(b) 

(c) 

(d) 

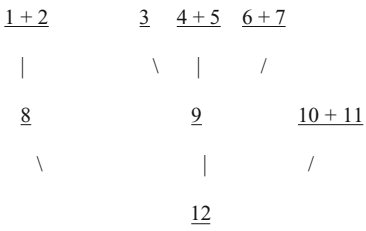
(e)



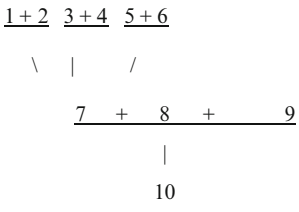
1. *Consider the following argument.*
   1. Animals have value to God.
   2. Whatever has value to God has intrinsic value.
   3. Humans may not claim to be the only measure of good as regards animals.
   4. If humans may not claim to be the only measure of something's good, then that thing has intrinsic value.
   5. Animals have their own needs, interests, and patterns of behavior.
   6. Whatever has its own needs, interests, and patterns of behavior has intrinsic value.
   7. Animals have intrinsic value.
   8. It is morally wrong to cause anything with intrinsic value avoidable death or injury through deprivation or starving.
   9. Using animals for food always causes them avoidable injury or death.
   10. It is morally wrong to use animals for food.

Which of the following diagrams most accurately portrays the logic of this argument?

(a)



(b)



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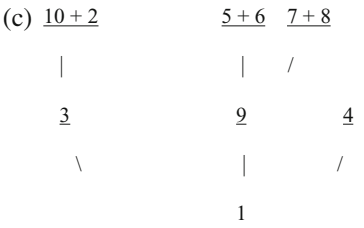

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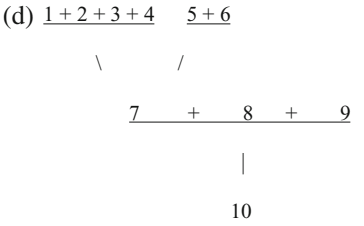
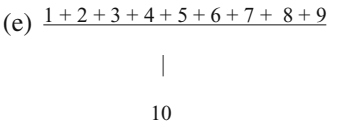


(e)


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Chapter 4
Method

Gary L. Comstock

Abstract An introduction to ethical reasoning, emphasizing similarities and differences between methods in ethics and science.

Keywords Ethical theory • Scientific method • Reasoning • Coherence • Consistency

Case: Dennis the Relativist

"All this discussion of cheating being wrong seems utterly obvious to me," says Nancy, a graduate student acting as Dr. Wright's teaching assistant. She's having a strawberry daiquiri in a local bar. She continues, "I think it is wrong to cheat just as it is wrong to spread lies about a colleague to get a grant for which we are both competing. Pass me the pretzels, would you please?"

Dennis, a graduate student in molecular biology, hands her the snack. "What do you mean by 'wrong'? That no one should do it? That's not what I mean by 'wrong.' I mean an action that someone does not want others to perform. You don't *want* people spreading lies in that situation. But I see things differently. If spreading lies were the only way for me to keep my job and feed my family, or avert widespread ecological catastrophe, then spreading lies in that situation is something I would like them to do."

Nancy replies, "Well, perhaps I should have added to my initial statement the qualifier 'all other things being equal.' But there's a deep problem here. You think the term 'wrong' means 'something I don't like.' But I think it means 'objectively impermissible.' Wow. Those are two very different concepts."

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"You're absolutely right about that. But there's a deeper problem: People have widely different values. Even if people agree about the meaning of an ethical term, they will find a way to disagree about the situations to which it applies. You claim that it is wrong to spread lies to get grants, but I don't think so. Not always. Suppose that the competing colleague had first spread lies about you. I wouldn't think it would be wrong to even the score; you would just be leveling the playing field."

Nancy sighs deeply. "I don't agree with that analysis at all."

"Well, let me add one more complaint while I'm at it," says Dennis.

"Fire away."

"You hold the belief that cheating on colleagues is wrong because you fear that it might happen to you, and you would not like that."

Nancy can't sit still. "Now, wait a minute. I have good grounds for holding to my original belief about the wrongness of lying. I believe it because I think human beings should be respected, and lying fails to show persons the respect they are owed."

Dennis is not persuaded. "You only believe *that*," he retorts, "because you heard it in that moral theory course you took last year."

"No," Nancy replies, "I believe it because I have good reasons. Persons are rational creatures and are able to make free choices. To lie about them is to interfere with their distinctive capabilities and therefore is wrong."

Dennis will not give up. He thinks he has caught Nancy in a circularity. "Look," he retorts, "you think it is wrong to interfere with a person's distinctive capacities only because you do not want others to do it to you. And you don't want others to do it to you because it would hurt you. And that's what I said about your dislike of lying a few moments ago; you don't approve of lying simply because you fear lies and liars. But you are going around and around, not getting anywhere. Why don't you just say, "I don't like lies," and be done with it? Why try to dress up your feelings in fancy philosophical language about human *rights* as the foundation of *respect* that *rational persons* are owed? Everyone knows that's just gibberish that some philosopher made up."

"Hey, don't get me wrong; I don't think this is your fault. Anyone who tries to 'do ethics' is caught in the same trap. It's all completely circular and based on emotion. Not at all like what we do in biology and science, where we have well-established methods for getting objective and verifiable results."

Case: Discussion Questions

1. Do you think ethicists have a method they follow that is as objective as the method that scientists follow?
2. If you answered *yes*, explain analogies you see between ethics and science.
3. If you answered *no*, explain any disanalogies you see between ethics and science.
4. Dennis gave three reasons for thinking ethics is not like science. Explain whether you agree or disagree with each argument, and why.

(a) People have conflicting definitions of ethical terms.
(b) People make conflicting ethical judgments.
(c) We cannot establish the reliability of our ethical judgments without using circular arguments.

Discussion of Issues

The sciences are descriptive disciplines in which we try to discover and articulate natural laws and regularities that in fact govern the behavior and relationships of objects in the natural world. We commonly believe that scientific laws are *discovered* in the world and that science provides real knowledge about the actual workings of nature. Ethics, on the other hand, is a normative discipline aimed at prescribing conduct; in ethics, we try to discover and articulate moral laws that ought to govern human behavior. Insofar as ethics is unlike science in this fundamental way, might it be that ethical rules are *socially constructed*, that is, simply invented by individuals and groups that cook up these rules? Is ethics therefore completely unscientific?

In his debate with Nancy, Dennis has focused attention on three reasons, discussed in the following sections, that are commonly offered for thinking that ethics bears no relation to science.

People Have Conflicting Definitions of Ethical Terms

Dennis and Nancy are surely right about this one. There *is* great ambiguity in our vocabulary when we use basic ethical terms such as *wrong*. The word *wrong* can by used as Dennis uses it to mean *something I don't like*. Or, it can be used as Nancy uses it to mean *objectively impermissible.* These two uses point to two very different, and probably irreconcilable, meanings. Many people would agree with Dennis that the ambiguity of ethical terms is a good reason to believe that ethical words are *always* open to whatever interpretation people want to give them. But perhaps Nancy is right to protest that this relativistic conclusion does not necessarily follow?

People Make Conflicting Ethical Judgments

Dennis and Nancy agree about this claim too and, again, they are both right. It does initially appear that a wide variety exists in our moral assessments. We often assume, therefore, that this is a reason to believe that ethical judgments are relative to the values of an individual or group, that no commonly shared ethical

judgments are possible. But, given our experience in working through the shock treatment for naïve relativism (see Exercise 1.C in Appendix A), must we accept this conclusion?

People Cannot Establish the Reliability of Ethical Judgments Without Using Circular Arguments

Even if two people agree on their terms and on some of their judgments, they are bothered by the fact that their judgments seem to rely on a host of unargued assumptions. The judgment that it is wrong to spread lies, Dennis complains, assumes not only that we know what *lying* and *wrong* mean but also that we can tell an instance of lying when we see one; that we are not commonly deceived about the difference between right and wrong; that people deserve respect; that lying shows disrespect; and on and on. We simply must assume the truth of all these claims in order to justify any particular moral judgment. Doesn't that mean that ethics lacks foundation?

Well, maybe. It is true that Nancy does not want others to spread lies about her because it would hurt her, and her desire not to be hurt is one of her reasons for thinking it wrong for anyone to tell lies to get grants. She is indeed drawing on her feelings, somewhat surreptitiously, in order to justify her Kantian argument about the need to respect persons as rational creatures. Furthermore, she has not provided any reasons for the legitimacy of her desire that others not spread lies about her. She thinks she probably could provide such reasons, but she has not done so yet, and she wonders, indeed, whether she would not have to draw on Kantian claims in order to do so.

It seems, at this point, that Dennis is right. Nancy is apparently caught in several illegitimate moves. First, she is trying to justify her original assertion by relying on premises that are only implicit. Logically, one should not make use of premises in an argument when one has not spelled out those premises. Second, the truth of the suppressed premises has not been established. Third, and perhaps worst of all, it is not at all clear that the truth of the suppressed premises could be established without invoking some form of the Kantian premises that are currently at issue. In other words, in order to establish any grounds at all for believing the hidden premises that she is using to support her conclusion, Nancy would have to assume the truth of something like her conclusion. The reliability of Nancy's original judgment can be secured only by invoking other beliefs, beliefs that in turn can be rendered reliable only if we assume the credibility of the first assertion. This circularity seems to be vicious, as if we are always begging the question whenever we try to justify ethical judgments.

Does ethics contain no objectivity, no truth of the matter? Dennis's question is one of the most difficult in moral philosophy because it raises the issue of whether moral judgments can be justified. To address it, I first examine how we justify scientific judgments. Getting a clear picture of that procedure will provide us with a

foundation from which to explore the question of whether any analogous method exists in ethics.[1]

Many of us typically think that scientific judgments are justified on the basis of what we have learned to call *the* scientific method. But, as Ernan McMullin and others have pointed out, sciences uses many different kinds of methods (McMullin 1984). The Babylonians, interested primarily in astronomy, were interested in prediction. Aristotle, on the other hand, was primarily interested in explanation. Evolutionary biologists and geologists typically are less interested in predictive power than in natural history. Scientific endeavor consists, in sum, of different models, aims, and, most significantly, methods.

Nonetheless, many students at least seem to think that one method exists, a "value-free" form of inquiry, that begins with pure observations, leads through experiments to facts, and ultimately leads to true theories. We begin with observations, and on the basis of reliable observations, we construct hypotheses, which we then test using controlled experiments. When we have proven a hypothesis, we have the basis for constructing a scientific theory. This method, we are told, provides objective knowledge that cannot be doubted, is infallible, and does not need support from other sources. *The* scientific method provides knowledge that is indubitable, incorrigible, and independent. It is knowledge that is fundamental, the standard against which all other kinds of knowledge claims are to be judged.

Examining the "Scientific" Method

Following is a discussion to see whether this is how modern biology actually works. Take the case of the discovery of Pfiesteria piscicida, a toxin that has been killing fish in eastern coastal waters of the United States and that killed half a million fish in the lower Neuse River in North Carolina during 5 days in July 1998 (Pfiesteria outbreak 1998). Pfiesteria is a dinoflagellate, a microscopic, mostly one-celled organism that lives in tidal estuaries. It is an intriguing organism. Botanists seem to think that dinoflagellates are plants because some of them thrive through photosynthesis. But other dinoflagellates eat protozoans, so these organisms probably ought to be classified as animals. The growth of Pfiesteria appears to be spurred by agricultural fertilizers, urban runoff, and animal wastes from hog confinement operations that leach into waterways. The microbe causes lethal lesions to grow on fish and biologists fear that it may affect the health of humans as well.

[1] I presented versions of this chapter at a symposium, "Ethics in the Practice of Science," at the Luso-American Development Foundation, Lisbon, Portugal, May 4–5, 1998, and at the Bioethics Institutes at Illinois State and Oregon State. On this subject, I have learned much from Martin Curd, who presented two lectures on this subject at the Purdue Bioethics Institute, and from Ernan McMullin, who lectured on the philosophy of science at the Lisbon conference.

People who have come into contact with Pfiesteria have complained of disorientation, temporary memory loss, and skin infections. The prospect that Pfiesteria might attack people if they so much as wade in North Carolina streams is not welcome news and is especially troublesome for North Carolina agribusiness and tourist industries.

Intriguing ethical twists in the Pfiesteria story revolve around the aquatic botanist Dr. Joanne Burkholder of North Carolina State University, perhaps the world's leading authority on the organism.[2] Following is a review of the rather mundane steps by which Pfiesteria was discovered.

In 1988, a Ph.D. student named Stephen Smith was working in the lab of a fish pathologist, Dr. Edward Noga, at the Veterinary College of North Carolina State University. Smith was trying to figure out how the immune systems of tilapia, a small and common African fish, would handle exposure to parasitic organisms. Smith believed that the dinoflagellates killed fish by attaching themselves permanently to gill tissue and mucus membranes. But before Smith could even begin his experiment, all the fish in his 300-gallon holding tank died as he was raising the salinity level to approximate that of the ocean.

What was wrong? He had a hunch that something had failed with his equipment, that the biological filter was defective or that the air supply hose had been unintentionally disconnected. I quote from Barker's book:

> Using a kit designed for just these situations, he checked for the usual environmental toxicants and was surprised to find that the ammonia levels were just fine, as were the nitrite and the pH. Since he was unable to figure out what was wrong with the water by the obvious methods, and as there was obviously something clouding the water, he took a sample up to the laboratory and looked at it under a light microscope, where he found the specimen swarming with weird little organisms. (29–30)[3]

Smith has just discovered Pfiesteria. How did he do it?

Intuitions

Smith began with a sort of nondescript feeling: the fish in the holding tank were killed because of a failure of equipment. It seems appropriate to call it a feeling because it is completely unsubstantiated. Smith has no evidence for it; it came as much from his training as anything and he landed upon it more or less by default. Years of working in fish toxicology labs made it second nature for him to suppose that when something

[2] I recommend (Barker 1997). In that work, Dr. Burkholder is described as complaining about ethical violations in her pursuit of her research. She expresses concerns that funding agencies intentionally ignored her work; that the state of North Carolina was negligent in failing to underwrite her work; and that colleagues competing for funds harassed her. My purpose in describing Burkholder's work is not to weigh the merits of her ethical charges but rather simply to describe the scientific method that was pursued in discovering the dinoflagellates.

[3] Cf. (Toxic-algae crusader famous, but still furious 1997). Thanks to Ken Tenore for bringing these Pfiesteria resources to my attention.

goes seriously wrong, the first thing to do is check the equipment. Notice that this feeling was part of his personal agenda. Smith *wanted* to figure out the problem, he was *interested* in the solution, and, for all we know, he *desired* to get the project back on track quickly so that he can go on a brief vacation with his wife and daughter. The feeling was not disassociated with his personal values or from the interests of his scientific community. He cares about the integrity of his work, and his community cares about the accuracy of his experimental results. So, having been acculturated in the scientific community's usual ways of proceeding, Smith easily hit upon the idea that he ought to check the equipment. The feeling, in other words, was not unmotivated; it is rather, to use the current jargon, "theory laden." It comes from what we might call "the theory of fish toxicology lab science."

All of this points to one conclusion: Although Smith's feeling was a good one, he was nonetheless in a rather insecure epistemological state. He has no evidence that his hunch was true and he had not articulated to himself or anyone else any reasons that he ought to believe it. He was simply acting on an inherited tradition, on a belief he had acquired from his community. Were it not so distasteful a word to the scientific community, one could almost say that he was acting on intuition.

Checking Procedures

Hunches and intuitions can be made well or poorly, and they can be based on good training or self-interested bias. Did Smith get the feeling that the equipment malfunctioned because he wanted to get out of the lab as soon as possible and this seemed to be the easiest solution? Or was his feeling based on his best scientific lab instincts? Notice that I am not (yet) asking whether the intuition was true or false but only whether it occurred in good faith. The intuition may have been motivated by defensiveness: Smith's fish die; he lays the blame on someone else. We can imagine Smith saying, "Ken, that graduate student idiot, must have sabotaged my experiment by yanking the hose off the tank."

Smith probably did not know at first whether his initial feeling was biased or not. So he runs a few checks: Did he have reason to suspect Ken? Should he discount his hunch because of his poor relationship with Ken? Or because of other defects in Smith's personality? Is he prone to believing conspiracy theories – did he think his neighbors were out to get him? Was he sick of working with Ken, fed up with tilapia, frustrated by North Carolina State University, resentful of Dr. Noga? Did he have some secret reason to sabotage the experiment? Was he simply absent-minded, turning off the air supply while flicking off the lights as he left for the evening?

Suppose that as Smith was examining his motives, he found that the answer to each of these questions is negative; he is as honest and diligent and virtuous as the next postdoc and he has only the best of relations with everyone in the lab. He might then check his assessment of himself against the assessments of others in the lab, with his wife, with others in the department, with his friends in his neighborhood.

Suppose that all these tests prove satisfactory. Everything was in order; Smith found no reason to think that his initial hunch was a defensive strategy

for avoiding a real problem. He completed a checking procedure of examining motives for his belief. He had not yet tested his belief against any alternative hypotheses, but he had a sufficient reason to think that his intuition may be sound. Was it? To that question he now turned.

Considered Judgments

We might call Smith's epistemological state at this point one of "considered judgment," in which he possessed an intuition that he had carefully scrutinized and then reaffirmed. On the basis of this and other "screened intuitions," Smith was now entitled to perform some quick inductions and so to produce a hypothesis.

Hypothesis Formation

Smith's hypothesis needed to explain the following two facts. First, in prior experiments using the same tank, water source, and species of fish, no massive die-off occurred. Second, during the most recent experiment, under the same conditions, all the fish died rapidly. We can imagine Smith forming the following hypothesis: "The fish do not die if I ensure the proper functioning of all equipment. They do die if crucial pieces of equipment malfunction." He then tests the hypothesis. In the real-life case, the hypothesis turned out to be false. The equipment functioned properly but all the fish died, again, when he replicated the experiment.

Notice how many assumptions Smith had to make to test his hypothesis. He had to assume that:

- The fish shipped to him by the scientific supply company really are tilapia and not a near relative.
- The hose supplying air to the tank was not infected with a toxic substance after it passed the quality assurance test of its manufacturer.
- The hose was not infected after it reached his lab.
- The chemicals he uses to disinfect the hose before installing it are not contaminated with foreign compounds.
- The glasses he is wearing to read the labels on the chemical jars are not distorting his vision causing him to think he is reading something other than what the manufacturer printed on the jar label.
- His eyes are trustworthy.
- He is not suffering hallucinations from nerve damage.

Were we to pause for a few minutes, we could quickly fill up several pages, and eventually volumes of books, with entries detailing everything that Smith must take on faith in order to complete the most mundane of experimental procedures. If we had the time, we could compose long lists of propositions stating assumptions of Smith's experiment. And, as the last two items on the list suggest, these assumptions would reach all the way down to the reliability of Smith's own cognitive and perceptual capacities. For he is taking it on faith – he is, in other words, not testing

the assumption at the moment – that even his eyes and neural system are reliable. In trusting our own senses, our own observations and memories, we have no independent deductive argument to justify us in accepting the claims of the apparatus in question. What we have are circular arguments – arguments based on lots of assumptions. There is no shame in this condition, because science apparently works perfectly well in spite of the fact that scientists independently cannot prove their every assumption (Alston 1991).

Of course, none of the assumptions need remain an assumption forever. We can decide to hold any one of them up to the light of critical scrutiny. We just cannot hold all of them up for scrutiny *at the same time*.

Smith took his intuition and turned it into an empirically testable hypothesis. How did he find out that it was false?

Hypothesis Testing

He tested it. It was not faulty equipment that was causing his fish to die. He did not know at first what the reason was, but he and his mentor, Dr. Noga, suspected that it might be the tiny dinoflagellates clouding up the water. They knew little about these organisms, so they contacted Dr. Burkholder. What was the first thing she did? She repeated Smith's experiment and her test results corroborated his findings. To test a hypothesis, we hold all things constant except for one or perhaps two key variables. We make a prediction based on our expectations about what ought to happen and then we see whether we are right. We then replicate the results.

After Smith's original intuition proved false, Burkholder performed a variety of novel experiments that proved another of Smith's original beliefs false. At the beginning of his work, you may recall, Smith believed that parasitic dinoflagellates attack tilapia by permanently attaching themselves to fish tissue. Burkholder showed that some Pfiesteria do lethal damage to fish in one stage of their life cycle; then they detach themselves from the fish, transform themselves into another stage, and drop to the bottom of the tank. Repeated experiments by other labs later confirmed Burkholder's hypothesis.

Scientific Principles

Burkholder produced what was, apparently, a new scientific explanation, or principle, in the history of aquatic ecology: "Pfiesteria produce toxins that kill fish without permanently attaching themselves to the fish." Notice that this principle does not purport to state merely Joanne Burkholder's own personal opinion, nor an opinion she happens to share with Smith. Nor is it a statement summarizing the results of a vote among Pfiesteria specialists. If her principle is true, it is true whether or not she believes it and whether or not Smith wants it to be true, and whether or not the North Carolina Chamber of Commerce has a favorable attitude toward it. And, if the principle is false, it is false whether or not she believes it and

whether or not Smith and the Chamber of Commerce believe it. It would be very strange were it the case that Burkholder's principle was true for her but false for the Chamber of Commerce, true for blue-eyed Methodists but false for brown-eyed Catholics. The reason is that true scientific explanations state some fact about the universe and this fact remains whether any humans know it or not.

Of course, our degree of certainty in the truth of the principle may be very low, in which case we will want to be diligent about reviewing it. If a higher-powered scanning electron microscope comes on the market, we may want to take better pictures of the guts of the Pfiesteria to confirm prior results. If a new form of an even smaller dinoflagellate is discovered and we suddenly have a reason to suspect that it is doing the damage formerly attributed to the larger Pfiesteria, then we ought to reexamine the principle. On the basis of new observations and tests, we are justified in revisiting, and are even required to revisit, scientific principles we previously accepted. We test again and again. For that is the way science proceeds: begin with intuitions, check them in an initial screening procedure, form hypotheses, test them, reach scientific judgments about their truth, assign to them appropriate degrees of confidence, retest them when they are called into question, and so on.

But this is not the end of the story.

Scientific Theories

Scientific principles are, as Ernan McMullin puts it, questions rather than answers. Individual explanations are not satisfying on their own and they seem to invite attempts at systematization. We see groups of individual scientific principles and wonder, what is the whole explanation? Higher-order general explanations are called scientific theories.[4]

Smith and Burkholder have not been alone in their inquiry. Scientists have performed a wide range of experiments over the course of several years, and the conclusions all point in a single direction. The "direction" is this: Dinoflagellates kill fish by interfering with certain biological pathways. Now, if we wanted to turn this explanation into a theory, we would have to enlarge its scope in order to explain a large body of perceived irregularities. A very general scientific theory about the way in which toxic dinoflagellates kill fish and cause sickness in humans would have to include a large range of claims from not only the disciplines of cellular and

[4]In cell biology, therefore, we observe that something in the cell directs the growth of organisms; we decide to call it a gene. We further observe that biochemical structures in the cell direct the production of proteins; we hypothesize the existence of chromosomes. By inference and explanation, we construct a model designed to account for the phenomena, and we derive a theory of molecular biology. Other sciences proceed similarly. In soil science, we observe that different soils have different filterizing capacities, and we theorize that chemical leaching tends to increase with increasing soil permeability and decreasing soil dissipation capacity. Slowly, we build a model of the transport of liquids through soils. Cf. (Reynolds et al. 1995).

molecular biology but also genetics, marine ecology, epidemiology, and even sociology. It would have to include such laws as:

- Basic environmental interactions can be explained in terms of natural processes such as aerosol-based dispersal of contaminants and blood-based dispersal of toxins.
- Human interactions with the environment can be understood as a set of interacting subsystems of the larger earth science system.
- One ecological subsystem consists of relationships that can be characterized in part in terms of potentially harmful chemicals produced by aquatic microorganisms.
- There is an epidemiological subsystem at the level of the individual organism (such as a person), the terms of which allow us to explain causal relations between the presence of symptoms such as disorientation and pneumonia in a patient and the presence in that patient of toxins produced by Pfiesteria.

The overarching background theory that lends coherence to these various laws will be comprehensive and detailed, and will include many other statements, such as:

- Humans with high levels of exposure to environmental pathogens are more likely to experience dizziness, disorientation, and hastened mortality than humans with low levels of exposure.[5]
- Each of the two genes at a locus has a 50% probability of being the single gene at that locus carried by a particular gamete (Mendel's law) (Edwards 1977).
- Basic biological elements can be characterized by atomic weight and chemical composition.

And so on. We come to accept overarching scientific theories not on the basis of observations alone but also on the basis of their coherence, simplicity, and elegance, along with their capacity to synthesize, unify and explain, as William Alston puts it, "a vast body of otherwise heterogeneous and unrelated empirical generalizations" (Alston 1991).

The best background theories are also fertile. On the basis of the theory and a host of additional empirical assumptions, we can make predictions about the outcome of new experiments. For example, on the basis of the theory, we might now predict that the outcome of a new experiment will lead to the following scientific judgment: The incidence of newly reported cases of pneumonia will be higher when streams are infested with Pfiesteria than when no stream is infested with Pfiesteria. Just as background theories are built up out of screened intuitions and tested hypotheses, so theories in turn serve to generate new hypotheses and intuitions. In an appropriately roundabout way, this feature of scientific inquiry

[5] "Career radiation doses for 8,961 male workers at the Calvert Cliffs Nuclear Power Plant (CCNPP) were determined …. On average the workers experienced mortality from all causes that was 15% less than that of the general population of the U.S., probably due to healthier members of the population being selected for employment" (Goldsmith et al. 1989).

helps to confirm the suspicion with which we began: that theories influence observations. The reason, in part, is that theories are themselves fecund, giving rise to new ideas.

A good theory is robust and we are justified in clinging to it even in the face of a handful of experiments that render anomalous conclusions. Good scientists do not give up on a robust theory on the strength of one contrary observation. We are justified in holding to theories, even in the face of initially contradictory evidence, until an accumulated weight of evidence from a variety of sources begins to suggest that the theory needs revision. Part of the reason is that the laws of the theory are stated at such a level of generality that a single low-level observation is unlikely to call the theory into question. However, such an event is not outside the realm of possibility, and during a time of scientific paradigm change, an accumulating number of low-level observations may in the end point to an anomaly that will make us decide to change the theory.

One hundred years ago, physical theorists believed that matter was indestructible, but an accumulation of observations has led them to reverse themselves. The fact that they reversed themselves is not a good reason, however, to think that physics is entirely subjective and naively relativistic. Not so long ago, molecular biologists held that information could flow only from DNA to RNA, but the accumulation of observations has destroyed this theory as well (Nelson 1997). So, although scientific theories appear to be inductively constructed purely on the basis of value-free observations, the actual relationship between the theories and observations is dialectical. Observations do not provide scientists with an indubitable and incorrigible foundation, nor do theories, hunches, or hypotheses. These various sources of scientific beliefs provide us with a web of beliefs that may forever be in need of mutual correlation, revision, and adjustment.

Scientific theories sometimes conflict and we must figure out how to evaluate them. Very complex methods for theory assessment exist, and through these methods we try to assess which theory is most adequate in explaining the phenomena; that is, which method proves to be the most coherent, simple, and fertile. The mere fact that scientific theories may conflict, however, is not a sufficient reason to suspect that we do not properly understand the phenomena that the theories are designed to explain. Conflict between theories may signify simply that we have not yet reached a level of understanding sufficient to decide which is the best theory.

The best theory will also be the one with predictive power. Some sciences lend themselves more readily to predictions than others because it is easier in some sciences to deduce testable consequences from the theory. Making predictions in some branches of chemistry is reasonably easy; making predictions in some forms of ecology is notably difficult. The relationship between theories and predictions is straightforward. If the theory entails a prediction and the prediction is true, then the prediction confirms the theory. If the theory entails a prediction and the prediction is false, then the theory must also be false.[6]

[6]I owe this point to Martin Curd, from a presentation he made to the 1997 Bioethics Institute at Purdue.

I have avoided saying anything about whether nonobservable entities postulated by scientific theories actually exist. This issue calls attention to the complex debate between realists and anti-realists in the philosophy of science (McMullin 1984). I think the account I have given of the way scientists justify their judgments is neutral on the issue of whether scientific judgments disclose real structures in the world.

Scientific Inquiry and Human Interests

The way contemporary biology actually proceeds is very different from the way my undergraduate students think it proceeds. They think the scientific method is unilateral, foundational, and value free. They think that observations have no connection to the personal motives, values, and theories of the investigator, or to the social contexts of the discipline, or to the political machinations of the scientific grant award process. In fact, however, scientific inquiry is inextricably bound up with human interests. Students also typically think that the scientific method gives them facts that cannot be doubted and are free of other assumptions with which the students are working. In fact, however, it is impossible to generate any hypothesis, much less submit it to empirical verification, without making many assumptions. Students think, too, that scientific theories provide an incorrigible foundation upon which all other knowledge can be constructed. In fact, however, scientific theories have been, can be, and will be overturned.

Students also think that science is independent and self-supporting. In fact, however, no way exists to provide absolute foundations for science. Any such attempt must appeal to premises derived from human observations, and human observations are themselves part of the perceptual practice of science. To appeal to the truth of observations when one is trying to establish the reliability of the cognitive method that itself relies on observations is to beg the question. Science has no sufficient noncircular argument to secure the truth of the scientific method of acquiring knowledge. This fact does not mean that scientific knowledge is subjective or untrustworthy; it is simply the way the world is. I hope I will not be misunderstood; I am not arguing for antirealism or that science is unobjective. The description of scientific knowledge offered here does not lead to skepticism. It leads only to appropriate epistemic humility about science and healthy doses of circumspection when passing along its findings to others.

How Do We Justify Ethical Judgments?

I want to suggest that in ethics we are in approximately the same position as we are in science when it comes to finding warrants for our judgments. In ethics, we often begin our inquiry with little more than an intuition, and we make thousands of assumptions in trying to defend moral judgments. We cannot question all our

assumptions simultaneously, but neither is any assumption above individual scrutiny. Neither intuition nor theory provides an indubitable foundation for our values, and there are competing, mutually contradictory ethical theories. These features of ethics might incline us to agree with Dennis, that ethics is entirely unscientific; however, given the previous account of scientific justification, you may already see that such a conclusion would be exactly the wrong one. Ethicists seem to be in no worse epistemic shape than are scientists, and scientists seem to be subject to as many assumptions as are ethicists. Indeed, all the features just mentioned are the ones that render ethics most like science.

There is, for example, at least one method for checking the reliability of moral intuitions and justifying moral judgments. The method is called *coherentism* and has been developed during the last three decades as a method for theory construction and decision making in ethics. John Rawls, a Harvard philosopher, outlined it originally, and it has been developed by prominent philosophers convinced that theory acceptance in ethics is analogous to theory acceptance in science. The underlying idea is that ethics involves bringing together a variety of moral and nonmoral beliefs, considered intuitions, and background scientific theories so that all our values can be rigorously examined and, through mutual adjustment, formed into a coherent system. The goal of ethical inquiry is, in Rawls's phrase, to attain "reflective equilibrium" between these various inputs.

The following discussion examines how this method might work by applying it to the Pfeisteria case.

Intuitions

Joanne Burkholder has been a lightning rod in the scientific community in part because she represents ethical values that are widely accepted. Now, to my knowledge, Dr. Burkholder has not publicly revealed what her ethical conclusions are or how the argument might go for those conclusions. But suppose that a fictional character called Jean Burmeister, who is in a position similar to Burkholder's, expressed the following moral judgment:

> The state of North Carolina should fund my scientific research program because it will protect the people of North Carolina from Pfiesteria.

Notice that this is a normative claim; the word *should* gives us a clue that Burmeister is making an ethical assertion about what the state of North Carolina morally ought to do. Normative claims cannot be assessed using only empirical techniques; we must use philosophical techniques to determine whether a normative claim is justified. In response to Burmeister, I can already hear Dennis objecting, "Well, that's only her opinion." Would he be right?

I think so. At this stage of the inquiry, the normative value stated previously appears to be a kind of feeling, a hunch on Burmeister's part about the obligations of state governments to citizens and about the role of state-funded scientific researchers in protecting public health. Burmeister, we may assume, has no

evidence for the feeling and has landed upon it by default. She has no other explanation of her views at present, and this one is familiar to her from her days of thinking about her role as a tax-supported scientific researcher. She has worked in the role of public servant for years and has been acculturated in our secular democratic political system. Her feeling, as Dennis might point out, comes from her environment and is motivated by her own interests in securing funding.

All this is true. Our initial moral hunches are not free of our personal values or communal upbringing. Burmeister cares about the health of North Carolina residents and wants very much to do the right thing in her professional life. That is why she articulates her initial feeling in the way that she does. Her feeling is theory laden; it fairly drips with the ideal of the modern liberal state.

I have stipulated that our fictional Dr. Burmeister does not have the conceptual tools or knock-down arguments at the beginning of her ethical inquiry to justify calling her feeling anything more than a feeling. Because I have set up the thought experiment this way, we may say that she is in the same epistemological state that Dr. Smith was in when he had the feeling that he ought to check his equipment. Neither one can articulate sophisticated reasons for his or her starting point, but neither needs to do so. We start with intuitions in ethics and in science. No problem, for one might well ask: Where else *could* we start?

Checking Procedure

Hunches, as Dr. Smith found out, can be wrong. Burmeister's moral intuition might be wrong, too. Does the state have the obligation she identifies? To answer that question will require some work in ethical theory. But there is a prior set of questions that she must address. Her moral feeling is not that some Pfiesteria scientist or other has the right to receive North Carolina taxpayers' hard-earned dollars. It is, rather, that *she* has that right. Does she? Or is she espousing this value only to support her contention that she ought to get a grant? Perhaps Burmeister is flirting with duplicity here, not endorsing the feeling stated previously at all, but mouthing it only to give the appearance of moral respectability to her greed for funds.

The second step in ethical inquiry is to check our intuitions to make sure that we are not acting merely out of self-interest. Is Burmeister deceiving herself and us, espousing a moral value only because it serves other, darker, motives of hers? There are widely accepted ways to proceed here. Burmeister can ask herself whether she has a secret agenda. Am I prejudiced? Overly self-interested? Do I have a habit of saying things I don't believe? Suppose that she carefully considers each question and honestly answers no. She might then check her judgment against the views of others. Suppose that everyone says, "Jean, you are scrupulously honest and fair-minded, a citizen of great integrity, and you have nothing personally to gain from your moral intuition." If everyone agrees, then she has some reason for believing that her intuition is not distorted by personal preference. Someone may even point out to her that the intuition might endanger some of her

own self-interests, because the intuition might be taken to imply that scientific research should be peer reviewed, meaning that she should compete with other scientists for scarce research tax dollars. When we personally have something to lose as a result of one of our moral intuitions, we can usually assume that we are not biased in espousing it.

At the end of her review, Burmeister finds no good reasons to think that she is lying to herself. She has done what she could to check her moral intuition for bias. She has every epistemic right to proceed.

Considered Judgments

Passing a test for distortion does not prove that an intuition is true. Burmeister now has sufficient reason to justify calling her belief a "considered judgment," a moral conviction in which she can have confidence, because she has ascertained that the intuition has a low probability of representing merely her own individual prejudice. On the basis of such judgments she may now perform some quick inductions and produce the ethical equivalent of a scientific hypothesis: a particular moral judgment.

Particular Moral Judgment (PMJ) Formation

The judgment here needs to link the factual conditions of the decision Burmeister faces with the normative dimensions of her intuition. The result will be a particular moral judgment (PMJ), a judgment about what morally ought to be done by a specific person or group of persons in a particular context. Here is one formulation she might come up with:

> PMJ #1: It is wrong for the state of North Carolina knowingly to expose its residents to unacceptable risks of disease from exposure to Pfiesteria toxins by failing adequately to fund Pfiesteria research.

Burmeister has converted her initial hunch into a particular moral judgment. How does she find out whether it is justified?

Particular Moral Judgment Testing

We test a scientific hypothesis by devising experiments to test its factual claims. We test PMJs by determining whether good arguments exist to support them. Moral arguments consist of at least one factual claim, at least one general moral principle (GMP), and the conclusion, which is the particular moral judgment. Here is a plausible, valid argument to support PMJ #1:

> Fact #1: By failing adequately to fund Pfiesteria research, the state of North Carolina will knowingly expose its residents to unacceptable health risks.

GMP #1: It is wrong for any state knowingly to expose its residents to unacceptable health risks by failing to fund Pfiesteria research.

PMJ #1: It is wrong for the state of North Carolina knowingly to expose its residents to unacceptable risks of disease from exposure to Pfiesteria toxins by failing adequately to fund Pfiesteria research.

We know how to test scientific judgments. How do we test moral judgments? At least three ways are available. First, we test the factual premises using scientific means. Is Fact #1 actually true? Should it turn out to be false, then this argument cannot support PMJ #1. Of course, PMJ #1 would not thereby be proven false, because other arguments, still to be considered, might justify it. Second, we ascertain whether the argument is valid by asking whether we have made any logical mistakes in drawing the conclusion from the premises. In this case, the conclusion could not be false if Fact #1 were true and GMP #1 were justified, so the argument is valid. Valid arguments can be unsound, however, so the third test is to assess the general moral principle. Is it morally wrong for a state to knowingly expose its residents to unacceptable health risks? How do we assess such a claim?

General Moral Principles

One way to test a GMP is to examine its implications. In the case of GMP #1, it seems that at least one counterintuitive implication exists, as follows: Residents of the state of North Carolina may face exposure to organisms other than Pfiesteria that pose much greater health risks than the risk posed by Pfiesteria. Residents of all states face all manner of disease risks, including the risk of widespread chronic diarrhea, malnutrition, and death from waters polluted with human wastes. The state of North Carolina, therefore, regularly spends a large portion of its budget supporting the construction and maintenance of wastewater treatment plants. The state budget is not unlimited, and bureaucratic officials face hard choices.

Suppose that the only way adequately to fund Pfiesteria research in North Carolina is to take money out of long-standing programs designed to protect public health. In that case, the state might well be subjecting its residents to even greater health risks by funding Pfiesteria research. If we accept GMP #1, however, we would be led to the particular moral judgment that the state of North Carolina is *obligated* to fund Pfiesteria research even if it means taking money away from other projects and thereby placing its citizens in harm's way. This implication of GMP #1 is, however, deeply counterintuitive. GMP #1, we may conclude, is not justifiable. So we throw it out, or at least look for ways to qualify it. Here is one idea:

GMP # 2: It is wrong for any state to expose its residents to unacceptable health risks by failing to fund Pfiesteria research *unless failing to fund Pfiesteria research is the only way to prevent even greater health risks.*

In the course of ethical inquiry, we would then test GMP #2, repeating the procedure by asking whether it leads to PMJs that are counterintuitive. If we find

that it has no counterintuitive consequences, and if we find that the principle has many plausible implications, then we have gone a long way toward justifying the principle.[7]

It bears noting that if we substitute GMP #2 into the original argument, we get a new PMJ:

> PMJ #2: It is wrong for the state of North Carolina knowingly to expose its residents to unacceptable health risks from exposure to Pfiesteria by failing adequately to fund Pfiesteria research unless doing so is the only way to prevent even greater health risks.

The aim in ethics is to construct an argument in which all factual claims are true and the GMPs lead to many plausible PMJs and no counterintuitive ones. If we make no mistakes in reasoning from the minor premises to the conclusion, then we have done all that we can to test our PMJ and we are justified in holding to it.

When we arrive at moral judgments that have withstood years of scrutiny of this kind, we add them to our list of moral truisms. Notice that these truisms (it's wrong to drown babies, it's right to do your job, it's right for state governments to protect their people from dangers) do not state mere personal opinions, nor are they the result of votes among moral specialists. If PMJ #2 is justified (I'm not asserting that it is justified but only asking you to suppose that it is), then it is justified whether Burmeister believes it or not, whether you or I believe it, whether the state legislators of North Carolina believe it. In such a case, PMJ #2 would (remember that we are still assuming that it is justified) come as close to stating a moral fact about the universe as a similarly well-justified claim in the life sciences would come to stating a biological fact about the universe. Of course, we have not established that PMJ #2 is justified, and should we discover another widely accepted PMJ that contradicts it, then we would have reason to believe that it may not be justifiable. Or if we came to accept a different moral theory than the one we currently accept, we would also have to see whether the new theory entails the contradiction of PMJ #2. On the basis of new arguments and theories, then, we can be required to go back to values we have accepted as truisms and retest them. Perhaps they will be overturned. This may seem like a house of cards, but that is the way ethics proceeds. It is not different in science. We begin with intuitions, check them in an initial screening procedure, form a judgment about their truthfulness, test it by reasoning about it, and then assign to it an appropriate degree of fallibility.

Ethical Theories

Now on to the most difficult and complex step. As Ernan McMullin has suggested, scientific laws are not answers but questions demanding a theoretical explanation postulating an underlying causal structure of some sort. General moral principles in turn are not answers but questions demanding a theoretical explanation postulating

[7] Thanks to Fred Gifford for help in formulating this point. I learned much about science and ethics from his lecture, "The Relation Between Science and Ethics," at the 1996 Michigan State University Bioethics Institute.

an underlying rational structure of some sort. As we acquire GMPs in which we have confidence, we begin to wonder whether some meta-principle exists that ties them all together. So we see whether we can raise the level of generality of the GMPs. For example, is there any reason not to revise GMP #2 to apply it to every nation, as well as every state? As we accumulate more and more considered justifiable moral judgments, and as we move them to higher and higher levels of generality, a moral theory may emerge. We may find, for example, that a single, simple, overarching principle exists that summarizes many of the GMPs that we accept. For example, we might decide that the following statement sums up most of our GMPs: We should never perform an action that has the consequence of leading to a lower ratio of significant-preferences-being-satisfied over significant-preferences-being-left-unsatisfied.

Or, alternately, we might decide that the following principle forms our theoretical base: We should always perform that action that best respects individuals as ends in themselves.

Here we have statements of two major ethical theories, preference utilitarianism and deontology. In science, theories can be used to make predictions. Is that possible in ethics? Well, yes, although here the predictions will be normative predictions about what we ought to do, not empirical predictions about what in fact will happen. Martin Curd explains how moral theories can lead to practical predictions:

> A philosopher, such as Peter Singer, will take a normative theory (such as utilitarianism) or some general moral principles that appear to be plausible and well-confirmed, and deduce from them consequences concerning our duty to relieve world hunger and to stop raising animals for food. These consequences may be surprising and unwelcome, but if they really do follow logically from a theory that we accept as true, then, on pain of inconsistency, we have to accept them and act accordingly (Curd 1997).

Following is an example of a practical prediction (PP) formed on the basis of an ethical theory (ET), and a moral hypothesis (MH). The ethical theory is preference utilitarianism, defined previously.

> ET: Preference utilitarianism is true.
>
> MH: If preference utilitarianism is true, then humans ought not to raise and kill mammals for food. (Because: mammals have significant preferences; to kill a mammal is to deprive it of the ability to satisfy significant preferences, and; eating meat from mammals is not a significant preference for humans to try to satisfy. Therefore, killing mammals for food lowers the ratio of significant-preferences-being-satisfied over significant-preferences-being-left-unsatisfied.)
>
> PP: Humans ought not to raise and kill mammals for food.

Notice that, in ethics as in science, we come to accept a background ethical theory not on the basis of considered judgments alone. We also examine the coherence, simplicity, and elegance of the theory; its capacity to synthesize, unify, and explain "a vast body of otherwise heterogeneous and unrelated" (Alston) normative generalizations. To the extent that our best systems of ethical beliefs have been tested in this rigorous way, they provide us with a sufficient reason to assume that

any one of our considered intuitions taken individually is justified, unless and until we have a good reason to question it (Alston 1991).

But how do we decide which theory is correct? This is as difficult a task in ethics as it is in science. Challenges to each theory will arise from unacceptable implications of the theory. For example, the first principle, the principle of utility, would sanction doing medical research on people we do not like (such as drug pushers). And the second principle would sanction the sacrifice of thousands of innocent people in order to protect one potentially guilty saboteur. But both of these particular moral judgments seem counterintuitive. It seems wrong, for example, to do medical research on people against their will just because they are unsavory to us. And it seems wrong to allow the death of many people just because we do not want to obtain information through torturing an imprisoned informant. When the implications of an ethical theory give rise to action-guides that conflict with our considered judgments, we have a reason to consider readjusting, or giving up on, the theory.

But defenders of utilitarianism and rights theories are not left without a response. Utilitarians, for example, might respond that the counterexamples are unrealistic. Rights theorists, in turn, might respond that the counterintuitive conclusions simply must be accepted (Smart 1973). And this is the way theory construction goes in ethics. We work back and forth, revising our particular moral judgments so that they match the premises of our theory, and revising our theory so that it fits with our strongest considered convictions. In sum, we start with paradigm judgments of moral rightness and wrongness and then try to construct a more general theory that is consistent with these paradigm judgments, working to close loopholes and fight incoherence. Then, because we can never assume a completely stable equilibrium, we renew the process, just as in science.

As the moral theorist Joel Feinberg notes, this procedure is similar to the reasoning that occurs in courts of law. On the one hand, if a principle commits one to an antecedently unacceptable judgment in a particular case, then one should modify or supplement the principle to render it coherent with one's particular and general beliefs taken as a whole. On the other hand, when a well-founded principle indicates the need to change a particular judgment, the overriding claims of coherence require that the judgment be adjusted (Beauchamp and Childress 2001). Ethicists, like scientists, reject theories that are inadequate, inconsistent, and fail to account for a wide range of considered judgments.

In conclusion, with this understanding of ethics in mind, I revisit Dennis's original objections.

The first objection was that people have conflicting definitions of ethical terms. Yes, people disagree with each other, and they sometimes react to agreement in ethics by *trying* to redefine ethical terms to produce disagreement. But the mere fact that people disagree about ethical terms is not a good reason to think that ethics is subjective. Consider another case of disagreement. I read that some fundamentalist Christians in the state legislature of Alabama want to enact legislation to redefine the mathematical value of pi as 3.00 instead of 3.1415 (and so on). Their reason is that the Bible says that the ratio of the diameter of the holy altar in Jerusalem to its circumference was 3. Now the mere fact that some people believe that pi has a different value is no reason to think that the value of pi is subjective. People can be wrong.

As in math, so in ethics; people can be wrong in their values. Suppose that a lawyer wanted to sue the state of North Carolina for harms caused by Pfiesteria in the state's drinking water. Suppose that he knows that no hard evidence of Pfiesteria in the drinking water exists but that there is evidence of a harmless microorganism, call it Q. To strengthen his case, therefore, he decides to redefine the class of microorganisms called Pfiesteria so that it includes Q. If he is allowed to have his way, then there will suddenly be ample evidence of "Pfiesteria" in the drinking water. But what would such an absurd claim mean? Our courts would lack all appearance of justice were we to allow willy-nilly changes in the meaning of key terms, and no self-respecting judge would tolerate our imagined attorney's procedure. As in the law, so in science and ethics. A presupposition of reasoned discourse and inquiry is agreement about definitions and a commitment to hold them stable. Therefore, if in the middle of testing a particular moral judgment, a student suddenly wants to redefine the term *wrong*, we simply must refuse. We would get no further in ethics than we would in science if we allowed wanton obfuscation.

Dennis's next objection was that people make conflicting ethical judgments. Several comments are in order here. First, we have already noted that there are a vast number of PMJs on which we agree. So the extent of disagreement may be overestimated. Second, we can disagree only with claims we understand, and we can understand claims only if we understand all their key terms. Much disagreement on ethical issues may be more rhetoric than reality because the partners to the controversy are using different definitions.

Third, ethics is hard work. It is easy to bail out of an ethical argument by declaring disagreement when one has not done the necessary work of understanding, explaining, justifying, and theorizing. Before we declare that we disagree with someone's moral judgments, we ought to be able to give an account of those judgments that will satisfy our partner. If the disputants committed themselves to even this minimal level of mutual understanding, they might find that they disagree about less than they like to imagine.

Yes, it sometimes seems that we make no progress in ethics but, again, we might be wrong here. In the United States 200 years ago, few people thought that African Americans should be free; that women should be allowed to vote; that horses that kick should not be beaten. Today, it would be difficult to find many United States citizens who think blacks should be enslaved, women should be disenfranchised, and animals should be abused. The reason students think of ethics as an area where no progress is made may be that they focus on recent, very difficult questions, such as abortion and euthanasia. A little historical perspective provides an effective antidote to such constricted vision.

Finally, Dennis protested that we cannot establish the reliability of our ethical judgments without using circular arguments and a host of unargued assumptions. True. In ethics we simply assume the truth of a large body of considered judgments (for example, the truisms we collectively produced in Chapter 1), and of an elaborate background normative theory, if we are effectively to test any one particular moral judgment. However, this fact need not undermine our confidence in the reliability of any of our values. In ethics, every judgment is potentially open to revision, no judgment is ever beyond question, and we make thousands of assumptions

every time we try to argue about ethics. But there is no reason to be concerned; we proceed in exactly the same way in science.

Further, in ethics no noncircular sufficient argument exists to establish the reliability of any one of our values. In ethics, epistemic circularity is inevitable and, as William Alston explains, to establish the reliability of any claim we must always "make use of premises derived from the practice under consideration" (Alston 1991). But there is no reason to run and hide here, either. As we have seen, biologists are caught in the same circularity. The circularity exists, but it is not vicious.

Dennis, in sum, is right. In ethics we do not have indubitable, infallible foundations. We have intuitions that emerge from the cultures in which we live. We have a web of beliefs that are motivated by human interests, deriving support from a multitude of sources. We cannot question all these sources simultaneously. But we can work dialectically, back and forth, mutually adjusting considered moral intuitions and general moral principles, examining arguments and testing theories, trying to construct a system of beliefs in which all our sources of information are in equilibrium. Subjective and unreliable? Not at all. It is the way we ought to proceed if we are interested in getting at the truth.

We have focused on one of the most difficult questions in moral philosophy, the question of whether particular moral judgments can be justified. We have seen that there is at least one method. Truths of ethics are truths, as James Rachels puts it, of reason. "The 'correct' answer to a moral question is simply the answer that has the weight of reason on its side" (Rachels 1993). In trying to find where the weight of reason lies, ethicists make truth claims, test them according to widely accepted methods, and offer practical predictions and explanations. If this account of ethics is correct, then more similarities exist between ethics and science than we typically realize. Students probably need to raise their opinion of their epistemic position in ethics while lowering their assessment of their epistemic position in science.

In science, students are probably in worse shape than they like to imagine, whereas in ethics they are probably in better shape than they allow themselves to think.

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Part II
Life Science Ethics

Chapter 5
Environment

Lilly-Marlene Russow

Abstract An introduction to environmental ethics with special attention to issues arising from the practice of agriculture and the argument that nature has intrinsic value.

Keywords Environmental ethics • Intrinsic value • Anthropocentrism • Ecofeminism • The land ethic

Case: Marie the Environmentalist

As Emily and Doug are settling into their chairs on Friday of the third week of Ag Ethics, they notice a woman standing at the front of the class next to Dr. Wright.

"We begin today," announces Dr. Wright, "to think about our duties to the environment. I'm sure you will all agree that there are obvious reasons to try to preserve nature. Farmers want to preserve the fertility of their soil so that their farms will be profitable years into the future. Eco-tourists want to preserve pristine wilderness areas so that they can get away from the hustle and noise of city life. City-dwellers want clean water and air so that their children can grow up in a healthy environment."

"Notice that each of these reasons," he continues, "is an 'instrumentalist' reason. The farmer, eco-tourist, and city dweller all want to protect nature because nature is a useful instrument, and it can be used as a tool as they pursue their various goals. There is an altogether different kind of argument often given for environmental protection, however. This is a 'noninstrumentalist' argument, and we must consider it carefully."

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"So what is it?" interrupts Rich.

Dr. Wright looks at him. "The argument is that nature itself has value. And this value exists in nature even if humans do not recognize it. The environment is significant even if it is not, has not, and never will, serve as an instrument to some person's goals."

"Who believes *that*?" asks Rich, incredulously.

"Well, many people believe it, including today's guest speaker."

At this point Dr. Wright turns to the woman standing beside him. "This is Marie," he says. "She has explicitly asked me not to say anything more about her by way of introduction, except to add that she is a Friend of the Chatham River."

Marie laughs. "Yes, I am a Friend of the Chatham. As you know, the Chatham is a river that runs not far from here. I am the president of an organization, the Friends of the Chatham, that is dedicated to preserving the river. As you may know, the river is currently the focus of a major controversy. The city council of Springdale wants to use the Chatham for its water supply, a supply that Springdale needs very badly given the town's incredibly rapid growth. But our local farmers are objecting. They're worried that if Springdale takes water out of the Chatham, there will not be sufficient moisture for them to irrigate their crops."

"Friends of the Chatham," Marie continues, "sides neither with the residents of Springdale nor with the farmers. We have a different view. We want the Chatham to remain relatively untouched and unspoiled, with sufficient water in its banks to be of value to many different people: people who fish in it, hike along it, and boat on it. Now, I understand that I am speaking to a group of ethics students, so I want to explain our reasons."

"We have two arguments for wanting to protect the river. You might call our first argument 'humanitarian.' We believe that the Chatham river ecosystem is *instrumentally* valuable because it serves a wide variety of uses, including fishing, boating, and camping. These people enjoy the Chatham for its aesthetic and even spiritual characteristics. Our second reason is aligned with these spiritual considerations. You might call it the 'instrinic' argument. The Chatham River ecosystem is *intrinsically* valuable, even if people do not use it or benefit from it, simply because it is relatively wild, untouched by human hands. According to the second line of argument, it would be morally wrong to pollute or use up or waste water from the Chatham simply because doing so would tend to undermine the wildness, stability, beauty, and integrity of the river's wonderful ecosystem."

Rich shakes his head in disagreement.

"Therefore," Marie continues, "I have been involved in actively opposing the Springdale town council's attempts to steal the Chatham's water. They are trying to drain the river of its lifeblood, an action that would not only harm farmers and recreational users of the river. It would kill the Chatham river *itself*, and it would hurt those of us who love its wild beauty. Please join us. Nature has rights, and destroyers of nature must be stopped!"

Marie is clearly basing her case on an important controversy within environmental ethics. She has claimed that the Chatham River has a special sort of value,

intrinsic value,[1] in addition to its instrumental value, or the fact that it contributes to some other good, such as an activity that humans enjoy.

She is also identified as a friend of the Chatham River, suggesting that she is not just looking at how the river can be used for human benefit but also is exploring how to take seriously the idea that the river can be looked at in terms of friendship and trying to determine what is in its own best interests. When we talk about instrumental value, we are trying to determine what something is *good for.* Money has instrumental value because it is good for buying things that we desire. A river may have instrumental value because it can be used to irrigate crops, serve as a source of water that people need, and for many other reasons. However, terms like "intrinsic value" or "for its own good" introduce another complication: the idea that something's value and how it should be factored into moral judgments sometimes go beyond instrumental value. It is a way of saying that there are things that are morally right or wrong independently of how useful they are for a specific purpose.[2] It is important to keep in mind (1) that some-thing can have *both* instrumental and intrinsic value and (2) that intrinsic value is not always more important than instrumental value. If I am alone in a burning building and trying to escape, it would make sense for me to leave my child's fingerpainting that is hanging on the refrigerator (which has intrinsic value), and pick up a wallet containing cash and credit cards, which have "only" instrumental value.

Rich shakes his head in disagreement because, although he understands the distinction that Marie is trying to make, he has not heard good arguments to show that something, especially something like a river, can be evaluated in terms such as "intrinsic value," let alone why we need to distinguish it from instrumental value. He may even think back to the Four Cs and worry about clarity, and how whatever is supposed to have intrinsic value can be identified. What, exactly, is referred to by "the Chatham River"? The actual river bed and the water that flows over it? That, plus the immediate surroundings? The species of animals and plants that grow in or around it?

Marie does not help her case when she describes "our [Friends of the Chatham] different view" because she starts with the view that the river should remain relatively unspoiled and have sufficient water to sustain fishing, boating, and other activities, and these sound like instrumental criteria. It is similar to claims that we ought to pre-serve the tropical rainforests because some undiscovered plant might help us find a cure for cancer. Even when she appeals to esthetic and spiritual values, it is important to ask whether these are truly intrinsic – whether they apply to the Chatham regardless of what people in the area think of it – or whether these too are instrumental values, even though they are noneconomic and something we think we cannot or should not put a price tag on.

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[1] Some philosophers draw a distinction between *intrinsic* and *inherent* values, but that is not necessary in order to understand Marie's basic point. For the most part, we can treat *intrinsic* and *inherent* as having the same meaning.

[2] There are strong connections between utilitarianism and instrumental value and between intrinsic value and deontological theories (see Chapter 3), but it would be oversmplistic just to assume that these connections hold.

In order to establish that something has intrinsic value, you need to explain and justify the claim that this thing has a good of its own that must be taken into account. For that reason, her explanation that the Chatham has intrinsic value because it is "relatively wild, untouched by human hands" is a real argument, even though it might be true. *Why* does a "relatively wild" river have intrinsic value? Since "wild" is meant to contrast it with other, tamer, or more artificial rivers – let's say the Avon River that flows through Stratford, Ontario – why would it be true that the Chatham has a sort of value that the Avon lacks? You might also note that it seems inconsistent to claim that she wants the river to be valued because people fish in it and so on, while at the same time claiming that is valuable because it is "untouched by human hands."

Since she has given a reasonably clear distinction between instrumental and intrinsic value, Marie has done a good job of explaining the distinction in general. Rich is, we hope, more worried about the apparent lack of *argument* to show that the Chatham River has intrinsic value. Keeping an open mind, he listens carefully to what Marie has to say next to see whether she offers an argument for her position that stands up to the Four Cs discussed in Chapter 3.

Case: Discussion Questions

1. Imagine that you are Emily. For the moment, forget any doubts you may have about whether Marie is an environmental nutcase. The immediate question you must answer is very specific: Do you think, Marie is correct, that it is possible to harm a natural entity like a river? Is it possible to harm a natural entity even if one does not harm any humans in the process? Explain your answers.
2. The American environmentalist Aldo Leopold wrote that a thing is morally right when it tends to support the stability, integrity, and beauty of the land, and it is wrong when it tends otherwise. What do you think Leopold meant? Do you agree with him? Apparently, Marie has read Leopold. Do you think Leopold would support her view about the moral standing of the Chatham?
3. How would you know when an action was tending to support the stability, beauty, and integrity of an ecosystem?
4. To what extent, if any, should the Town Council shape public policy so as to take account of what Marie calls her "natural" argument? To what extent, if any, is it possible for us to shape public policy on the basis of duties to what Leopold called "the land?"

Discussion of Issues

The position defended by Marie the environmentalist is introduced as the *noninstrumentalist* position that "nature has rights." Marie herself describes her position as an appeal to a "natural" reason, namely that the Chatham River is intrinsically valuable.

In doing so, she echoes the arguments of several important authors and schools in environmental ethics who base their moral claims on the thesis that species, ecosystem, or nature itself has intrinsic value. Some, like J. Baird Callicott, appeal to a deeper ecological understanding, of the sort advocated by Aldo Leopold as a means of demonstrating the intrinsic value of a properly functioning ecosystem.[3] Others embrace the concept of "deep ecology," a term introduced by Arne Naess and popularized by Devall and Sessions. Finally, many branches of Ecofeminism demand a personal involvement with nature as a way of justifying an "ethics of care" for nature. To understand and evaluate Marie's position, we must analyze which of these theories, if any, is implicit in her appeal, and which, if any, offers support for her defense of the Chatham River. The common denominator in all these approaches is that they all make reference to the intrinsic value of nature or some part of it that is not an individual sentient creature: a mountain, river, species, ecosystem, 'wilderness,' or nature as a whole.

Although appeals to intrinsic value figure prominently in environmental ethics, it should be noted that not all philosophers take this route. In the previous case, "Gordon the lawyer," environmentalists advanced the claim that nature can be harmed, and that it is a moral affront to do so, but it is not clear that this requires an appeal to the rights or intrinsic value of nature. At least one prominent figure in environmental ethics, Bryan Norton, would agree with Gordon, but would base his argument on pragmatic considerations, theories about the scientific bases of assessing ecosytemic health, and concern for future generations. Since these are also influential positions in environmental ethics, we will want to consider theories which do not appeal to the intrinsic value of nature. In the last section of this chapter, I will defend a conclusion similar to Norton's – that appeals to intrinsic value are not an effective argument in favor of environmental ethics – but the reasons I shall give are importantly different from Norton's.

How are these claims best understood? What are their implications for real-life applications, specifically environmental policy? Are there good supporting arguments that could be offered in their defense, and what are some problems that might afflict them? The main goal of this essay will be to address these questions, but first, let us put the debate in a broader context, with the help of a familiar real controversy.

Basic Concept: Intrinsic Value

Statements such as "the Chatham River has rights" and "the Chatham River has intrinsic value" are often used interchangeably. They both tend to be invoked as 'trump cards' designed to put a halt to utilitarian-based cost benefit analyzes. The

[3] Specific references for selected examples of Callicott's work, and other authors or schools mentioned in the text, can be found in the references.

connection between rights and intrinsic value is far from necessary in either direction, but a full discussion of rights would take us too far afield. While a discussion of different concepts of rights falls outside the scope of this chapter, a closer look at the idea of intrinsic value is essential to any critical analysis of arguments in environmental ethics. We can make significant progress in this area while setting aside, for the purpose of this discussion, a careful examination of the possibility of attributing rights to nature. In embarking on this task, let us begin with a caveat. Many philosophers have distinguished between the concepts of 'intrinsic value' and 'inherent value' (or inherent worth). However, there are two problems with the distinction: (1) many writers use the terms interchangeably, and (2) those who draw the distinction often do so in ways that differ from other writers who want to use both terms. In what follows, I will use the term "intrinsic value" to cover both ideas, but as you pursue further reading in environmental ethics, be alert for nuanced distinctions. Also, discussions of value tend to focus on things that are good, but values can be negative as well as positive.

The first feature to notice about attempts to define the concept of intrinsic value is that almost all of these attempts are phrased negatively: intrinsic value might be defined as 'non-anthropocentric,' 'non-relational,' or 'non-instrumental.'[4] The most basic of these characterizations is the last: the contrast between intrinsic and instrumental value, so let us start there.

As the name implies, saying that something has instrumental value is to say that it is good because it serves some *further* purpose. A $20 bill, for example is instrumentally good because it can be used to purchase food, buy a ticket to a concert, or contribute to the Nature Conservancy. Claims of intrinsic value, on the other hand, are intended to highlight ends in themselves: to say that something has intrinsic value is to say, in effect, "the buck stops here" or "this is simply a good thing," As the 'trump card' analogy was intended to suggest, it puts a halt to the demand for justification. It seems reasonable to ask "what is a $20 bill good for?" or "why is it good to contribute to the Nature Conservancy?" but inevitably there will come a point at which such questions have only the answer "because it's good," Marie is claiming that having a clean, free-flowing river is such a stopping point: a healthy river is good in itself, has intrinsic value.

The contrast between intrinsic and instrumental value also makes it clear why any ethical theory has to recognize *some* concept of intrinsic value. One needs a foundation, something that instrumental goods ultimately aim towards. Without such a foundation, our system of values (sometimes referred to as an "axiology") would at best be circular, and at worst so chaotic that our choice of values would fall into an arbitrary set with little room for giving arguments, justification, or reasons for attributing values.

Utilitarianism, as we saw in Chapter 3, must specify which basic values, such as happiness, must be maximized. These would be intrinsic or inherent values.

[4] Apparent exceptions to this are the arguments which claim that intrinsic value has some sort of objectivity that intrumental values lack. This claim is highly controversial; see Cheney (1987) and O'Neill (1992) for further discussion.

Anything that is not a basic value will be judged on its instrumental value, the way it contributes to a basic good. However, deontological or rights-based theories will often argue that some things have intrinsic value whether or not they contribute to human happiness. A clear example of an appeal to intrinsic value within utilitarianism that deliberately intends to avoid that sort of arbitrariness can be found in the classical utilitarianism of Jeremy Bentham and John Stuart Mill. Both argued that happiness was an intrinsic good, valued for its own sake, and that anything else was good only instrumentally, only insofar as it maximized happiness or reduced pain and suffering (which are intrinsically bad). But clearly these values require a subject capable of experiencing pain or happiness. This brings us to the second important question about intrinsic value: does there have to be a 'valuer' in the picture?

If we continue for a moment to restrict ourselves to the simple case, if happiness is the only thing that is intrinsically good, if there were no people (or other individuals capable of feeling pleasure or happiness) *nothing* in such a world would have intrinsic value.[5] This approach to intrinsic value is commonly called "anthropocentric," or, by at least one writer (Callicott) "anthropogenic," The prefix "anthropo-" implying the need for a human valuer, is traditional but can be misleading. Many philosophers who are directly involved in the debate – Bentham, Singer, Callicott – argue that any sentient creature is by definition a source, determinant, or definer of value. There is no recognized philosophical term for this sort of theory; perhaps a term such as "protecentrism," from the Greek verb, "to choose"[6] would be a useful addition to our standard vocabulary. Protecentrism falls between anthropocentrism and biocentrism. It shares with anthropocentrism the emphasis on the need for valuers, but does not assume that only humans are capable of valuing things. On the other hand, living things which do not have preferences – e.g. the simplest forms of animals, and plants – would be included in biocentrism, but not in protecentrism. Biocentrism ascribes intrinsic value to all living things, regardless of whether they are sentient or have preferences. It is popularly associated with Albert Schweitzer, and has been given a sophisticated analysis and defense by Paul Taylor. It is also the first point of NASA's statement of bioethical principles on animal research. All three differ from ecocentrism, in that they all focus on individuals rather than groups, systems, or 'superindividuals.'

There is a subtle difference among philosophers who advocate anthropocentric, and by extension, protecentric views which is, unfortunately, often overlooked. Some, like Bentham, use the term to mean that only certain sorts of experiences (happiness) can be intrinsically valuable. A tree can have instrumental value if contributes to happiness, but it cannot itself be intrinsically valuable. Let us call this '*strong anthropocentrism*' or '*strong protecentrism*' depending on whether only

[5] This does not contradict my earlier claim that any system of values requires some foundation in intrinsic value. There would be nothing valuable on such a world, and indeed the whole talk of ethical theory or moral principles would make no sense.

[6] My thanks to James Stephens for this suggestion.

human interests and experiences are considered, or whether the experiences and satisfaction of all sentient creatures are included. Others cast their net more widely: anything can have intrinsic value if it is (correctly) valued for its own sake. Thus, on this second variation, a tree can have intrinsic value if some valuer correctly recognizes it as being good 'in itself' rather than for some other purpose. Let us call this '*weak anthropocentrism*' or '*weak protecentrism*'. Dr. Wright's definition of 'anthropocentrists' seems to cover only strong anthropocentrists, and my point is that anthropocentrism is more complex than his brief remarks might suggest. However, it is important to remember that in both variations, a world without valuers is a world without value; for that reason, both weak and strong anthropocentrism are variations within the general category of anthropocentrism and protecentrism.

In contrast to anthropocentric and protecentric views are nonprotecentric views – biocentrism and ecocentrism –, and these have played a particularly important role in environmental ethics. As the names imply, these theories hold that something can be intrinsically valuable even if no sentient creature is available to recognize that value.[7] In environmental ethics, the most influential nonanthropocentric view is "ecocentrism," the view that certain nonliving things – rocks, mountains, rivers, – as well as some sorts of groups or systems – e.g. species, ecosystems, nature, wilderness, Gaia – have intrinsic value It is this ecocentric view that Marie seems to have in mind when she contrasts her natural reason with humanitarian arguments.

A useful and popular thought experiment to determine whether a particular person or theory is appealing to a nonanthropocentric understanding of intrinsic value has come to be known as the "last person argument." If you were the last person (or last sentient individual or valuer) on earth, and were about to die, would there be anything morally wrong with cutting down the last redwood tree, or destroying the Grand Canyon? If a thesis, argument, or theory entails that it would still be morally wrong, then it presupposes a non-protecentric understanding of value.

The final issue surrounding intrinsic value, especially nonanthropocentric versions, is that a fully complete account will have to explain how we should justify and evaluate claims that something is intrinsically valuable, and thus how to settle, or at least make progress on, disagreements about whether, e.g., the Chatham River ecosystem is intrinsically valuable. We have already seen that such an explanation cannot *merely* fall back on an appeal to instrumental value, but there are still issues and questions to be addressed. Generally, they are epistemological: how do we know, or justify our belief that, X has or lacks intrinsic value?[8] However, they might

[7] This phrasing is a bit convoluted, but necessary for accuracy. The second variation on anthropocentrism, if coupled with moral realism, might agree that something could have intrinsic value even if nobody *in fact* valued it for its own sake: the valuers might simply be wrong about their moral judgments.

[8] Generally anthropocentric views will have more options here: they might, for example, appeal to a moral sense, intuition, or natural emotion. Some of these options may be open to the nonanthropocentric, but they fit less well together.

be metaphysical in nature: what qualities must a thing have in order really to be intrinsically valuable? To address these questions fully would take us deep into disputed areas of abstract metaethical theory, so we must set them aside for now, but towards the end of the chapter, when we address the question of whether an ecosystem can have intrinsic value, I shall suggest some principles which can be applied. This practice is quite common in environmental ethics: starting with a specific case or type of case, and using it as a paradigm from which one can try to abstract more general principles. This is certainly the case for Aldo Leopold, the father of ecology in America, and since Marie directly invokes his view, that would be a logical place to start our move from general concepts to specific positions in environmental ethics.

Leopold's Legacy

The works of Aldo Leopold have often been cited as offering a good criterion for intrinsically valuable ecosystems. Marie's claim is based on a direct quotation from "The Land Ethic," an essay included in *A Sand County Almanac*: "a thing is morally right when it tends to support the stability, integrity, and beauty of the land, and it is wrong when it tends otherwise" (p. 262).[9] When he uses the term 'land,' Leopold meant the entire ecosystem: animals, plants, water systems, even the soil.[10] This formula entails that the fundamental good, that which is intrinsically good, is a stable, integrated, beautiful ecosystem; something is instrumentally good if and only if it promotes such ecosystems.

Thus, there are two key themes in contemporary environmental ethics that have their roots in Leopold's writing: a holistic approach, and a rejection of the idea that the value of land is to be judged solely in terms of what it can produce that is useful for humans. Trained as a forester, Leopold was particularly opposed to forestry practices that turned mixed, thriving ecosystems into monocultures of a particular sort of "valuable" tree, planted in rows and managed "like cabbages." (p. 259). Let us look at each of those in more depth, and then ask whether the criterion is an effective way of determining which things are intrinsically good.

As noted above, Leopold claims that the moral worth of any individual thing, event, or action – i.e., whether it is morally good or bad – is determined by its effect on the land or the ecosystem. A forest fire might be good or bad, depending on whether it is necessary for the continued stability of the ecosystem (as it is, for example, on prairies) or whether it destroys the balance in an irreparable way, or so as to disrupt the stability of the ecosystem. The contemporary term for this is 'ecoholism.'

[9] All references in this section will be to Leopold (1966). See bibliography for full citation.

[10] However, in other essays, 'land' is used as a pejorative term: "There is much confusion between land and country. Land is the place where corn, gullies, and mortgages grow. Country is the personality of land, the collective harmony of its soil, life, and weather" (p. 177).

Although he did not use the term, the emphasis on effects of actions would suggest that he based his judgments on utilitarian grounds. He applied to same standards to selective logging, the introduction of new species or removal of others, and hunting and fishing. Thus, when there is an overpopulation of deer, Leopold would support controlled hunting: even though the individual deer will suffer, the ecosystem as a whole will be better off. Leopold himself was an avid hunter for a good portion of his life.

As these examples indicate, Leopold did not think that the land must remain untouched by humans, or that human interference was necessarily morally bad. In this way, he differs from most contemporary "ecoholists" who, as we shall see presently, view any human impact on the environment as suspicious. A related question about Leopold's views is whether they are truly nonanthropocentric, as they are sometimes portrayed. The obvious observation here is that "beauty," one of the three criteria, is obviously based on human evaluation.[11] To say this is not to condemn it as a reasonable criterion for evaluating ecosystems; it is merely to observe that Leopold may not be as committed to contemporary visions of ecoholism as some have portrayed him. However, this brings us to the question of whether Leopold's criteria are: do they give us necessary and sufficient conditions for determining the health of an ecosystem, whether an ecosystem has value, or how we ought to evaluate an action that will have an impact on ecosystem. The three criteria, just as a reminder, are "integrity, stability, and beauty," I believe it is useful to take them up in reverse order.

An appeal to beauty is the most obvious barrier to the claim that Leopold is nonanthropocentric; of all the three criteria, this most clearly cries out for a sentient being to recognize beauty. Unless one begs the question, however, that does not necessarily disqualify it as a good or justifiable criterion. In many ways, it lies at the core of Leopold's approach, which has led some philosophers to dub his theory a "land aesthetic" rather than a "land ethic," Using the distinction introduced earlier, we can see that, at least with his appeal to beauty, Leopold falls into the category of weak anthropocentrism. This is important because it reveals that one can be both anthropocentric and an ecoholist. It follows from this that ecoholism and ecocentrism are not the same position, and the first does not entail entail the second.

The concern about an esthetic basis for intrinsic value is that it initially seems to capricious to provide a meaningful basis for a rational environmental ethic. After all, some of us like mountains, others prefer the ocean, and still others the lights of Broadway; some would prefer to preserve an area of wetlands, while others would rather see the "swamp" developed into a convenient Wal-Mart. However, just as there can be educated and uneducated judgments about music and painting, so too can there be educated and uneducated judgments about the beauty of an ecosystem, and Leopold was quick to point out the beauty of the land can best be judged and appreciated by those who understand how the ecology of the area works. An insect

[11] Indeed, I have argued that it is often the most important consideration, if understood correctly.

or plant that might seem boring and unattractive to the untutored eye may be recognized as a valuable gem by the sensitive ecologist. This factor will not guarantee the elimination of all disagreement, any more than a demand for informed rationality will eliminate all disputes in ethics, but it can provide a norm by which different views can be compared and evaluated.

The criterion of stability has necessarily undergone reinterpretation in order to remain a viable candidate for evaluating ecosystems. Ordinarily, 'stability' suggests a sort of permanence, a lack of change; on this understanding, the surface of the moon would be perhaps the most stable ecosystem we know. However, contemporary ecology emphasizes the fact that ecosystems must constantly change and adapt to internal as well as 'outside' influences (more about the reason for putting 'outside' in scare-quotes momentarily). Thus, a contemporary reading of Leopold's criteria would take a stable ecosystem to be one that is capable of responding to a wide variety of changing conditions while remaining a balanced system in equilibrium.

One must be careful here; it would be silly to claim that an ecosystem is unstable just because it is unable to maintain any sort of equilibrium in the face of bulldozers and concrete. Rather, we expect a stable ecosystem to respond appropriately to *normal* or *natural* forces: internal forces such as increased squirrel population or the growth of a taller and thicker forest canopy, as well as external forces such as lightning strikes. This raises a further difficulty: what counts as normal or natural? As we have seen, Leopold allows that humans can have a positive effect on an ecosystem, that human actions which change an ecosystem can be morally good. Therefore we cannot assume that 'normal' or 'natural' can be defined as anything like 'without human interference.'

Even if we could answer these difficult questions, we must deal with the context relative nature of stability. That is, how stable a system is depends on the scope of our survey, both in size and time. A system that seems chaotic right now, may, within a period of a month, year, or decade, return to a state of balance. Similarly, a tidal pool or flood plain might seem quite unstable as changing conditions result in dramatic changes in flora and fauna, but can also seen as part of a larger system that is stable in part because of the activity within that one small area. Conversely, an apparently stable system might turn out to be nothing more than a dormant stage in a long history of instability. For example, one concern about various attempts to "reclaim" or "rehabilitate" a system is that these efforts may only produce a temporary fix, one which will disintegrate as soon as the engineers pull out. This may seem like an empirical issue – what is the proper perspective from which to do scientific investigations of ecosystems most effectively? – but it brings us directly to Leopold's third criterion, integrity.

'Integrity,' according to the *New Shorter Oxford English Dictionary* has as its first two definitions:

1. The condition of having no part or element taken away or lacking; undivided state; completeness;
2. The condition of not being marred or violated; unimpaired or uncorrupted condition; original state; soundness.

Given what we have already said about Leopold, it follows that his notion of 'integrity' must concentrate on "having no part taken away," and "completeness"; while "soundness" is important to Leopold, it would already be covered under the criterion of stability. But those concepts require that an ecosystem has a definite identity, in order that we can have good reasons for judging it to be complete or incomplete, of having or lacking its essential parts. This brings us back to the motive for putting 'outside' in scare-quotes in the preceding discussion of the criterion of stability.

One of the most basic messages that ecology conveys is "no ecosystem is an island." The Chatham river is affected by its surrounding river basin, and the runoff from it. The runoff is obviously affected by land use in the immediately surrounding area (e.g. fertilizers and pesticides used, types of vegetation, how much land is developed and paved, etc.). Perhaps less obviously, much broader climatic effects at the global level or perhaps the level of the solar system can also have an impact. In short, the hope of determining the boundaries of an ecosystem, what it encompasses and what lies outside it, seems more and more misguided as we gain a better understanding of both the theoretical and empirical issues involved in such an enterprise.

What, then, shall we say about the theoretical cogency of Leopold's criteria? On the one hand, at least the concepts of stability and integrity raise difficult empirical issues, important questions on which to consult the best available ecological sciences. However, there is no such thing as a purely value neutral evaluation; notions of stability, integrity, and ecosystem health[12] all involve choices about what is valuable and what the appropriate perspective is. Therefore, these issues are not merely a matter of 'getting the science right'. One needs to be clear about the values one is importing, even if only implicitly. What *kind* of stability, and on what scale, do we value, and why? When we talk about the integrity of a system, how do *we* draw the unavoidably arbitrary boundaries? In short, we need to dig deeper into the criteria proposed by Leopold.

The second question just posed reminds us of the basic metaphysical problem which became explicit in the discussion of integrity: the identity of the ecosystem. What constitutes an ecosystem; where does it begin and end, both in space and time? Some philosophers have tried to finesse the issue by insisting that nature as a whole is "the ecosystem",[13] but that brings problems of its own, as we shall see when we turn to a consideration of ecoholism.

If the basic concepts on which Leopold relies themselves turn out to require more basic value judgments, or be irreparably unclear or arbitrary, we would do well to continue further in our search for a basis for attributing intrinsic value to an ecosystem and/or some of its components. Therefore, let us see how his ideas have fared in contemporary environmental ethics.

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[12] See Jamieson (1995) and Russow (1995) for discussions of how the concept of ecosystem health is value-laden, and Norton (1996) and Rapport (1995) for dissenting views.

[13] Callicott has taken this even further, pointing out that the land ethic "could fairly be called a case of earth chauvinism" (p. 262) – although he thinks it's a perfectly justified form of chauvinism.

Contemporary Holistic Approaches

Environmental ethics has become increasingly recognized as a legitimate part of moral theory, and hence, has spawned a variety of approaches. Many discussions of environmental ethics proceed within the traditional frameworks of philosophical, legal, or social ethics, or an extension thereof; I examine those more closely later, in the section "Environmental Pragmatism." Some philosophers and activists have found this allegiance to tradition an unsatisfactory way of defending the environment, however. These other philosophers, who are attracted at least to Leopold's basic approach and find the traditional approach lacking in some way (e.g., too anthropocentric), have proposed what are presented as totally new approaches, or approaches grounded in other traditions not generally acknowledged in Western ethical theory. I examine two of the most influential.

1. Ecoholism

Ecoholism is sometimes thought of as another name for "deep ecology," a term coined by Arne Naess, made popular in philosophical circles by Bill Devall and George Sessions, and often associated with the "Earth First" movement. I would suggest that deep ecology is better understood as one type of ecoholism, for reasons that the following definitions should make clear.

Ecoholism, briefly, is the doctrine that a fundamental source of value, perhaps the most fundamental, is the ecosystem as a whole. Parts of the ecosystem, whether individuals, subspecies, or species, derive their value from the contribution they make to the welfare of the ecosystem. As noted earlier, ecoholism tends to view ecology as teaching us that the environment or nature as a whole is some sort of almost organic unity, thus avoiding the 'identity problem' mentioned in conjunction with Leopold. In this way, ecoholism tries to combine ecocentrism with empirical claims about the environment.[14] Two influential proponents of ecoholism are J. Baird Callicott and Holmes Rolston, both of whom (particularly Callicott) see their arguments as having their foundations in Leopold.

Opponents of ecoholism often point out that this view entails an abrogation of individual rights: Tom Regan had at one time referred to this view as "ecological fascism," as a way of drawing attention to the fact that individuals or groups might be sacrificed for the good of the "state," i.e. the system. It is also important to remember that this is a view about moral values, not merely the empirical claim that the various parts of the ecosystem are so interconnected that affecting any one part of it may well have an effect on all the others. Even the most radical anthropocentrist generally is becoming increasingly more aware of the truth of the latter claim, but that does not make her an ecoholist. As long as someone insists that the foundation of moral good rests with the good of individual humans, or individual animals, or even individual species, one is not an ecoholist. Only when

[14] However, Comstock (1996, 2001) has raised serious doubts about the scientific currency of this interpretation of ecology.

one argues that all of these goods must inherit their moral value from their impact on the ecosystem as a whole, or on nature, does one get to the defining characteristic of ecoholism.

If we think back to the discussion of intrinsic value with which we begin, there is certainly an intuitive conceptual appeal to a holistic approach. If intrinsic value is, as we said earlier, a trump card or a way of saying "the buck stops here," then one cannot go much further back than nature as a whole. However, we must weigh that against the serious concern underlying Regan's rather contentious label of "environmental fascism": nothing that is merely good for an individual without benefiting the environment, will not count as having moral value. Thus, according to ecoholism, donating to a charity such as a college scholarship fund, or the American Heart Association, or even saving the life of a drowning child, would not be a morally good thing (unless we can figure out some way in which it benefits nature as a whole). At best, it would be morally neutral or permissible; it might even be morally bad.

Ecoholism also faces a deep and as yet unresolved conceptual issue, which can be summarized in the question: "are humans part of nature?" The question raises a dilemma:

1. If humans are a part of nature, then what we do to the environment is natural and therefore acceptable.
2. If humans are not a part of nature, then 'nature' must be defined as the part of the world that does not include human interference.
3. ∴ Either anything we do is acceptable, or else ecoholism applies only to those parts of nature that are pristine – free from human interference.

The force of this dilemma is driven home when we realize that there are probably *no* places on earth that have not been touched by humans, either directly or indirectly. In order to escape the dilemma, ecoholism must provide a satisfactory definition of 'nature' that allows it to slip between the horns. So far, such a definition has not been forthcoming.

Deep ecology represents a radical version of ecoholism, in that it adds what it refers to as a spiritual dimension, a personal experience and connection. It is also a call to action, including very far-reaching policy changes which will require population reduction, and "basic economic, technological, and ideological structures … The ideological change will be mainly that of appreciating life quality (dwelling in situations of inherent value) rather than adhering to an increasingly higher standard of living."[15]

Environmental ethics, then, is no longer a purely rational, academic discipline for the deep ecologist. Deep ecologists often put more emphasis on wilderness than

[15] This is taken from Naess's "Eight Points," originally formulated in (1979), but widely reprinted in anthologies, including Armstrong and Bolzer (1993), from which this is taken.

on other sorts of ecosystems, perhaps in the hopes of weakening the force of the dilemma noted in ecoholism. Unfortunately, 'wilderness' has exactly the same problems as 'nature,' perhaps even compounded.[16] Moreover, deep ecology has often been accused of promoting misanthropic and elitist attitudes: misanthropic, because human interests are almost always discounted, and elitist because, while it is fine for comfortably-off academicians in the developed countries to renounce increasingly higher standards of living, it seems grossly unjust to make that a general recommendation, including to those struggling in third world situations of extreme poverty. To sum up: deep ecology inherits all the difficulties of ecoholism in general, and creates more problems of its own.[17]

One of the interesting things about Aldo Leopold is that while he was always committed to ecoholism, he seemed to move back and forth between a sort of deep ecology and a much more pragmatic sort of ecoholism, with ample room for humans. His way of escaping the dilemma would probably be to deny the first premise: humans are a part of nature (we saw earlier that he did not think human use of natural resources, or even changing an ecosystem, was necessarily bad), but humans have a proper place. Our actions are morally wrong when we ignore that sense of place. Unsurprisingly, an understanding of proper place sounds, in Leopold's writing, very much like an esthetic appreciation coupled with an understanding of ecological principles.

Ecofeminism

Ecofeminism is also often associated with ecoholism, and indeed many ecofeminists are ecoholists. A few even endorse deep ecology, although many ecofeminists criticize deep ecology for its emphasis on self realization rather than relationships with others, and its failure to pay sufficient attention to social factors (see, for example, Cheney, and Plumwood; for a response, see Fox) However, even the association between Ecofeminism and ecoholism ignores several important theoretical and practical distinctions, not the least of which is the range of conclusions defended by ecofeminists. As we shall see presently, there is an ongoing debate about the incompatibility of Ecofeminism and deep ecology. First, however, let us try to identify some common characteristics of Ecofeminism.

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[16] It is interesting to note in this regard that the largest designated 'Wilderness Area' in the U.S., the Boundary Waters Canoe Area (BWCA) was in fact fairly extensively logged up through the early twentieth century.

[17] One response to some of these issues has been a split between deep ecology and "social ecology," the latter most closely associated with Murray Bookchin. See Chase (1987).

If there is any defining characteristic of Ecofeminism, it would seem to be an emphasis on the issue of domination. More specifically, current attitudes towards nature are seen as one instance, part of a pattern of domination: men dominating women, whites dominating people of color, colonialists dominating native people, humans dominating nonhumans, etc. As Karen J. Warren, a leading ecofeminist notes:

> What all ecofeminist philosophers *do* hold in common, however, is the view that there are important connections between the domination of women (and other human subordinates) and the domination of nature *and* that a failure to recognize these connections results in inadequate feminisms, environmentalism, and environmental philosophy. (Warren 1996, p. x)

Domination is often linked to 'dichotomized' thinking: separating the world into 'us' and 'other' is often a first step towards the view that 'we' are more valuable. Thus, many ecofeminists emphasize connections and community rather than a search for differences.

A second theme often found in ecofeminism, and feminist ethics more generally, is the claim that traditional moral theories overemphasize rationality and impartiality, and undervalue feelings, connectedness, and personal relations. This theme has its roots in Carol Gilligan's critique of Kohlberg's formulation of stages of moral development in which one progresses to 'higher' stages of moral thinking by engaging more and more in abstract, impersonal reasoning, and setting aside specific personal connections and context. Gilligan argued that the latter was an equally important component of morality, and, following Gilligan, is sometimes referred to as 'an ethics of care'. There is, of course, disagreement about how much such impartial rationality is too much; Wendy Donner, for example warns against a too thorough rejection of these traditional values, as well as the strongly individualistic sense of self they imply. However, particularly since an emphasis on rationality and 'coolness' is often linked to practices of domination and dichotimizing, this theme is also quite important to ecofeminism.

Both the emphasis on community and the location of attitudes towards nature within a larger pattern of domination which includes intrahuman domination, makes it unsurprising that many ecofeminists have paid close attention to 'real world' social and political situations, especially in a global context, with special attention to third-world issues. Vandana Shiva is only one example of a philosopher who address this important part of ecofeminism.

As noted earlier, there do seem to be some natural affinities between deep ecology and ecofeminism: a rejection of the domination of nature, the tendency to think of nature as a connected whole, and the insistence that disinterested rational analysis by itself is not a sufficient grounding for environmental ethics. However, there have been serious disagreements between some proponents of each theory (usually accompanied by the charge that the opposition is 'shallow'!). Much of the dispute revolves around the issue of how much our attitudes towards nature must be understood as part of a pattern which includes domination of other people, and the social and political forces which shape our interactions. Ecofeminists may charge deep

ecologists with ignoring the particularized, cultural, and political forces which affect human relations as well as interaction with the environment, oversimplifying when they talk about 'human' attitudes as if they were univocal and ahistoric. Deep ecologists sometimes object to feminists' attention to what some see as traditional human-centered concerns. Again, this is an area in which there is substantial disagreement in both camps, but it serves as a useful reminder not to oversimplify either position and reduce it to a caricature.[18]

Whatever the differences, all ecoholists and most ecofeminists advocate a non-extensionist approach: attitudes towards nature (and other groups) is not merely a matter of retaining our individualistic approach to moral ethics, while perhaps extending to more individuals (sentient creatures, or living things). Thus, if any of these alternative approaches is to be plausible, we must be able to make sense of nature as a suitable object of moral concern and duty, and do so in a way that is irreducible to concerns for individuals. To see whether we should move in this direction, we must first identify the alternative, individualistic theories that holism finds wanting before turning directly to the question of whether nature can be harmed.

Environmental Pragmatism

The term *environmental pragmatism* has two related roots. The first, as its name implies in ordinary usage, eschews very abstract theoretical analysis in favor of those issues which translate more directly into policy. The second, more closely tied to philosophical terminology, suggests a tie with the school known as *American pragmatism*, associated with philosophers such as William James, John Dewey, and Charles Sanders Pierce. Most contemporary writers representing environmental pragmatism, notably Bryan Norton, Andrew Light, Eric Katz, and Paul Thompson, combine elements of both these orientations.

Norton has written quite extensively on the first of these themes. One of his repeated targets is the concern with inherent or intrinsic value, which he finds to be a distraction rather than a help to increased clarity about environmental ethics. He argues that we can make more progress via alternative routes, particularly by addressing questions of scope and scale. With respect to temporal scale, for example, he argues that if we are sufficiently cognizant of the fact that environmental policy must consider short-term, medium-range, and long-term, multi-generational effects, we can arrive at sound policies without getting bogged down in debates about kinds of values which may have no clear implications for policy at all.

As noted earlier, the phrase 'environmental pragmatism' is also used to invoke a connection with the philosophical tradition known as 'American Pragmatism.'

[18] For a more detailed discussion see the essays by Sessions and Plumwood in Warren (1996).

The dual use of the phrase is not coincidental, since American Pragmatists approached classic issues in philosophy by searching for a more common-sense and useful answers to questions about knowledge or reality as well as ethical questions. Moreover they generally championed a closer connection between philosophy and the natural sciences. This connection has two aspects. First, humans are viewed as part of nature, not distinct from it. Second, our understanding of the natural world, like our understanding of reality in general, is viewed by pragmatists as to at least some extent relative to context and interest, rather than a predetermined given.

Although I have described environmental pragmatism in general terms, there are more subtle differences among proponents of this movement to which I cannot do justice here. An anthology edited by Andrew Light and Eric Katz, *Environmental Pragmatism*, offers an excellent collection of essays on this topic. It is interesting to note the speculation that Aldo Leopold, with whom we began this essay, may have been influenced by a pragmatist (in both senses) orientation.

One potential problem with both versions of environmental pragmatism is a concern about the lack of a theoretical foundation and the subsequent risk of begging questions about which policies should be adopted. This approach seems to assume that we will be able to reach agreement at a policy level as long as we pay proper attention to the scientific data – i.e. we are well grounded in ecology – and common sense. However, all of the participants in the Chatham River debate seem to meet both criteria, and no consensus is in sight. Other real-world cases also suggest that pragmatism may be too optimistic about the way in which consensus will be generated.

Extensionalist Theories

Philosophers who are skeptical about a theory's ability to overcome the serious difficulties discussed in the previous section, who find Leopold's approach overly romantic and lacking in rigorous analysis, or who simply remain unconvinced that we need a "new environmental ethic" may argue in favor of a more individualist approach: anthropocentrism, protecentrism, or biocentrism. Such philosophers often agree that environmental ethics should extend the boundary of traditional ethical concerns, but believe that such an extension can proceed from already familiar ethical and legal foundations.[19] Christopher Stone, for example, argued that the legal notion of rights currently in use can and should be extended to trees. Paul Taylor presents his thesis as a natural and logical extension of the Kantian perspective on respect and rights. Gary Varner has defended an extensionalist approach by arguing that proper attention to our duties to individual animals, whether grounded in a Singer-type utilitarianism or the rights-based theory defended by Regan, will also entail protection of the environment, including hunting of some species

[19] Hence Comstock's (1996) term for such theories: "extensionist environmental ethics."

(see the section "A Triangular Affair," later in this chapter, for more detail about this issue). I have argued that our duties to protect endangered species and ecosystems is best understood as a recognition of the interests of sentient creatures and the intrinsic esthetic value of individuals (including plants and "places" as the latter term is often used in the phrase "sense of place").

The previous list by no means covers all the possibilities: nothing will be said about appeals to natural law, or the Continental tradition in environmental ethics.[20] Indeed, since individualistic approaches in traditional ethical theories are so varied, and since most such approaches can be extended to some degree so as to apply to environmental ethics, if only negatively, it would be pointless to attempt to survey all the possibilities.

The main issue to keep in mind when evaluating individualistic approaches is whether anything is lost if we no longer consider 'ecosystems' 'species,' or 'nature itself' as a direct object of moral concern. So, let us turn to that question.

Can Nature Be Harmed?

One way of asking whether nature can be an object of moral concern is to consider whether it can be harmed in a morally significant way. It puts the issue in more concrete, familiar terms, while still serving as a reflection of the more basic issue of whether nature itself has intrinsic value, as we shall see presently.

Although it is natural to read the question as "Can nature be *harmed*?," I propose to put the emphasis elsewhere: "Can *nature* be harmed?," That is: is Nature the sort of thing to which it makes sense to apply concepts like benefit or harm? The two versions of the question should lead to the same answer, but the emphasis will help guide our attempt to answer it. In order to do so, we must first get clear on what is meant by 'harm' in these contexts. Let us stipulate that in the following discussion 'harm' and 'benefit' are to be understood as moral concepts; to harm someone or something in this sense is to do something that is *prima facie* morally bad.

There are two ways in which something or someone can be harmed in a morally significant way: one harms X if one fails to respect X's interests, or if one's actions result in a net decrease of X's intrinsic value (or the intrinsic value of some Y of which X is a part).[21] These two forms of harm are not equivalent, but they are not exclusive, either. So, in order for X to be the sort of thing that can be harmed, it must either have interests, or intrinsic value; we can safely set aside the parenthetical condition in the case of 'Nature'. So: is Nature the sort of thing that can be harmed in one of these ways?

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[20] For a detailed discussion, and a scathing critique of the latter (see Ferry 1995).

[21] The second condition is not quite precise enough: X must somehow contribute to the intrinsic value of Y, such that our effect on X diminishes the value of Y. That is, there must be a direct causal link between what we do to X and Y's diminution of intrinsic value; it can't just be a coincidence.

First, it is clear that nature cannot have interests in the narrow sense, cannot have something it "cares about." It is not sentient, even though some parts of it are: sentient individual animals which *may* include humans, depending on how 'nature' is defined. In order to have interests in the narrow sense, one must care about something, and in order to care about something, one must be sentient (These are necessary, but perhaps not sufficient, conditions). There is a broader sense of 'interest,' sometimes called 'welfare interest' in which X has an interest in anything that contributes to its faring ill or well. Appeals to this broad sense, however, begs the question unless we have independently established what it is for Nature to fare ill or well, and why that is morally significant, since having interests satisfied or thwarted does not always create moral obligation.

The second alternative is the only possibility, then. Is it possible for some action we might take (or fail to take) to make nature less valuable? In considering this question, it is important to keep in mind that we are talking about intrinsic value, or what might make *nature* valuable 'in and of itself,' rather than instrumentally valuable for some other purpose that we or other interest-holders might have; that was the reason for the change in emphasis in the first sentences of this section. This might seem to involve an obvious answer: after all, it seems clear that water pollution, clear cutting, erosion caused by ATV's in fragile environments, and allowing an endangered species to become extinct are all examples of harming nature. But initial appearances may be superficial; we need to look deeper.

I am not disputing that all of the examples just cited are bad things, but it is not clear that they are bad because they diminish the intrinsic value of nature, once separated from weak anthropocentrism or protecentrism. After all, we not only think that water pollution is bad because it kills fish and other life that depends on the water supply, we even *define* what counts as pollution by its effects on plants, animals, and people. Similarly, we decry clear-cutting of trees (but not always of corn[22]), but the reasons we cite tend to be aesthetic: clear-cutting destroys the beauty of the forest:, or very specific about its effect on sentient beings: depriving animals of necessary habitat, allowing runoff that will negatively impact stream life, etc. In short, our objection is not fundamentally that nature *itself* is harmed, but that the properties of nature which creatures who have an interest in nature being one way rather than another are changed in ways that affect those creatures.

Of course, life is not that simple: what is helpful to one individual may harm another. In those cases, the natural impulse is to sum and compare those benefits and harms, or to appeal to the rights of those affected, both of which are classic individualistic approaches. That is to say, even assuming that we have a clear understanding of what 'nature' means, we see it as important for the interests of individuals, but not necessarily intrinsically valuable.

[22]Although arguments in favor of conservation tillage often follow similar lines of argument as those adduced against clear-cutting of trees.

All of this presents the following challenge to those who would attribute intrinsic value to nature itself:

1. If nature has intrinsic value, it must be possible to harm nature directly by decreasing or destroying its intrinsic value.
2. The examples surveyed rest on harms to individual sentient creatures rather than direct harms to nature.
3. ∴Absent a new counter example, so-called harms to nature are more fundamentally understood as harms to individual sentient creatures or diminution of instrumental value as judged by those creatures.
4. There is at present no convincing argument that nature can be harmed.
5. ∴ There is at present no convincing argument that nature has intrinsic value.

In addition to this problem about attributing intrinsic value to nature, we must also consider another issue that has already been mentioned: What do we mean by 'nature'? This is not really a new question, since we ask about what we mean by nature in order to figure out what would be a harm to *nature* as opposed to something else, but considering the question in this form reinforces the previous argument. The question was raised earlier when we considered the dilemma of how humans fit into nature. There are three possible answers: (a) no human interference is natural; i.e., any environment affected by human interference is non-natural; (b) humans are simply part of nature, and any effect they have is therefore natural; (c) some effects of humanity are natural, but others are not. Unfortunately, no convincing arguments have been given for (a); (b) seems naive, and certainly unhelpful to environmental ethics and (c) requires a criterion, *with justification*, for determining which effects are natural and which are not; and such a criterion is not forthcoming.

So far, we have considered the issue of whether nature can be harmed, but the other side of the coin should also be recognized. Another question to be considered is whether we can identify anything that is **good** for nature, in and of itself. Here again, the same issues arise: we have not yet gotten a good definition of nature, and what we tend initially to gravitate towards as examples of things that are good for nature seem, upon closer examination, to turn out to be good because they benefit individuals. To give one example: is prairie restoration good for nature? Certainly prairies are good things for many reasons: they provide excellent habitat for many species, they are good for enriching the soil and curbing erosion, they remind humans of their past, they are beautiful (although the recognition of their beauty may require a better understanding of ecology than is generally present), and so on. But it is not clear that any of these reasons show that such activities are good for nature itself. Moreover, by definition, prairie *restoration* is a human activity; it is, on one interpretation of 'nature,' unnatural.

In short, attempts to answer the question of whether nature itself can be harmed reveals two fundamental problems with any attempt to argue that it can be harmed: (1) whether we have a clear enough sense of what 'nature' means to know that the question refers to, and (2) whether nature is the sort of thing that really has intrinsic value, i.e. whether beneficial or objectionable actions are judged to be beneficial or

objectionable because they affect Nature itself, or rather on the basis of their effects on individuals within the natural world. These two issues carry over directly to questions about specific ecosystems – e.g. the Chatham River – and species.

Can Ecosystems or Species Have Intrinsic Value?

As we have seen, attributing intrinsic value demands two linked necessary (but not sufficient) conditions: a clear definition of identity, and a criterion for 'harm for X' that is independent of instrumental concerns, or concerns about how those harms are fundamentally harm for someone/something else. These conditions must be met by anyone who argues that an ecosystem such as the Chatham River, or a species such as the spotted owl, has intrinsic value. Can these conditions be met? I will argue that they cannot; each fails to satisfy at least one of the conditions. Let us start with the issue of whether species can have intrinsic value.

Although biologists have frequently revised the definition of species, the question of whether two individuals belong to the same or different species is rarely a serious issue. Exceptions to this general rule do occur with subspecies (different subspecies of trout), and species that once had been geographically isolated but have expanded into overlapping ranges (e.g. different types of juncoes), but this rarely has an impact on environmental debates. One notable exception is the Dusky Seaside Sparrow, which, when reclassified as a color variation of the Seaside Sparrow, was no longer protected as an endangered Species. This enabled Disney World to be built on the last known natural habitat of the sparrow. The last Dusky Seaside Sparrow died in captivity in Disney World. However, concerns about protection of endangered 'species' often do not parallel the biological definition of species. Protection of subspecies such as Mt. Graham ground squirrel, or even domestic breeds like the Norwegian Fjord horse, is not uncommon. Thus, although the 'identity condition' can be scientifically met on the species level, those distinctions do not seem to capture what environmentalists are often concerned about. At the subspecies level, the identity criterion becomes more problematic, but perhaps not an insurmountable barrier.

The real problem for species is the second condition: can a species be harmed? On the face of things, the question seems silly; the whole idea of a species being endangered, or going extinct, seems an obvious sort of harm. But if we probe a bit deeper, and ask who or what is harmed when a species is endangered, or becomes extinct, the issue becomes more difficult. Obviously individual animals are harmed if their habitat is destroyed or they are killed, whether though hunting by humans or other animals, or destruction of their habitat – again, whether through human impact or natural causes.

Humans may be harmed if they are deprived of the opportunity to see a beautiful snow leopard or an awe-inspiring stand of old growth Douglas firs. A common line of reasoning about the rain forest is that there are hundreds of species that we haven't identified yet, and one of them could prove to be a cure for cancer. This is

also obviously anthropocentric. Other arguments tend to focus on the fact that a species may occupy an essential niche in the environment. If we eradicate black flies, we would unknowingly interfere with the pollination of wild blueberry bushes. This is persuasive if we like blueberries.

Thus, when we examine the question of whether species can be harmed, species do not seem to be the right level at which to identify any harm done by the endangerment or extinction of a species unless we try, as Rolston does, to argue that the species itself is some sort of "superorganism," Certainly there are harms done to individuals: humans, members of the species in question, and other individual plants or animals that depend on the threatened species. In some cases, the ecosystem may be altered, perhaps irreparably damaged, although in many cases, such as the California condor, or Prezwalskis' horse, there is little or no impact on the ecosystem. Neither works all the time. Until a new suggestion is forthcoming, it would seem that individuals and ecosystems can be harmed, but that *species* themselves are the wrong place to locate the harm done by extinction or endangerment. If so, species may have instrumental value, but do not seem to meet the conditions for intrinsic value.

Marie's argument, and Leopold's, however, does not focus on individual species, but on ecosystems as a whole. Thus we must consider whether ecosystems can have intrinsic value, judged according to the same two criteria of identity and harm. Let us consider them in reverse order.

Many philosophers have suggested that the concept of 'ecosystem health' is a value-neutral measure of harm and good to an ecosystem. Dale Jamieson and I have both argued that this is not so, for a variety of reasons. However, while my argument was intended primarily as a rebuttal of the claim that the concept is value-neutral (or, as sometimes claimed, 'purely' scientific, or 'purely' objective, as if those three terms were synonymous), it also highlights the ways in which someone might argue that an ecosystem can be harmed. That is to say, an ecosystem is harmed if its health is diminished.

Ecosystem health has been defined in a number of ways, but two key, related, features are natural diversity, and a dynamic sort of resilience. 'Resilience' here is intended to replace an outdated static sort of stability. It refers to a system's ability to maintain itself by adapting to natural internal and external changes while still supporting a high level of biodiversity. Conversely, biodiversity is often what allows an ecosystem to be resilient: a larger gene pool is more likely to contain life forms with the ability to adapt to new conditions. Of course, some of the problems with Leopold's concept of stability noted earlier are inherited by its successor, but ecologists such as Constanza and Rapport, who have tried to define the concept of 'ecosystem health' have made significant progress in these areas.

The other criterion for intrinsic value is the identity condition: can we specify with reasonable precision *what* is supposed to have intrinsic value? It is necessary to identify the 'bearer' of value, or else we are left with free-floating value, a nonsensical idea. Here is where the attempt to ascribe intrinsic value to ecosystems encounters serious obstacles.

An ecosystem is shaped by native and invasive animals and plants, migration, water, soil, climate and air, just to name the main components. None of these have

clear boundaries, so it follows that the ecosystem which comprises them will not have identifiable boundaries either. But without boundaries, without any way of determining what is or is not part of the ecosystem, there seems to be no way of meeting the identity criterion. So, the main challenge to anyone who wishes to argue that ecosystems have intrinsic value would be to develop a coherent account of how to identify and delineate an ecosystem.

Conflicting Interests

So far, we have identified certain values that should guide environmental ethics. It would be easy to decide what to do if we could just run down a checklist of these considerations and calculate the values involved. Unfortunately, in the real world, demands and values often come into conflict. Whether or not we have a satisfactory way of resolving the conflict, we should at least be cognizant of the most common areas in which such problems arise. This section surveys some of the most important areas of conflict. Together, these issues remind us that environmental ethics does not occur in a vacuum; it must be developed and evaluated in a context of ethical concerns about humans, non-human animals, and social justice.

Human Flourishing Versus Wilderness

As noted earlier, deep ecology places special emphasis on the importance of wilderness, but it is certainly not the only theory in environmental ethics to do so. In fact, arguments for protection of wilderness areas are often the central focus of environmental ethics. However, protection of the wilderness poses a theoretical problem about how to define 'wilderness,' as well as at least three potential areas of conflict with what we might generally call 'human flourishing'.

What, exactly, is a wilderness, and why is it singled out for special recognition and (sometimes) protection? In the strictest sense, a wilderness is an ecosystem that is unaffected by human interference, and if that is the standard we choose, there are almost certainly no wilderness areas on this planet. More typically, 'wilderness' is used to designate an area that is set aside and protected from development or uses that would change the area's 'natural' condition. This leads back to the question, considered earlier, of what 'nature' or 'natural' means. There is no need to go over the theoretical issues again, but it might be useful to identify some practical issues which arise specifically with wilderness areas.

It would seem obvious that a basic level prerequisite for wilderness preservation is the absence of major human interference, either in the form of development, or interference with natural processes. However, wilderness areas have, at least until recently, been actively managed. Such management can sometimes yield apparently devastating results, at least in the short run, such as the fires in Yellowstone

(for a unique perspective on human interference in Yellowstone, see Chase). Second, wilderness areas have usually been so designated long after the natural balance of life has been disrupted, with special impact on large predators. Without such predators, other species exhibit an impact: prey species such as deer or elk may multiply far past the carrying capacity of the land, and other species such as coyotes may partially, but not fully, expand to cover an empty niche. What should be done about these situations? Third, wilderness areas are isolated islands surrounded by developed areas, and this, too, poses problems. One current example is the fate of bison in Yellowstone: their natural behavior is to migrate to lower ground in winter to obtain better grazing, but current policy – dictated by ranchers who are concerned about the possibility of buffalo infecting domestic cattle with brucellosis – allows, and sometimes demands, that they be shot as soon as they stray outside park boundaries.

These are major, dramatic issues affecting wilderness, but sometimes the seemingly minor issues are more illuminating from a philosophical standpoint. The basic theoretical problem is how much interaction between humans and wilderness should be allowed or encouraged. One of the reasons often given for maintaining wilderness areas is that they provide a valuable opportunity for people to get back to nature, but that means people must have access to those areas. Deciding what sort of access is appropriate creates a host of practical problems.

Let's assume for the moment that all of the previous major problems have been resolved. A less dramatic question would be whether to have marked trails and campsites in a wilderness area, and if so, what sort and how many. Obviously, such things are unnatural, but they are part of almost every managed wilderness area. Paths, trails, and established campsites are intended to control human impact by concentrating it in limited areas: hikers should use the trails rather than bushwhacking through fragile underbrush. But they also change the ecosystem; they are more susceptible to erosion, non-native plants are more easily established at such sites, and the local wildlife is quick to adapt to the 'easy pickings' at a campsite or portage head. So by making the 'wilderness experience' accessible to more people, and by trying to protect the land from damage imposed by human use, we seem to be making the area less and less of a wilderness. But if we do nothing, very few people will be able to enjoy the wilderness, and those who do will have an uncontrolled impact on the ecosystem.

The previous discussion, while relevant to U.S. wilderness areas, represents only a small part of the issue. When most Americans think of wilderness, we do so from the perspective of an affluent society with the leisure time and resources to enjoy, or at least contemplate, the rain forest, Siberian tigers, and unpolluted streams. From the perspective of a developing nation, setting aside nature preserves to protect tigers while ignoring the needs of people who depend on that land for the basic necessities of survival might well be viewed as imperialist or elitist. Ramachandra Guha and Anil Agarwal have been particularly eloquent in analyzing this topic, and identifying the presuppositions built into a glorification of wilderness.

As the previous issues imply, an emphasis on wilderness runs the risk of inviting us to overlook other pressing environmental concerns. After all, very few people

have any direct contact with wilderness areas, and most of the world's population lives in an urban environment. Dale Jamieson has discussed the relevance of environmental ethics to cities in an illuminating way, and serves as a reminder that preservation of wilderness is hardly the only, or even most pressing, issue in environmental ethics. Thus, any fully developed and effective ethical theory ought to address urban concerns, and insofar as a "wilderness focus" occupies a glamorous, romantic role, it runs the risk of distracting attention from environmental issues that have a far greater real-world impact.

"A Triangular Affair"

The connection between environmental ethics and animal rights, or animal liberation movements, has always been murky. Tom Regan has accused ecologists of "environmental fascism," because they sacrifice the rights of individual mammals (clearly, sentient creatures) in order to preserve species and ecosystems, even to the point of killing sentient animals to preserve plant species. In 1980, J. Baird Callicott published an article titled "Animal Liberation: A Triangular Affair" in which he argued that 'animal liberation,' or more generally an ethical stance that emphasized the moral considerability of individual sentient animals, is often incompatible with environmental ethics. Although he later modified his own interpretation, his initial challenge still poses an important problem for environmental ethics.

As just suggested, there are at least three potential conflicts between environmental ethics and concerns about animal welfare: environmental ethics tends to value the welfare of a wild species over that of an equally sentient domestic animals, might justify sacrificing the welfare of individual animals for the good of the species, and sometimes justifies harm to a sentient creature in order to preserve a non-sentient but endangered species. In all three cases, it is difficult to see how to reconcile conflicting demands. Callicott is not the only philosopher to highlight these conflicts; Aldo Leopold was an avid hunter, Mark Sagoff has responded to Callicott's attempt to retreat from his early position, and, as noted earlier, Regan has characterized some versions of environmental ethics as 'fascism'.

With regard to the relative status of domestic vs. wild species in moral deliberation, it is clear that any ethical theory which judges the worth of something in terms of its contribution to an ecosystem will automatically dismiss almost all concerns about domestic animals. Callicott refers to them as 'artifacts,' and claimed that

> a herd of cattle, sheep, or pigs is as much or more of a ruinous blight on the landscape as a fleet of four-wheel drive off-road vehicles. There is thus something profoundly incoherent and insensitive as well in the complaint of some animal liberationists that the "natural behavior" of chickens and bobby calves is cruelly frustrated on factory farms. It would make almost as much sense to speak of the natural behavior of tables and chairs. (p. 30)

Despite Callicot's later renouncement of this view, there is a clear tension here between the emphasis on sentience and the ability to suffer emphasized by animal projectionists, and moral considerability based on contributions to an ecosystem.

Secondly, environmentalism tends to focus on species rather than individuals. This has several consequences. An endangered species should be given more weight, morally speaking, than a common one. Individuals can and should be sacrificed for the good of their own or other species (this is, presumably, what provoked Regan's label of environmental fascism, since fascism demands sacrifices of individual rights for the good of the state). This may involve active hunting or trapping to control populations, encouraging predators, and allowing animals to die of starvation or accident even when rescue could be effected.

Finally, environmental ethics typically downplays the importance of sentience. If forced to choose between killing a plant or killing a sentient creature, the decision should be made on the basis of what each contributes to the ecosystem, not on which will suffer more pain.

In pointing out these conflicts, I do not intend to condemn environmental ethics, or to suggest that it has overlooked something vital. Indeed, environmentalists may be on the right side of all these issues. But they are real issues, and must be recognized and analyzed as carefully as possible.

Environmental Racism

Environmental ethics has sometimes been portrayed as less concerned than it should be with issues of justice, particularly when those issues have their greatest impact on minorities or third world, non-European nations. We have already touched on this issue in the discussion of urban environments, since, at least in the U.S., cities tend to have a higher minority population than rural areas. However, there are other ways in which to raise the question of environmental racism.

In this country, local sources of pollution tend to concentrate in poorer, often minority, areas, for two reasons. First, people with money are more apt to have their voices heard in the political systems which decide on zoning, what industries to allow in an area or even promote. Rich and poor both have the right to say 'Not in My Back Yard' but politicians generally pay more attention to the former. Second, undesirable types of land use, ranging from landfills and large hog farms through nuclear waste disposal sites, make surrounding property less desirable and less valuable. Those who can afford to do so may choose to relocate, but those who don't have the same means will be forced to live with the environmental hazard, or might find such areas the only location for 'affordable' housing. In both cases, the motive may not be racist, but the effect is.

Environmental racism also exists on a global scale. The same issues that exist intranationally – using other places as dumping grounds – there are other areas of potential abuse as well, usually grounded in a practice of discounting developing, usually non-white countries, or viewing them from our own perspective of already having 'made it.' We've also already mentioned the issue of wilderness protection and endangered species Cries to protect the rain forest often fall into the same category. Deforestation and loss of biodiversity is supposed to be a global problem, but

all too often the local population is expected to bear the apparently invisible economic and social burden that such efforts entail. There are frequent expectations that areas of Africa, Central and South America, India set aside nature preserves, and some laudable efforts are made to ensure that such projects actively involve and respect native human populations. Other campaigns fail to realize how much havoc an elephant can cause, or how few alternatives are readily available to those who depend on a slash and burn style of agriculture.

Similarly, calls for controls on ozone-depleting chemicals or other practices which pollute the air or water can sometimes ring hollow. Developed countries have depended for years on such practices, and are now in a position to understand the environmental impact they have had. However, issues of justice arise when attempt to hold developing nations to the same standards of restricting resources and their use that they, in their current affluence, are able to consider.

Environmental ethics is a rich and rewarding field, posing everything from deep theoretical problems about the nature of value and moral standing to very practical decisions. This essay could only hope to scratch the surface of some of those issues, but hopefully it has provided some guidance about how we can make a bit more progress in our thinking about them.

Appendix: The Spotted Owl

Consider the statement: “We ought to preserve the old growth forest in the Pacific Northwest because it is the last habitat for the spotted owl, an endangered species”. On a scale of one through five, with ‘1’ representing strong disagreement, ‘3’ neither agreement nor disagreement, and ‘5’ strong agreement, choose a number that best represents your attitude. If you chose ‘1’ or ‘2’, write down a sentence or two explaining why you disagree. If you chose ‘3’, explain what additional information or arguments might move you to one side or the other of the scale. If you picked ‘4’ or ‘5’, indicating strong agreement, complete the following statement:We should protect endangered species like the spotted owl because.

One obvious purpose of this exercise is to articulate and identify some of the many ways in which we justify concerns for the environment (what sorts of reasons were given in the ‘fill in the blank exercise), and also reasons which may come into conflict with those concerns (the sorts of considerations articulated by those who chose ‘1’ or ‘2’). However, there is an additional twist, hidden in the ‘because’ of the original statement. In fact, the Endangered Species Act was, and continues to be, invoked as an argument to justify protection of the old growth forests: does preservation of a particular species, such as the spotted owl, drive our concern for the habitat which it needs to survive, or does our concern for the habitat, the ecosystem, drive our concern about the perilous status of the spotted owl? Further answers to the ‘fill in the blank’ part of this exercise often turn back to a stronger emphasis on the value of the ecosystem, with the plight of the owl viewed as a symptom of a more basic problem. While this may seem like a purely academic

distinction, it has important implications for environmental policy. Suppose, for example, that spotted owls thrive and reproduce quite well in zoos, so that we could preserve the species and continue logging. In such a case, should we still be concerned about the habitat? Why or why not?

This brings us back to the question of intrinsic value. Is it the individual owls, the survival of a unique species, the ecosystem of which it is currently a part, or some combination of these that is purported to have intrinsic value? To make progress towards answering, or even understanding these questions, we need to survey some of the options listed above. Before we do that, however, an initial understanding of the concept of intrinsic value, and its relation to claims like "nature has rights" is essential.

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Chapter 6
Land

Paul B. Thompson

Abstract An introduction to agricultural land from a philosophical perspective, emphasizing the fact that different social groups have different economic and political interests and asking how such conflicts should be resolved.

Keywords Land • Utilitarianism • Libertarianism • Egalitarianism • The land ethics

Case: Gordon the Lawyer

"Remember Marie the environmentalist?"

Doug is looking at Emily, who is busy reading about property rights.

"Yes, of course."

"Remember she said that she was opposed to the Springdale city council's attempt to take water from the Chatham river?"

"Yes, why?"

"My brother is the city attorney in Springdale."

"Really?"

"Yup."

"So he's doing battle with Marie?"

"Yup."

"What's the story?"

"Well, Springdale borders the Chatham River and, like many rural communities, is desperately seeking economic growth. The Springdale Town Council is convinced that economic growth can be assured only if water can be made available for light industry and residential use. Herein lies the rub, for Springdale's wells are

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already producing at their limit. So the Town Council has proposed to divert large flows of water from the river into the city."

Doug's brother's name is Gordon. In a recent phone conversation, Gordon explained to Doug the challenges he faces in defending the Council's plan. The town is opposed by two groups. The first group consists of farmers, who are riparian rights holders who have used Chatham water for more than a century. Farm water usage has expanded and contracted over the years, and at various times has included watering of stock and irrigation of crops as well as farm household uses. The State Water Board study of stream flow in Chatham River indicates that in years of reduced flow, the Town Council's plan would prevent farmers from maintaining their current levels of use, much less expanding them. The farmers are certain, however, that their property rights as riparians entitle them to expanded use. In short, they think the Town Council is surreptitiously planning to steal water belonging to them and them alone. The farm group is rumored to be considering legal action to protect their rights.

"I have some sympathy with these guys," Gordon said. Like Doug, he was raised on the family farm and knows how difficult it is to make a living there. "But it is my professional duty, nonetheless, to defend the Town Council, and defeat these farmers. Even in court, if it comes to that."

The second group, Gordon explained, is Marie's Friends of the Chatham, a loose knit coalition of outdoors enthusiasts. The Chatham River supplies sustenance to fish and wildlife up and down its length, including an endangered species of salamander unique to Chatham River habitats. The Town Council's plan will threaten the Chatham ecosystem on which this wildlife depends during years of reduced flow. Harm to the Chatham ecosystem is offensive to the Friends of the Chatham for two reasons. One is that recreational users of the Chatham ecosystem come from around the state and have a strong attachment to the fishing, camping and appreciation of nature that the ecosystem provides. The second is that members in Friends of the Chatham who do not use the Chatham River for recreation nevertheless believe that harm to the wildlife and, indeed, the ecosystem itself, is a moral affront. The Town Council, they hold, has offended nature simply by proposing a plan that displays little apparent regard for the interests of nature. Like the farmers, the environmentalists are utterly opposed to the plan Gordon must defend.

Case: Dicussion Questions

1. Imagine you are Emily. For the moment, forget any doubts you may have about whether environmentalists are right or wrong in their belief that it is possible to harm nature even if you do not harm any humans, present or future, in the process. Forget, too, your questions about the relative numbers of farmers versus city dwellers who will be helped or hurt by the Town Council's proposal. The immediate question you must answer is very specific: Do you think that there is some scientific process by which Gordon can figure out for himself which party,

the farmers, the townsfolk, or the environmentalists, is most justified in their claim to have rights to the water? Explain your answer.
2. In general, Americans tend to think that contested policy issues are not settled on rational grounds but are settled by politicians trying to satisfy the most politically powerful group. Let us assume that there are twenty times as many residents of Springdale as there are farmers, and three times as many residents of Springdale as there are environmentalists. How important are these facts to deciding what is the correct answer to Gordon's moral dilemma? How much do the numbers count?
3. Libertarians believe that others should not interfere with our basic liberty and property rights. Libertarians also believe that property owners should enjoy the authority to utilize their property according to their wishes, whatever their wishes may be, so long as they do not harm or interfere with others. If the farmers adopted a libertarian position in ethics to defend their claims to the water in Chatham River, how would their argument go?
4. Utilitarians believe the right action is always the one that will maximize the greatest benefits for the greatest number. Utilitarians also believe that it is permissible to sacrifice the interests of the few if so doing will promote the greatest good of the many. If Gordon were to adopt a utilitarian position in ethics to defend Springdale's appropriation of Chatham River water, how would his argument go?
5. To what extent, if any, should the Town Council shape public policy so as to take account of the interests of people who do not live in town?

Discussion of Issues

The dispute about the Chatham River in which Gordon is embroiled is like many disputes over water use. People use resources differently, and their uses are not always compatible. For citizens of Springdale, the Chatham is a resource for industrial and residential development. For farmers in the area, the River is an input for their production process; they purchased the rights to the water, they believe, at the time they bought their land. For hunters and outdoor recreationists, the water is a "leisure good" – critical for enjoyable activities, such as bird watching, hiking, water skiing, and hunting. For environmentalists, the river ecosystem is valuable in its own right, even if humans do not make use of it. On this view, humans should understand their use of water in terms of what nature demands. Each of these groups – the citizens, the farmers, the hunters, the environmentalists – believes that they value the river correctly, and they are loath to be told otherwise. How should Doug understand the different values these people place on the water?[1]

[1] The Chatham River case described here is drawn from (Wilson and Morren 1990). The case and its relation to interest group conflicts in water policy is discussed in (Thompson 1996).

Clearly each group has an economic or political interest in seeing the policy issue resolved in a way that permits the water to be used *their* way. If Gordon were a typical policy lawyer, he would not see this as a problem in ethics. Each interested party has their own preferred solution to the Springdale water issue, and there is nothing to be said about whether some preferences are better than others are. Of course, Gordon does have his own ethical standards. He believes that as a lawyer he should negotiate a solution that leads to the greatest possible satisfaction of interests. But this demands that he understand why each interest group would believe that they are in the right.

This leads Gordon to see that each group not only has an interest in seeing the dispute resolved in their favor, they also have a philosophical framework in mind. This framework, or ethical worldview, provides criteria for saying which interests have moral priority – which uses are compatible with what ethics demands. In real world politics it is often difficult to tell what comes first, political interest or moral principle. Doubtlessly some people use ethical arguments simply because they happen to support their economic or political interests. While that fact makes us skeptical about their intentions, the arguments themselves do not depend on the motive for making them. And, of course, other people come to support political interests as a *result* of moral deliberation.

Gordon tells Doug that if he were to review the main arguments that are used to make a moral evaluation of soil and water use, he would discover four main types. One stresses the instrumental use of soil and water in producing food and a second argument stresses property rights. A third group of egalitarian arguments interpret land use as part of a larger problem, namely, social inequality. The last group of arguments understands a person's relation to land as an irreducible component of moral character. But before moving into these different viewpoints, we should remind ourselves of just how important soil and water actually are.

Agriculture and Environment

As Gordon knows, soil and water are crucial to agriculture. Indeed, agriculture has a more extensive spatial impact on the environment than any other single human practice. According to the Food and Agriculture Organization (FAO) of the United Nations, slightly more than one third of the earth's land is used for agriculture. The remaining two thirds are forests, deserts, tundra, swamps, wetlands and savanna. Only a fraction of the earth's landmass is concentrated urban areas. In the United States, agricultural uses account for nearly half of the total landmass. American urban and recreational lands (including uninhabited deserts, swamps and high mountain ranges) account for a mere 20% of the total.

Obviously, the way in which farmers use soil and water is critical to the health of our planet. Lester Brown, who founded the Worldwatch Institute and coined the phrase "sustainable development," has long believed that food production is the key to sustainable land use. Agriculture also uses the largest share of fresh water.

Not surprisingly, a large percentage of the world's crops and pasturelands are located in areas of reliable rainfall. Rainfed farms and ranches get first crack at this water, taking their share before rainwater enters ground or surface systems. Brown (1997) writes, "There is a tendency in public discourse to talk about the water problem and the food problem as though they are independent. But with some 70 percent of all the water that is pumped from underground used for irrigation…the water problem and the food problem are in large measure the same."

The ethics of land and water use is first and foremost an ethic for agricultural production. What environmental parameters should be considered in farming and ranching? Should food production operate within a framework of totally renewable resources, or should some consumption of non-renewable energy, soil and water resources be regarded as an acceptable trade-off for the production of food for hungry mouths? What does it mean for farmers to be good stewards of nature, and how do economic or policy incentives affect their stewardship? Only when these questions have been answered does it become meaningful for the 98% of U.S. population *not* directly involved in farming or ranching to ask how their consumption choices can be made on a more ethical basis.

Soil and Water as Instruments of Production: The Utilitarian View

Farmers have long recognized duties of stewardship, duties to leave the land as they found it, at least as far as soil and water are concerned.[2] The moral foundation for these duties has been a mix of religious and secular obligations to Creation, to posterity and to nature herself, often personified as having intent and purpose. The moral justification for converting soil and water assets in meat, milk and grain commodities, however, has typically rested on the role that these goods have in satisfying human wants, and in the contributions to wealth and prosperity that their production brings.

Gordon has heard agricultural economists explain how these facts provide a basis for understanding the value of land. **Asset theory** holds that the price of land will reflect its relative capacity for bringing forth the goods that people want.[3] Soil and water figure prominently in the assets of any land put to farming purposes.

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[2] Farmers have definitely *not* left land as they found it as far as the diversity of plant and animal species is concerned. Drained wetlands and leveled contours have dramatically altered habitat. Agriculture is the dominant force on the landscape (and hence on plant and animal life) in most areas where human habitation occurs.

[3] There are two economic theories for explaining the value of land. According to *location theory*, the price of land will reflect the cost of getting goods back and forth, so that land near large centers of trade and population tends to be worth more than land that is distant or inaccessible. Both asset and location theory value soil and water as resources that can be converted into usable and exchangeable goods.

The richer the soil and the more reliable the water supply, the more valuable land will be. The greater productive potential of fertile and well-watered land makes farmers willing to pay a higher price for it. They will make up for the higher cost of land by producing more per acre. Land prices can be distorted by other factors, but when distortions are absent, the market price of land reflects its asset value.

Of course, a non-farm buyer may place a higher value on soil and water. In most areas, industrial and residential users are willing to pay much more for water than farmers. Why shouldn't the water just go to the buyers who are willing to bid the most for it? Wouldn't that be consistent with the goal of allocating soil and water assets to their most valued use? Indeed, anyone who is inclined decide soil and water use by comparing farming to other uses will soon conclude that farming should only be done in those places where no other use is profitable. That is a conclusion that supports the view of developers in places like Springdale.

The idea of a "most valued use" is a moral norm that is often used in making social decisions about soil and water. It is a decision rule that derives from **utilitarian** philosophy. The basic pattern of utilitarian thinking is simple. Consider the options available, and estimate the costs and benefits of each option. Then choose the option that has the best consequences, the best balance of cost and benefit. However, as utilitarians start to understand and compare cost and benefit, they inevitably find themselves making a series of additional assumptions. Some of these assumptions are summarized in the following premises, frequently adopted by those who tend to think of soil and water in terms of their asset value:

1. Soil and water are instruments for producing goods that are, in turn, instruments for the satisfaction of human wants and desires. They are *not* intrinsically valuable.
2. Value is attributed to a good by individual human beings. Something has value because at least one human being performs the subjective mental act of wanting or desiring it. To say that something has intrinsic value is simply to say that one cannot go any farther in saying why someone wants or desires it.
3. The goodness of health or the psychological and emotional welfare of individual human beings requires no further justification. Benefit or harm to health and welfare, thus, represent intrinsic values.
4. Comparison of benefit and harm should consider *everyone* affected by the options under review. This principle has led Peter Singer to the view that benefit and harm to non-human animals should be included in the assessment.
5. Benefits and harms are quantitatively additive. One can simply "add up" the benefits and "subtract" the harms expected for each affected party. The total satisfaction (or utility) increases or decreases when the health and welfare of a given individual changes, or when another individual is included in (or eliminated from) the affected group.
6. Monetary or material wealth is valuable because it is instrumental to intrinsic values. However, monetary wealth is so readily convertible into conveyances of health and welfare that abundance or lack of wealth is both an essential feature

and a reasonable estimate of both individual and social welfare. Many utilitarians go further: everything has a price.

7. Production of food and fiber commodities is justified up to the point that it contributes to individuals' ability to satisfy intrinsic wants and needs, and to the extent that exchange of these commodities contributes to individual and social wealth. Simply put, if it's profitable, it's morally right.

These propositions imply that soil and water are valuable precisely because they are inputs into the production of food and fiber commodities. On this view, the asset value of soil and water becomes equivalent to moral value. On this view, we should invest the asset value of soil and water so that all of human society, including posterity, receives the greatest total return of value, or as Bentham and Mill wrote 'the greatest good for the greatest number.'

Utilitarianism thinking reflects the way that many farmers, businessmen, government leaders and scholars of agriculture come to understand production. As already noted, it often supports the idea of simply allowing the market to decide issues of resource use. In the Chatham River case, for example, it appears that the most valued use is development rather than farming. But one must be sure that one has included all the costs and benefits to all the affected parties in one's comparison. This will require one to consider benefit and harm to future generations. Future generations are affected parties, too. Yet if one is not careful, the utilitarian analysis of future generations ends in a quixotic recommendation.

For example, suppose the soil fertility and water availability on a given plot of land will return $100 in crop production every year forever, so long as it is farmed carefully. What would be an equivalent asset measured in dollars? The asset value of the land is the amount of money that would return the same amount in perpetuity. In order to keep the math simple, assume a constant interest rate of 10%, making the asset value $1,000. Now (still keeping the math simple) suppose that the farmer can farm so that the annual return will be $110, but that the productivity of the soil and water will remain constant for 100 years, then drop to zero.[4] At the end of 100 years, an extra $1,000 has been earned. The farmer's heirs can get $100 a year from the interest on that, and they will get the money without having to trouble themselves with farming. Under either scenario, ecologically sustainable or not, the farmer's heirs receive an "economically sustainable" $100 per year forever. Through the miracle of compound interest, if the farm family puts the extra ten dollars a year in an investment that yields 10%, then the break-even point comes at

[4] Although these assumptions are implausible, they are not as far-fetched as they may seem. Unsustainable agricultural practices can return high levels of productivity for many years before any noticeable drop in productivity occurs, but when the point of depletion nears, productivity drop off can be sudden and irreversible. It is also implausible, of course, to suppose that over a hundred years there will be no inflation, interest rates will remain stable, or that farming practices themselves will not change. Nevertheless it is unlikely that any of these factors would vary in a fashion that would make the underlying logic of the example lose force, or that would make an investor following the logic of the example lose money.

only about 25 (rather than 100) years. If the productivity of soil and water hold out longer than that, it is economically foolish *not* to deplete them.

This reasoning provides a philosophical basis for the claim that farmers can be said to meet their obligations to posterity *even if* they farm in a way that is not ecologically sustainable. Utilitarian thinking appears to show that a soil and water exhausting agriculture is morally acceptable.[5] Furthermore, if farmers consider only themselves and their heirs, it can seem like a pretty compelling argument. There are good reasons, however, to resist this advice. If all farmers farmed this way (and some utilitarians believe they should), posterity would be left with plenty of money in the bank and no capacity to produce food within a rather short period of time. We reach this conclusion by considering the farmer's practice in isolation. When we ask, "What if everyone did that?" we are asking for a more sophisticated way of understanding the total societal impact of individual production choices.

In fact, a utilitarian analysis of soil and water can provide a very illuminating analysis of ecological problems. Take, for example, the American Dust Bowl. Farmers in the 1930s tilled so many acres of fragile soils so extensively that drought caused not merely the loss of a crop, but wind erosion (and on a phenomenal scale). Dust was piled everywhere, devastating the productive capacity of all land, whether fertility or surface water had been conserved or not. The Dust Bowl is an example of the tragedy of the commons first described by Hardin (1968). When many producers use a common resource they follow a logic of "use it or lose it," resulting in a collapse of the resources productive capacity. Why did Dust Bowl farmers have to "use it or lose it"?

The answer is complicated, but we can gain insight into individual farmer decision making by looking at the Prisoner's Dilemma model from game theory. In the Prisoner's Dilemma, two prisoners are being interrogated separately for a crime they committed together. If both confess, they will both be prosecuted for a felony. If neither confesses, the police can't make their case, and both will be punished for a minor offense. The police offer each prisoner an attractive deal to confess and testify against the other in court. So each has an incentive to confess, but if both confess, the testimony will not be needed and the deal falls through.

Again with some assumptions to simplify the math we can represent the choices and payoffs for both prisoners in a two by two matrix. Each prisoner has two choices: confess and don't confess. In Fig. 6.1 we represent the payoff or expected value for each choice as years spent in jail. We use negative numbers to remind us that spending a year in jail is a bad outcome from the perspective of a prisoner. Payoffs for Prisoner Row are listed in lower left hand corner of each box, while payoffs for Prisoner Column are in the upper right. In the middle is the utilitarian or net social payoff, which is just the sum of payoffs for all affected parties.

[5] Simon (1980) is well known for such a view and economists including Avery (1985) have followed its logic in the belief that technological inputs will replace the asset value of soil and water for the future.

Fig. 6.1 The Prisoner's Dilemma

	Confess	Don't Confess
Confess	−4 (−8) −4	−6 (−6) 0
Don't Confess	0 (−6) −6	−2 (−4) −2

If the prisoners cooperate with one another (if they refuse to confess), they will both get off lightly, but since they are being held separately, such cooperation may be difficult to negotiate. In the meantime, if one prisoner thinks the other will not confess, he is tempted by the possibility of skipping all the prison time by testifying against the other. That is what a self-interested utility maximizer will do in that case. But if the other prisoner is thinking the same way, we expect her to confess for similar reasons. So what should one do if one expects one's counterpart to confess? One should still confess in order to gain a bit of leniency and save 2 years prison time (non-cooperative prisoners are treated more harshly). It seems the only circumstance in which one would not confess is when one could be confident that the other would not, and when both are willing to endure the 2-year sentence.

If we substitute losses in fertility or water availability for years in prison, the economic logic of the Prisoner's Dilemma is the economic logic of the Dust Bowl or the tragedy of the commons. Farmers would be better off to cooperate and take either modest gains or minor losses, but the one that does not cooperate can reap rewards at the expense of others. This happens because the dust blows on everyone's land, conserver and exploiter alike. Since one farmer expects the other to be rationally self interested, the result is the worst case scenario, where dust rolls across the plains, fisheries collapse, and the fertility of rangelands plunges into a death spiral.

Some look at this logic and draw the obvious conclusion that farmers (or prisoners) should simply cooperate in order get the payoffs represented in the lower right box. Indeed, that is what the utilitarian maxim recommends. But the Prisoner's Dilemma is important because it shows how individuals rationally pursuing their own ends can produce outcomes that are not only socially suboptimal, but that are obviously contrary to every individual's abiding interest. People will cooperate voluntarily in these situations only if they are confident in their fellows, a situation unlikely to occur when many users who are strangers to one another rely on a common resource. The alternative to voluntary cooperation is regulation: enforced cooperation that is truly, "for one's own good." The Prisoner's Dilemma thus shows why "free market" solutions fail, and why society might find it necessary to regulate practices that affect soil and water. Sometimes coercion is the only way to achieve "the greatest good for the greatest number."

Soil and Water as Private Property: The Libertarian View

Regulation is not the only solution to the tragedy of the commons. Garrett Hardin proposed to solve the problem by placing soil and water resources into private hands. Divide up the commons and give each person a share to manage on their own, without threat from use by everyone else. Private ownership would, he thought, supply the incentives needed to conserve by insuring that someone who is less exploitative of soil and water is able to capture the productivity benefits derived from having been so. Hardin's argument provides utilitarian reasons for placing soil and water under a regime of private property. It is an argument that is valid only when private property rights actually would produce the changes in conduct that take us from the upper left hand corner of the Prisoner's Dilemma down to the socially optimal (and individually preferable) lower right.[6]

Hardin's utilitarian argument for private property coincides with a much older and quite different way of understanding the moral significance of soil and water as components of private property. Traditionally, ownership of property has been thought to be a natural right. Natural law philosophy posited a moral order as an existing reality, owing variously to God's grace to mankind, to principles of order evident to any rational being, or to the implicit terms of a social contract thought to undergird the foundations of civil society. Although the philosophical rationale for natural law has varied, the centrality of property is remarkably stable. In virtually any system of natural law, property rights govern the exchange and control of alienable goods. Property rights are alienable (as distinct from the inalienable rights Jefferson celebrated in the Declaration of Independence) because rights to use or exchange property can be alienated from one person and transferred to another. The notion that there must be some stability and permanence in such transfers seems essential to the well-ordered society. If trades or exchanges could be abrogated arbitrarily (or even on unanticipated utilitarian grounds) there would be little but turmoil, dispute and conflict in social life. To this extent, then, there is more than a little common sense to the recognition of private property rights.

Rights come in at least two kinds, however. Property rights are usually thought of as **non-interference rights**. They protect the rightsholder's discretion or control over any and all uses (or non-uses) of the property in question. Property owners may do anything with the property they own, but only so long as they do not violate the non-interference rights of others by harming their person, compromising their liberty, or infringing on the free exercise in the use of such property as *they* might own. No one (including government) may interfere in the exercise of property rights unless the property owner has already forfeited the right to this protection by interfering with someone else.

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[6] Hardin's argument applies to overgrazing of a commons because private property rights give ranchers a way to keep others' livestock off their land. But it does not apply to the Dust Bowl, where no system of property rights would have made good stewards invulnerable to the windborne dust created by their extravagant neighbors.

However, aside from a duty to desist from acts that harm or interfere, property rights do not form the basis for claiming that others should act on one's behalf. Non-interference rights protect goods that people already have – life, liberty and property. They do not provide a basis for claiming that goods such as welfare payments or other benefits should be given to them. For example, people who claim a "right to education" are claiming that the government should provide schools. If so, someone must do the providing, someone must act on their behalf. A "right to education" or "right to healthcare" exemplifies the second kind of rights, discussed at some length below. A property right is *not* a "right to property" in a sense that parallels the right to education. In emphasizing the non-interference dimensions of property rights, we note that government must protect property owners from interference by others, but we do not say that people should simply be given property when they ask for it.

As a non-interference right, it is useful to think of property owners having a bundle of related rights to use their land, and a bundle of restrictions based on the way that use of land might harm others. A property owner can decide who has access to the land, and who is to be excluded. Property owners have the right to decide how land is used. Property owners have the right to claim income or benefits that accrue from the use of land. Property owners also have the right to sell, trade or give away any of these other rights for a limited time or in perpetuity. Interference in any of these rights constitutes a violation of the owner's property rights. However, owners have no right to use their property in ways that harm others. This feature of libertarian thinking could lead to policies that restrict farming practices that use chemicals or pose risk to others. For example, Hospers (1971), one of the leading proponents of libertarian philosophy, wrote that activities which expose other people to pollution count as interference and should not be allowed.

People who believe that social order would be perfect if no rights other than those of non-interference are recognized are called *libertarians*. Libertarians believe that private property rights are absolute so long as they are not abused through interference in the life, liberty or property of another. Most libertarians also believe that any property not used in performing essential state functions should be privately owned. On the libertarian view, soil and water should be used just as their owners' desire. A property owner who practices stewardship, or uses soil and water to produce beneficial food and fiber commodities might deserve our praise or gratitude, but there is no waste or profligacy in the use of soil or water that could justify interference in the owner's property right. There is ample evidence that many of the land-owning farmers and ranchers in millennial America have strong libertarian tendencies.

Rural property owners may be operating with a subtly different conception of property rights, however. For them, ownership of land secures both the opportunity right to food and their right to employment. As we will see below, such rights are not typically thought of in terms of non-interference. Food and income are often thought of as goods that everyone deserves, and that someone – usually the society as a whole – is obligated to provide. Historically, however, a landowner's right to food and income is protected when others are prevented from interfering in the landowner's use of the land. So again, the argument seems to shift back to an argument

for non-interference. Property rights are thus generally analyzed in libertarian terms. However, the link to sustenance provides a reason for landowners to think that property rights are of added moral importance, and to be especially wary of proposals that would limit the uses that they make of their property.

This discussion leaves many important philosophical issues untouched. Where do property rights come from? How are initial claims on rights to land justified? Are there cases that call for redistribution of property rights? For present purposes, however, what is crucial is simply that landowners feel morally justified in claiming a non-interference right to use the soil and water resources under their control. They feel particularly justified in uses that secure their livelihood. As one might think of soil and water in exclusively utilitarian or asset value terms, one might also think that the libertarian analysis says everything that is ethically significant about soil and water. A libertarian argument asserts that private property rights in land give owners the right to use soil and water in suboptimal (but not harmful) ways. Since the landowner's rights are all that matter, the libertarian view excludes consideration of the wider benefits society can derive from land use decisions.

Clearly, however, these different moral perspectives can come into tension with one another. The Prisoner's Dilemma analysis of the Dust Bowl shows how individual property owners making self-interested decisions about the use of soil and water resources can cause ecological and social disasters. Nor are these situations confined to bygone days and faraway places. Ranching of the Western rangelands in the United States results in an average annual soil loss equivalent to the thickness of a dime. Ranchers believe, with some plausibility, that they have a right to make a living from those rangelands, and a dime's loss of soil hardly seems enough to challenge that right. But topsoils in many parts of the West are only a roll of dimes thick (in some places, less). That means that the soil essential to the plants and animals of the range ecology will be exhausted in only 50 years! It is, thus, questionable whether the centuries-old tradition of rights can continue to guide our moral thinking on soil and water in the future.

Soil and Water in Producing Food: The Egalitarian View

Property can also be understood as an **opportunity right** – a right that *would* require giving property to the landless. No one has to act on behalf of the rightsholder in order to respect non-interference rights, but when opportunity rights are claimed someone (usually the government) must act to ensure that the entitlement or opportunity protected by the right is actually available. As already noted, when people claim rights to education or to healthcare, they are claiming opportunities that must be provided for them. Providing such opportunities usually requires that those who have must provide for those who have not. Opportunity rights thus equalize or level the distribution of resources in a society. Those who believe that we should recognize opportunity rights as well as non-interference rights are sometimes called **egalitarians**.

Importantly, the right to food, recognized in the International Declaration of Human Rights, is an opportunity right. When we say that the poor and the hungry have a "right to food", we mean that they should have a meaningful opportunity to acquire food. It may come through private charity or public programs supported by taxes. In modern welfare states, it is generally presumed that the right to subsistence will be maintained by entitlement programs, such as food stamps. For John Locke, however, who crafted history's most influential discussion of property, the opportunity right to subsistence was guaranteed by a right to claim land as property, to farm it, and thereby to live.

Today, common sense tells us that the claims of the poor and hungry would be poorly satisfied if we approached the right to food in this traditional way. In industrial societies, the opportunity right to sustenance is mostly secured through gainful employment. People in urban settings derive income from industrial or service jobs, or from operating their own businesses. Here property rights are linked to sustenance in that a person's right to expend income in any legal manner is presumed to secure that person's opportunity right to sustenance: one buys one's food from the grocery store. In this setting, the crucial opportunity right is the right to employment. Thus, in the U.S. it is easy to separate one's right to food from the ownership of land. Opportunity rights tend to drop out of the argument, and the libertarian view of property rights (which sees them strictly in terms of non-interference) comes into prominence.

Yet it is possible to argue that a landowner's property rights can be overridden by society's need for food and fiber. Every living human being needs food. Without food, we die. When food is scarce, humans become susceptible to disease, and suffer from a variety of reduced capacities. Agricultural land use does not produce just any commodity – video games or cuddle toys – that people are free to buy or not. Everyone must have food, and for the present, at least, meeting world food needs depends on agriculture.[7] By extension, then, producing food for human sustenance depends on soil and water.

One of the most obvious problems with utilitarian and libertarian analyzes of soil and water is that it seems possible to rationalize the current mal-distribution of food. Is it possible that the death and disease associated with this grotesque situation can be "outweighed" by benefits to others, or by private property rights? To be sure, utilitarians such as Singer (1993) have argued against such a proposition. Singer claims that the needs of the poor outweigh the wants of the rich. Similarly, libertarians have argued that individuals have a voluntary moral duty of charity (though *requiring* them to aid the poor is an injustice).

[7] Fishing provides a large portion of the world's food supply, but ocean fisheries are declining and most projections indicate that humanity will become more, rather than less, dependent on agriculture. High technology replacement systems for conventional agriculture produce food in hydroponic systems where nutrients are delivered along with carefully rationed water, and some speculate that biotechnology can also be developed to virtually replace conventional agriculture. But it seems unlikely that such capital-intensive ways of producing food are likely to improve conditions for the needy anytime soon.

However, these arguments arrive at assisting the poor through the philosophical back door. These two philosophical traditions do not provide any way of stating outright that every human being should be entitled to a fair share of the resources needed to sustain life.

Gordon has heard the moral proposition stated like this: Everyone has a right to food. As already mentioned, the United Nations Declaration of Human Rights includes a right to food. The rights listed in the Declaration are intended to specify what global society owes to individual human beings. It establishes a basis for individuals to claim food needed for survival, to have that claim recognized on the basis of common morality, as well as by international organizations. Because food is one of the most basic human needs, a right to food would override rights to higher level goods such as medical care or private property. Only when all humanity's food needs have been met would it be permissible to shift resources to the production of luxury goods. It would be impossible to imagine a situation where the poor's claim on food could be "outweighed" by the wants of the rich. One point of stipulating a right to food is to state that individual needs have priority over any norm or goal derived by weighing costs and benefits.

The right to food is importantly different from a property right in several respects. As already noted, it is *basic* and *universal*. People with no food have little interest in higher level rights to spend their money as they wish, and *everyone* needs this right. Most importantly, the right to food is an opportunity right, not a non-interference right. As already noted, opportunity rights are the basis for claiming that a just society owes its citizens more than simple protection from others. An egalitarian believes that society owes each person the basic needs that are necessary for having a decent life.

The egalitarian view is often developed as a reaction to libertarianism. Many people are attracted to libertarianism because it seems to give each individual the maximal amount of freedom and autonomy over their actions. Libertarian non-interference rights restrict a person from doing things that harm others, and they preclude *requiring* one to do anything on others' behalf, as well. But this result is compatible with a very uneven distribution of wealth and opportunity. Indeed, some may have so little wealth that they cannot feed themselves, while libertarian philosophy protects the property of the rich.

Clearly, if individuals may make a valid claim on the food that they need to survive, someone in society (or society as a whole) will have the responsibility to deliver that food to the needy. Respecting a right to food requires that someone give *their* food to the poor, or, more likely, that all of us give money to support a program of buying food for the poor. The right to food demands more than non-interference; it demands that society provide everyone with the opportunity to nourish themselves. The inclusion of opportunity rights, which demand positive action on the part of others, is what separates an egalitarian view from a libertarian one.

The right to food is also a *narrow* right, while the right to property is *broad*. Property rights are claimed for specific material goods (such as a bowl of beans), for land holdings (the case discussed above), and for ideas and discoveries (such as a gene with a specific agronomic function). The advocates for private property

often write as if *any* restriction on these broad claims threatens all the others. It is the institution of private property that they are defending as much as a property owner's claim in any particular case. Clearly, recognizing one hungry person's right to a bowl of beans may be instrumental to alleviating hunger, but it need not be understood as a general challenge to the institution of property rights.

However persuasive the case for a right to food, it may seem that we have strayed far from a discussion of soil and water. In most industrial countries, the right to food will be protected through public assistance programs (such as the U.S. food stamp program) that give people the money they need to purchase food.[8] Yet in times past (and still today in other parts of the world) the right to food was understood as a right to the resources needed to produce food. Traditional farming societies did not secure the right to food through markets. The right was secured either by an opportunity to produce one's own food (to farm), or through an entitlement to a share of local crops. Agrarian reform movements were launched by Gerrard Winstanley in sixteenth century England, by Bolsheviks in 1910s Russia, and by Central American revolutionaries in recent times. In each case, they called for a redistribution of land to secure every citizen's opportunity to provide for their own sustenance through farming or grazing. The link between a right to food and a claim on soil and water is somewhat muted in industrialized and bureaucratized societies. Yet the connection between land and subsistence rights was clearly seen in history, and continues to be important for people living in less developed countries today.

Linking soil and water to the right to food requires a shift in how we view the ethics of soil and water use. Whether we satisfy the right to food through a payment of money or through a redistribution of land, a certain portion of the earth's soil and water resources must be dedicated to the task of feeding every individual human being. For an egalitarian, the benefit-harm trade-off reasoning of the utilitarian is only justified when every individual's right to food is secure. The egalitarian rejects a libertarian view of property because the opportunity to eat must override rights that are less essential to the basic problem of survival. In either case, a right to food is viewed as more fundamental than the main concepts (utility and non-interference) in which utilitarian and libertarian theories have been framed.

The ethics of soil and water are more obvious when we think not only of the world's current population, but also of people yet to come. Soil and water resources are in decline, while human population continues to grow. Intensive agriculture currently produces enough food to feed the world, but maintaining our current levels of production will require a preservation of soil and water resources. If future generations also have a right to food, then the only way to give them an opportunity to claim this right is to bequeath soil and water (renewable resources) that is at least of comparable quality and quantity to our own. If future generations have a right to

[8] In many European countries, truly indigent and hungry people may not be prosecuted for simply taking the food they need to survive, even though they may not have the means to pay for it. This policy suggests a more direct right to food than U.S. welfare programs.

food, then we have a powerful ethical argument to preserve soil fertility and water purity at current levels.

Gordon is not convinced that these egalitarian considerations bear directly on the Chatham River case. No one is arguing that the Chatham basin should be used to grow food for the poor. But he believes that it is important to see how the ideal of equal opportunity confronts both libertarian and utilitarian thinking. And one *might* frame the question of access to outdoor recreation in terms of an opportunity right. One might, for example, argue that the need to preserve soil and water provides a basis for taking the stewardship viewpoint as a way to respect the opportunity rights of future generations. An egalitarian might also join environmentalists in opposing both development and exploitative farming because he or she thinks that equal opportunity requires us to ensure that *everyone* has access to outdoor recreation – hunting, hiking or bird watching. In any case, the argument for opportunity rights conflicts with the utilitarian way of thinking because the rights of a single individual can override the principle of the greatest good. Egalitarian philosophy conflicts with libertarianism because it recognizes both non-interference and opportunity rights. Gordon concludes that even if it is not obvious how opportunity rights should be applied in the present case, it is best to keep them in mind in order to avoid neglecting important moral considerations.

Soil, Water and the Ecology of Virtue

Gordon sees that the utilitarian, libertarian and egalitarian philosophies provide three different ways to understand soil and water, but he has also heard people express views that don't resemble these arguments in any discernable way. Sometimes, for example, people say that we should be stewards of the land. They argue that land has **intrinsic value**, value totally apart from the value it gets in virtue of the uses that humans make of it. Others believe that acclimatization to soil and water needs provides the basis on which moral character or **virtue** is to be measured. In placing land before human use, such statements implicitly reject the view that what is morally important about soil and water can be described strictly in terms of human use (or right of use). What do such claims mean?

Recent environmental philosophers have tried to provide some sense to the view that nature has intrinsic value. Some views (such as James Lovelock's Gaia hypothesis) propose that the entire planet is like an organism. The entire planet can flourish, or it can experience degradation and death. Understood as an organism, land itself may be said to have interests. People who hold this view believe that forests, lakes and watersheds have interests in the sense that each can flourish or die. Such views are often called **ecocentric** (centered on ecology) as opposed to utilitarian or rights philosophies that are **anthropocentric** (centered on human values). Another view, often called **deep ecology**, states that we cannot understand or appreciate the significance or beauty of nature until we view it as having value utterly apart from any of the uses – productive or recreational – that humans might make of it. Human

community (including human values) is built on a foundation of biotic community. Deep ecologists believe that we have a better understanding of our moral community when consider those biological foundations first. Here, human values must be derived from ecology in some sense.

Sometimes deep ecology or the claim that nature or land has intrinsic value is just a way of saying that we should respect nature, and that we should desist from spoiling ecosystems, irrespective of any uses that we contemplate either for posterity or ourselves. One can come very close to the same view without adopting the premises of deep ecology or intrinsic value. Philosopher Peter Singer has argued that animals have intrinsic value because (like humans) animals have interests. Animals are *sentient*: they experience pleasure and suffer pain. In Singer's view any sentient being has an intrinsic interest in seeking satisfaction and avoiding pain. Singer's argument provides a way to expand the utilitarians' concern with the well-being of affected parties, but land and ecosystems are not sentient. Singer denies that ecosystems can consistently be said to have interests. So Singer (1993) concludes that human and animal interests provide a strong basis for protecting the environment, but that attributing intrinsic value to nature is a mistake.

Like Singer, Gordon sees problems with ecocentric philosophy. Most importantly he does not see how to apply it to agriculture. Ecocentric and deep ecology views privilege *natural* ecosystems. In these philosophies, natural ecosystems must be preserved because they are intrinsically valuable. But agro-ecosystems are, by definition, not natural. Agro-ecosystems exist where the cumulative effect of farming and ranching has had a profound effect on the species that proliferate in the region, on way in which water moves through the ecosystem, and on the transport of nutrients and micro-organisms that sustain life. The Chatham environmentalists may be interested in protecting nature *from* agriculture, but it is not easy to see what they would have to say about an ethic for farming practice.

Gordon has heard that Leopold's land ethic provides the best statement of the stewardship ethic: "A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise" (Leopold 1948). Leopold clearly believed that this ethic applies to farming, and he also believed that farmers would be more likely to have the moral character needed to live up to the land ethic. He wrote, "There are two spiritual dangers in not owning a farm. One is the danger of supposing that breakfast comes from the grocery, and the other that heat comes from a furnace." In other words, people derive the knowledge and moral character needed to become stewards by living in immediate and intimate dependence on ecosystems. In such circumstances ecosystem and human interests merge.

Leopold's argument harks back to some very old philosophical ideas. The belief that soil, water and climate shape human culture and moral character has been expressed since antiquity. Long before Greeks invented what we now call philosophy, people have believed that human beings adapt, over time and generations, to a particular place. Over time, people develop habits of observation, patterns of response, and social norms of collaboration that make them better able to cope with the special challenges of a particular landscape. In some landscape myths, the

human body is itself transformed through a form of sub-species evolution. In other myths, a people is said to be of the land or even owned by the land. In most of these myths, the peculiar adaptation of a people to the land is thought to give them a special moral claim on the inhabitation and cultivation of the land.

The moral content of these ancient beliefs is often expressed in terms of the virtues and vices that living in one way (rather than another) are thought to inculcate. Virtues include character traits such as being courageous, reflective, soft- or harshly- spoken, industrious or adventurous. Vices include character traits such as cowardice, hot-headedness, avarice or laziness. Virtues and vices are evident in repeated and resilient expressions of mentality, personality and conduct. The term **moral integrity** conveys the idea that individuals (and to a weaker extent, social groups) tend to engage in conduct that maintains the coherence of the community in which they live.

Moral integrity reflects and results from the reinforcement of virtue and the discouragement of vice. A good or positive character produces a pattern of conduct that is, on balance, personally and socially functional. A virtuous person is capable of coping with adversity, is seldom self-destructive or anti-social, and evinces intentions and feelings of goodwill and beneficence toward others. Strong moral character is associated less with extraordinary facility in coping with singular challenges than with balance. One habit of personality (one virtue) intervenes when another threatens to carry over into vice. A person with excellent moral character is so rich in these self-correcting tendencies that our very conception of what is admirable in a person tends to be defined by excellent role models, rather than by criteria for virtuous conduct in any general situation.

If this is what Leopold had in mind when he refers to "integrity, stability and beauty," or to "spiritual dangers," he is advocating a philosophy that is similar to the ethics of Aristotle. The ethical life consists in finding the mean, the balance point, where virtues check each other and do not devolve into vice. There are two points that must be made in linking Aristotle and Leopold. First, those who stress the importance of land as forming moral character see nature as a crucial balancing force in shaping moral integrity. Aristotle himself may have the thought that society, the *polis*, was more important. Second, nature can play a role in shaping virtue or vice in at least two radically distinct ways. One is in the sense that we commonly distinguish "nature and nurture." Nature is "blood," or genetic endowment, while nurture is the family and community environment. After the genetic endowment is fixed, nature is done with its work.

In an *agrarian* philosophy, however, it is nature as *natural environment* that is thought to be formative. As the environment in which virtues and vices are reinforced or corrupted, nature is more like nurture than nature-as-genetic-endowment. That is, nature continues its work throughout the education and lifetime of the person. It would appear that Leopold is advocating an agrarian conception of virtue. The moral virtues that a person forms from interacting with nature (i.e. through farming, fishing or otherwise making a living from nature) are thought to be more durable, more functional and more carefully balanced than could be produced by any environment structured by the incentives of commerce or even manufacturing.

Whether this is what Leopold had in mind or not, the idea that humans respond to nature's own structure of incentives and reinforcement is sufficient to illustrate why this might be thought of as a form of moral ecology. An ethic of virtue would differ from a morality that might arise from the complex incentives found in more socially constructed lifeworld precisely because the integration of the agrarian life demands attentiveness to nature. Yet it is also important to stress again that nature's influence on personality and social life must be reproduced again and again for every generation in this model of agrarian virtue. There need be no suggestion that any traits or dispositions of moral personality are carried "in the blood."

The disclaimer of genetic inheritance is crucial, for it is just this claim that has been at the heart of the most egregious abuses of virtue ethics. The basic pattern of logic described above opens the way to practices that treat certain individuals or groups as flawed, incapable of receiving or retaining nature's imprint of virtue and moral character. Combined with the view that a certain ethnic or racial group is "of the land" and that others are not, genetic determinism and agrarian rhetoric have been the basis for exclusion, racial slavery and genocide. Perhaps for this reason, if no other, virtue arguments have fallen out of favor in recent years, and people have sought to express what is morally important primarily in the language of utility or rights.

A Philosophical Depth-Chart

Gordon has now done his work. He can see how political or economic interest line up with ethical philosophies. He summarizes these relationships in Fig. 6.2. At the top we see the basis for the dispute: everyone is concerned about how soil and water

Land	Land	Land	Land
Economic Developers	Farmers	Advocates of the Poor	Environmentalists
Regulated Market	Property Rights	Redistribution	Stewardship and Preservation
Asset Value	Ownership and Control	Means of Subsistence	Intrinsic Value and Virtue
Greatest good principle	Non-interference	Fairness/ Equal Opportunity	Ecological Integrity
Utilitarianism	Libertarianism	Egalitarianism	The Land Ethic
John Stuart Mill	John Hospers	John Rawls	Aldo Leopold

Fig. 6.2 A depth chart for soil and water

(e.g. land) is to be used. At the next level down we see the interests groups that are likely to be in contention: economic developers, farmers, advocates of the poor, and environmentalists. One more level down we see the legal or policy option that each group would prefer. Developers want regulation to ensure that soil and water resources are used efficiently, especially when Prisoner's Dilemma situations lead to the possibility that individual incentives do not line up with the best use. As property owners, farmers want to maintain traditional property rights that give them control over the land. Advocates of the poor want to ensure that everyone has a secure right to food *before* farmers or developers start their work. Property may need to be redistributed to the poor (either through land reform or social entitlements) in order for that to happen. Finally, environmentalists want rules that direct people to steward the land, and to protect soil and water ecosystems from degradation as the result of human action.

Each group has arrived at its preferred policy because its members tend to associate specific values with the use of soil and water. These values define the interest that each group takes in land use, and are summarized on the fourth line of the depth chart. Developers (and some farmers) see soil and water in terms of asset value: Is land more valuable for agriculture, for industry or for residential development. Differences in location, landscape and fertility will produce differences in asset value. As property owners, farmers stress the way that soil and water fall under their control, irrespective of whether they want to use land in the most beneficial way or not. Any law or policy that challenges their property rights is seen as a threat to their freedom and their ability to make a living. Advocates of the poor might stay out of land use disputes in the U.S., where the right to food is more reliably guaranteed by employment or food stamps. But in countries where land serves as people's main access to food, they will argue that soil and water must be distributed so that the right to food is fulfilled. Finally, environmentalists believe that the ecosystems in which soil and water occur have intrinsic value, or that they shape the formation of a virtuous human character in a fundamental and irreducible way.

On what basis can these values and interests be ethically justified? If we skip to the bottom row of the depth chart, we find the names of four men who devoted themselves to articulating broad principles for understanding ethics. The next row up gives the philosophical viewpoints with which they are associated. Nineteenth century philosopher John Stuart Mill is recognized as a key figure in the development of utilitarian philosophy. In the twentieth century, libertarianism was advocated by John Hospers, and egalitarian arguments were associated with John Rawls. Also in the twentieth century, Aldo Leopold articulated a new land ethic by combining traditional ethical views on virtue and moral character with new insights on the vulnerability of nature to human abuse. Many other people could have been listed on the bottom row. Each of these philosophies has many advocates, and other examples could have easily been listed.

On the third row up, we see the general principle that each philosophy would endorse most strongly. Utilitarians argue that all decisions should produce the outcome that is most efficient, that leads to the greatest good for the greatest number.

Libertarians stress non-interference, and limit law, policy and government to the protection of non-interference rights. Egalitarians see skewed distribution of property and opportunity as unfair, and advocate the recognition of opportunity rights that redress this injustice. Environmentalists stress the need to preserve the "integrity, stability and beauty" of the biotic community.

Each of these four principles supports the value judgment in the row immediately above it. Asset values allow one to see soil and water as tools for bringing about the greatest good. Ownership and control of property is at the very core of libertarian non-interference rights. Egalitarians will tend to think that fairness requires the protection of a right to food before any other interests are allowed at the table. The principle of ecological integrity supports the idea that soil and water should be managed so the key agro-ecosystem processes are preserved, including the feedback loops that link them to the formation and development of human moral character.

Gordon's depth chart allows him to understand how one can look at land use issues at several levels. Near the top, they seem like political and economic conflicts of interest. Near the bottom, they seem to issue out of incompatible life philosophies. The conflict, in short, may be one of interests *or* philosophy. Gordon appreciates the deep way in which these philosophies contradict one another. In a court of law, he can see himself as an advocate, like Mill, Hospers, Rawls or Leopold. Outside the courtroom, he sees himself as mediating conflict, rather than advocating any given philosophy. He tries to find legal solutions that allow each of these principled philosophies to survive, and that help interested parties live with one another. Admittedly, this is not easy to do.

As Gordon shows his scheme to Doug, he cautions that there is a danger in "depth chart" thinking. Cynics may see it as confirmation that moral disputes are irresolvable. True-believers will call it "relativist" because it suggests that we should take diverse viewpoints and styles of thinking seriously. But neither of these reactions is warranted, says Gordon. Moral inquiry *proceeds* by placing incompatible viewpoints in dialog with one another. Democracy *requires* a delicate balance of advocacy and mediation. For either to succeed there must be a vigorous debate, along with a search for policies that allow us to agree to disagree. Charting the depths of law and policy disputes yields an understanding of ethical differences. Gordon believes that charts start the process of ethical reflection and debate, rather than ending it.

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Chapter 7
Farms

Charles Taliaferro and Stephen Carpenter

Abstract An introduction to the ethical issues surrounding the value of farms.

Keywords Farms • Family farms • Morality • Impartiality • Particularity

Case: Roy, the Dairy Farmer

The semester has drawn to a close, and Emily is reminiscing with Doug about the class.

"Remember how this all started? How I almost got into trouble cheating on Wright's stupid quiz the first day?" she laughs.

Doug grins at her. Then his face turns sober. He picks up his cup of coffee.

"I need to tell you something."

"What?"

"My mom and dad are thinking about selling the farm."

"Why?"

"Well, you've seen the place. It's an open-lot dairy with just over 200 cows. The farm is about 500 acres total with most of the acreage, 400 acres more or less, in hay and grain. We use the forage to feed the cows. The cows are fenced in a ten-acre area. My folk's house, the barn and various buildings and holding pens for calves, take up roughly another eight acres and there is a two-acre lagoon in which run-off wastewater from the animals is stored. It's a small place. My folks think they can't continue to make it here unless we dramatically change what we're doing."

Doug speaks almost reverently about the place. Then he looks at his watch and bends over to grab his backpack.

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"Sheesh, I got class," he says. "Why don't you come back to the farm this weekend?" he yells over his shoulder.

The next Saturday, Emily helps Doug with milking in the morning, and they spend the afternoon talking with Doug's father, Roy.

Roy explains the problem to Emily. "You know that Doug has an older sister, Karen. Both she and Doug would like to become partners in the farm. To bring in two more families successfully, however, would mean that the farm would have to triple its profits. I think we can do this only by tripling the size of the operation. The dairy farm, that is, must either become exclusively a business proposition, competing on the basis of high-volume production of a low-cost product. Or . . ."

Roy does not finish his sentence. But Emily urges him on.

"Or?" asks Emily.

"Or, we must sell." Roy continues, "The problem with expanding is that milking 600 or more cows would place our farm in a new class. State environmental regulations dictate that a dairy of that size have many more acres over which to spread manure and wastewater. Consequently, we would have to take on sizable debt loads in order to buy not only cows, but land as well."

"Are there no other options?" asks Emily.

"Well, actually, there is one. It's the one Karen and her husband prefer, actually. There are two small abandoned farm homes nearby, one just across the road and the other about a half-mile away. We could buy those houses, one for Doug and one for Karen, and then split the current herd into three small herds of 65 cows each. I'd keep one herd, Doug would have one, and so would Karen. Each of us would place our cows in a rotational grazing system on land I now have in grain production. Rotational grazing of cows is a more labor-intensive form of farming that does not rely on heavy machinery and purchased inputs to move feed and manure; it relies on the cows to find their own feed in the pasture and to deposit their own manure there. The problem is that the profit margins to be expected from the alternative system would not be as high as the expected profits from the traditional purchased inputs system."

"Am I missing something?" Emily asks. "Why would anyone want to adopt a style of farming that would not only be less profitable but also seems likely to involve a lot more work?"

Roy turns to Doug. "Do you want to explain?"

Doug tells Emily that Karen and her husband are financial managers at a major corporation in an urban area about a 100 miles away. They are tired of commuting to work, tired of seeing little of each other, and tired of not having time to spend with their three young children. They have also been reading books about farm life, some of them written by Wendell Berry, a poet and farmer from Kentucky who praises the virtues of rural life and family farms. They are well-educated and well-informed and, after years of discussion and study, they have decided they would like to invest their considerable savings into an alternative system because they see it as a superior lifestyle option from several points of view.

"They often say it's a 'morally superior' way of life," winks Roy. "I thought you'd enjoy that remark, Emily, because you're taking that Ag Ethics course, too."

"Yes. But what do they mean by it?"

"Karen tells us that she and her husband think family farms are morally superior in four ways: they allow parents to spend more time with their children because everyone is working together on the farm; they promote closer relationships with neighbors, who often are unknown to city dwellers; they allow people to spend more time out of doors and being around animals; and they promote sustainable use of land, something that is good both for the environment and for future generations of humans."

"Yeah," chimes in Doug, "Karen's husband says three little farms supporting three families are three times better than one big farm supporting one family."

"Well," concludes Emily, "after thinking about agricultural ethics all term, I certainly resonate to that sentiment. But I also see the difficulties you face."

Roy is looking out the window. Doug is looking at his shoes.

Emily doesn't know what to say. At last she whispers, "I'm just glad I don't have to make the decision."

Case: Discussion Questions

1. Imagine you are Emily. For the moment, forget any doubts you may have about whether you would want to live the way Karen and her husband want to live. Forget, too, your questions about which style of farming is most likely to make the three families the most money. It appears that either style of farming will make some money, even though the three smaller operations will probably make less than the one larger operation. The immediate question you must answer is very specific: Do you think that there is merit in Karen's and her husband's idea that three smaller family farms are better in a *moral* sense than one larger family farm? Explain your answer.
2. In general, farms are getting larger and larger, not smaller and smaller. List five reasons that the family should opt for one large farm, and five reasons they should not make that choice. Then list five reasons that the family should opt for the three smaller farms, and five reasons that they should not make that choice.
3. Using your best critical reasoning skills, assess the reasons you have just listed. Identify those that you think Emily should throw out as bad reasons, and those you think she should pursue with Doug as good reasons.
4. Should we shape public policy so that it would be easier for farmers to make the choice Roy's daughter is recommending to her Dad and brother?
5. It is difficult, economically and socially, for farmers to make the choice Roy's daughter is recommending. Colleges of agriculture generally do not hold up the small farm as the farm to be emulated. Should we hire agriculture professors who would teach their students to aspire to have small farms?

Discussion of Issues

At first, Roy's decision may seem an entirely personal or private matter; it is a decision he is free to make in whichever direction he likes. If he decides to try to foster a small- or medium-sized family farm, well and good, but he should not be required to do so by us or by his family. In ancient Greek ethics, a decision that is not morally binding would be called *adiaphora* (from the Greek meaning "indifferent"). Today we may describe the adiaphora as the morally permissible. Even if it is granted that family farming has some moral superiority to other ways of living, such farming may still not be morally obligatory. Arguably, some actions are morally good – acts of charity or courage, for example – but are not morally required. An act of charity is charity in part because it is *above and beyond the call of duty*; those who courageously save the innocent when it is not their duty to do so (e.g., when the rescue operation imperils their lives) are rightly considered to be moral heroes precisely because they do something not required of them. So, initially one may well conclude that family farming between consenting adults is not morally forbidden and if farm families think they are living morally superior lives, let them. While ethical problems arise in family farming (environmental degradation and contamination, the health of farm animals, world hunger and food policy, *et cetera*), these are problems faced in agriculture at large and do not by themselves make it obvious that "family farming" is a distinct category of ethical concern.

But perhaps the decision is not such a private matter after all. The status of family farming may command the attention of the public and a case might be made that Roy *should* keep his farm small. What would this case look like?

The family farm has had a central place in North American social, economic, religious, philosophical, and political history. It has been a vital part of American heritage and, at present, it is endangered. Family farms have decreased radically, and we may witness the virtual collapse of this way of farming. The decline has not always been because of voluntary migration to cities, but due to bankruptcy. (Here we might return to the story and ponder whether the unoccupied farms that Roy's family might purchase are on the market because they have been abandoned due to bank foreclosure.) From 1954 to 1992 the number of farms in the United States declined by 60%. Now the farm population is less than 2%, whereas in 1840 it was 40% (Bureau of the Census, 1992, 1994). The attrition has also hit Afro-American farmers especially hard; 13% of the farm population was Afro-American in 1990 whereas it is now only 1% (Comstock 1987). Marty Strange is right in his observation that "Hardly anyone in the United States knows a real farmer" (Strange 1988). So, we do well to reflect on family farming insofar as this is essential to reflection on our own identity as a nation and culture, and also so that we may discover whether we have any responsibility to preserve this aspect of our identity. The obligation to assess the nature and value of our national identity applies to us as citizens in a democracy, but it may also press home to us in certain specific ways. For example, if you are a practicing life scientist, then you have some responsibility to reflect on what parts of society are benefited or disadvantaged by your research.

Is your biotechnology serving industrial, corporate agriculture over against a sustainable, alternative agriculture, family farm? If so, are you contributing to the loss of something of great value?

Another rationale for public debate emerges near the end of the conversation, when Roy reports on Karen's view, that small farms highlight a range of values that call for public exploration. Claims about several goods are in play, goods that involve family, neighborliness, health, and sustainability. These represent important civic goods and virtues. Wendell Berry, perhaps the leading advocate today of family farming, considers family farming an art that enshrines and fosters a deeply humane way of living that is threatened by industrial agriculture. Family farming offers an integrated way of life that either prohibits or at least discourages the commonplace, market-driven division between the producer of a product and the product. In the end, it is the integration of a farmer's livelihood and life that both demands that the farmer be a craftsperson or artist in his or her trade and also secures a commitment to the quality of the food produced by farms.

> I am more and more convinced that the only guarantee of quality in practice lies in the subsistence principle – that is, in the use of the product by the producer – a principle depreciated virtually out of existence by industrial agriculture... People who use their own products will be as concerned for quality as for quantity, whereas people who produce exclusively for the market will be mainly interested in quantity... Industrial agriculture has tended to look on the farmer as a 'worker'... We have neglected the truth that a *good* farmer is a craftsman of the highest order, a kind of artist. It is the good farmer – nothing else – that assures a sufficiency of food over the long term. (Berry 1991)

If Berry is right, then a rich, neighbor-centered agrarianism can highlight values that deserve the honor and allegiance of society at large. And if these values in quality and skill are publicly evident, then perhaps family farming merits the protection and assistance of society. Given some credibility to Berry's thesis, then, at a minimum, there may well be grounds for a social commitment not to deploy protection and assistance to large scale, industrial agriculture when this unfairly places family farming at a disadvantage. In the end, even if we conclude that such a public stand is not ethically required or politically wise and that a family's decision to foster and protect family farming is entirely private, it is still desirable for there to be public deliberation on the values involved, if only to enable persons to make intelligent, informed decisions about their own vocations. The decision to participate in the practice of family farming can be made more responsibly to the extent that rural *and* urban education makes available the facts about what Berry calls a craft "of the highest order."

Just as there are what may be called public reasons for society at large to engage in the family farm debate, there are reasons why family farmers – or those aspiring to become family farmers – should consider the public dimension of this practice. There is some reason to think that a decision to family farm is not an entirely private one from a conceptual point of view. The concept of "family" is a public, socially informed one. Of course, the term "family" is used to describe nonhuman, biological life, but the concept of "family" in human social contexts has a profoundly public, political meaning. (The concept of "family" has a role in other areas of bioethics in

accounts of medical health and responsibility.) Moreover, the very rationale Roy offers involves "neighborliness" and this further secures the public dimension of any decision to family farm. The very concept of *owning a farm* involves a nest of public relations. According to one popular theory of property, ownership is a social and political construction, secured by social contracts and backed by credible enforcement. So, even to frame the question to oneself about whether to engage in family farming involves public concepts and relations. Moreover, if one can successfully make the claim that family farming is indeed a vital part of American heritage or that it offers American culture moral insight, then family farming may constitute an important influence on farm policy, agricultural research and development.

Practices and Policies

The values that are cited by Roy in the story can be split up and examined in isolation, but in doing so, we risk missing the overall picture of what is at stake. Broken up, the case for family farming is tenuous. Take the components separately and they do not immediately seem very persuasive. For example, you do not need a farm to have a rewarding family life. There are many ways in which families can enhance their time together. Arguably, large-scale, corporate agriculture may yield conditions in which family values are cherished. Neighborliness can be achieved in a variety of ways and it is not obvious why owner-operated farming is the optimal route to securing it. Exercising outdoors can be accomplished through any number of routes, and sustainable agriculture can be carried out on large, corporate farms. If soil erosion is what bothers us, won't it be more effective to establish and verify good soil stewardship with several corporations, rather than the more scattered, decentralized framework of many family farms?

But this break down of the rationale for family farming taken from the case study and their critique does not capture the allure of family farming or what its advocates argue is its overriding value. According to Wendell Berry and other advocates of family farming, it is a practice or a way of life. The goods of family, neighborliness, health, and sustainability are folded into a way of life. They are not simply patched together like a quilt, nor does the family farming way of life represent a kind of container in which these goods are placed in a haphazard, sentimentalized fashion. Rather, these goods are complementary, internally related, and mutually supportive. Ideally, the goods are constituents in a greater whole that, according to some of its defenders, involves virtue and human flourishing.

Like Berry, Marty Strange describes family farming as a way of life in which various values are at work, quite distinct from market-driven employment.

> Above all, family farming carries with it a commitment to certain values, entirely independent of the pettiness of economics. The agrarian tradition, of which family farming is a part, calls for people to be neighborly, to care for future generations, to work hard and to believe in the dignity of work, to be frugal, modest, honest, and responsible for and to the

> community. Family farming may be a business, but it is not just a business. It is a way of life as well. The farms in a family farming system operate in a social milieu which constrains the business behavior of farmers. Perhaps the best test of whether a farm is a family farm is this: Does the farmer feel more pain at the loss of a neighbor than joy at the opportunity to acquire that neighbor's land? (Strange 1988)

If Strange is right, then there is a moral and psychological component at the core of family farming.

We use the term "practice" as well as "way of life" to describe family farming. It may seem odd to think of it as a practice. Certainly it is not a particular practice, narrowly defined such as a way of harvesting, but the term "practice" has often been employed by philosophers to refer to comprehensive and sometimes highly complex, principled ways of living. The chief end is to delimit such ways of living from highly abstract, purely theoretical projects. We are also using the term "practice" to deliberately juxtapose the way of life in family farming from policy-making. Family farming, as a practice, is influenced by government policy. At the most general level, government policy enables family farming to continue to exist (whether through aid to all forms of agriculture, special treatment, establishing trade policies), but family farming is not itself constituted by nor founded by policy making. As a practice or way of life, it is influenced by various forces (religious and economic institutions, and so on), but it is not a creature of law in the same way that a corporation is. Corporations are legal entities, created by contracts and the institutions that define and enforce them. The notion of a family farm is not the notion of a body of carefully crafted, explicit rules of responsibility and power, but a way of life in which the rules are embedded in the way some people live.

The portrait of family farming as a virtue-laden, fulfilling way of life or practice fits well with Aristotle's treatment of excellence and happiness. According to Aristotle (384–322 BCE), human flourishing or happiness consists in the virtuous exercise of human powers. Virtue is discovered through the exercise of practical wisdom or *phronesis*. Practical wisdom enables one to find the right balance of desire and appetites, pleasure and pain. In Aristotle's ethics, happiness or flourishing (he used the Greek term *eudaimonia*) involves more than pleasure or the satisfaction of desire. On his view, you may have all your preferences satisfied and yet, because your preferences are disordered or confused, you do not flourish and any happiness you claim is a sham. This understanding of happiness and flourishing is in close accord with what we shall see in the next section on family agrarianism with its emphasis on virtuous fulfillment through active collaboration with others.

The next section will explore the case for family farming and do so by taking seriously the interwoven nature of the various reasons marshaled by Roy, Doug, Karen and those like them. Increasingly, in various areas of philosophy, there is a growing appreciation of how a theory or world-view rarely stands or falls on the basis of a single line of reasoning. It is more common now to appreciate how a position may be bolstered by a series of arguments or reasons. But before proceeding on this tact, some further reflection needs to be devoted to the project of defining a family farm.

There are different definitions of family farming. Wendell Berry offers the following characterization of the family farm:

> What I shall mean by the term "family farm" is a farm small enough to be farmed by a family, and one that is farmed by a family – perhaps with a small amount of hired help. I shall not mean a farm that is owned by a family and worked by other people. The family farm is both the home and the workplace of the family that owns it... Furthermore, the term "family farm" implies longevity in the connection between family and farm. A family farm is not a farm that a family has bought on speculation and is only occupying and using until it can be profitably sold. (Berry 1987)

In *Family Farming: A New Economic Vision* Marty Strange offers this general definition of a family farm. A farming system which either is or tends to be:

Owner-operated
Entrepreneurial
Dispersed
Diversified
At equal advantage in open markets
Family centered
Technologically progressive
Striving for production produces in harmony with nature
Resource conserving

These features are not advanced by Strange as individually necessary conditions for family farming. Perhaps a farm may legitimately be considered a family farm if it only satisfies some, but not all of the conditions. Strange's goal is to delimit family farming from mainstream, industrial agribusiness. The latter is delimited by some of the following characteristics that Strange identifies:

Industrially organized
Financed from growth
Management centered
Capital intensive
At an advantage in controlled markets
Standardized in their production processes
Resource consumptive
Farmed as a business

This way of defining terms works with what the twentieth century philosopher Ludwig Wittgenstein called "family resemblances." Wittgenstein despaired of finding strict analytic definitions of terms and noted famously that even the term "game" does not admit of an exact definition free of vagueness and borderline cases. But just as we might be able to note certain resemblances among family members, we may also be able to recognize the resemblance and right grouping together of different cases of games. We may be in a similar fix when it comes to the concept of "family farm."

We believe we should not be any more precise at this stage than in using Berry's description and Strange's lists as guides rather than rigorously delimited

tightly bound concepts. After all, there may well be cases of farms that seem to trade in both corporate and family camps, on the format proposed by Wendell Berry and Marty Strange. Corporations can own farms that are run by families in a traditional fashion. Multi-national corporations may own small and medium sized farms that foster an Aristotelian-Marty Strange list of virtues. The descriptions proposed by Berry and Strange should thus be used simply to identify a proto-type or ideal case. Later we shall press onward to consider the prospects of more precise definitions and what to do with cases that aim at such ideals but fail miserably. Right now, as Gary Comstock points out, "the experts are at odds not only about what size farm qualifies (to be a family farm), but about whether size ought to be the deciding criterion" (Comstock 1987; Headler 1991; Sontag and Bubolz 1996).

We suggest that we also begin with a fairly flexible interpretation of the term "family." The family farm in American history refers to one or more heterosexual couples with children (parents, grandparents). But of course the constitution of heterosexual families raises many ethical issues (the status of adopted, not jointly conceived, children, child development, health care, children's rights, the scope of parental authority, blended families, maternal surrogacy, and so on), and there is now a significant movement to legally recognize homosexual couples to ensure that they have the rights, privileges, and responsibilities of heterosexual couples. For now, however, let the term "family" stand so that it covers the traditional definition and allow that, if the case for legally recognizing single-sex domestic partnerships as families is successful, then the term "family farm" includes this broader spectrum. We personally believe that this broader spectrum is warranted, though we will not argue for this point here.

One of the most important factors in the Berry-Strange case for family farming that affects the debate over the traditional definition of the family is that family farming is usually advanced as being inter-generational. If nontraditional families can meet this condition, securing a stewardship of land over generations, then the case for expanding the description of family farming would be strengthened.

Family Agrarianism and Stewardship

Certain concepts seem to have built into them criteria of valuation. Thus, "being a parent" seems to involve or entail judgments about what makes a good or bad parent. Should the parent abuse his/her child, we may well say the person has ceased acting as their child's parent. Maternal or paternal love is not simply love of a child by the biological parent, but a certain kind of nurturing care aimed at fostering the well-being of the child. According to some advocates of family farming, being a family farmer is in this respect like being a parent. A family farmer is one who cares for the family, the community, and the land. Wendell Berry locates the concept of "family farming" in the midst of such a network of intelligent wise care for others.

> If family farming and good farming are as nearly synonymous as I suspect they are, that is because of a law that is well understood, still, by most farmers but that has been ignored in the colleges and offices and corporations of agriculture for thirty-five or forty years. The law reads something like this: land that is in human use must be lovingly used; it requires intimate knowledge, attention, and care. (Berry 1987)

Berry contrasts the notion of a farmer with that of a strip miner.

> I conceive the strip-miner to be a model exploiter, and as a model nurturer I take the old fashioned idea of ideal of a farmer. The standard of the exploiter is efficiency; the standard of the nurturer is care. The exploiter's goal is money, profit; the nurturer's goal is health – his land's health, his own, his community's, his country's... The exploiter wishes to earn as much as possible with as little work as possible; the nurturer... to work as well as possible. (Berry 1977)

The farmer is ideal when a nurturer and not true to him or herself when an exploiter of the land, family and community.

Some agricultural policies are driven by terms that fail to capture this nurturing dimension of being a farmer and neglect, too, the way in which farming needs to be understood in a broadly ecological context. Berry places his philosophy of farming into a broader philosophy of interdependence.

> Obvious distinctions can be made between body and soul, one body and other bodies, body and world, etc. but these things that appear to be distinct are nevertheless caught up in a network of mutual dependence and influence that is the substantiation of their unity. Body, soul (or mind or spirit), community, and world are all susceptible to each other's influence, and they are all conductors of each other's influence. (Berry 1977)

In light of this broad understanding of interdependence, Berry envisions the family farmer as making a vital contribution to healthy human culture.

> A healthy culture is a communal order of memory, insight, value, work, conviviality, reverence, aspiration. It reveals the human necessities and the human limits. It clarifies our inescapable bonds to the earth and to each other. It assures that the necessary restraints are observed, that the necessary work is done, and that it is done well. A healthy farm culture can be based only upon familiarity and can grow only among a people soundly established upon the land; it nourishes and safeguards a human intelligence of the earth that no amount of technology can satisfactorily replace. (Berry 1977)

This interconnected, social context is one that defines the farmer's identity.

Berry contends that, at best, the farm is radically different from an industrial plant for producing commodities. Its function (Aristotle would have referred to its *telos*, its end or purpose) is to foster care for others, future generations, and the authentic (not merely artificial or contrived) integration of work and play, family and community. Living in an overly mechanized, urban culture we too often lose sight of the origin of the objects around us. Aldo Leopold claimed that there were "spiritual dangers in not owning a farm. One is the danger of supposing that breakfast comes from the grocery…" (Leopold 1949). Leopold and Berry stress that this is no mere intellectual failing. An intellectual failure can often be corrected in formal education, but the point is that there is an affective failure – a failure to appreciate the nature of plants and their harvest, animals and their care – in our losing touch with family agrarian culture. To live responsibly from the land is to invert the values of industrial, mechanical culture.

> When one undertakes to live fully on and from the land the prevailing values are inverted: one's home becomes an occupation, a center of interest, not just a place to stay when there is no other place to go; work becomes a pleasure; the most menial task is dignified by its relation to a plan and a desire; one is less dependent on artificial pleasures, less eager to participate in the sterile nervous excitement of movement for its own sake; the elemental realities of seasons and weather affect one directly, and become a source of interest in themselves; the relation of one's life to the life of the world is no longer taken for granted or ignored, but becomes an immediate and complex concern. In other words, one begins to stay at home for the same reasons that most people now go away. (Berry 1969)

This collection of home, labor, and land, are all articulated with an eye on the greater ecological context of our lives.

This bid for a richer appreciation of natural origins and our environment calls for a richer self-understanding and development of integrated skills. Wes Jackson along with Berry, stresses how industrialized agriculture can tend not to hone the human intellect, but to further atrophy the drive to develop ingenious, native ways of solving environmental problems. Jackson advances "regenerative agriculture."

> If someone were to ask me to define regenerative agriculture, my answer would be that regenerative agriculture is a state of mind that will cause us to constantly shift our focus from solving our problems through industrialization to solving our problems through the land. (Jackson 1988)

Berry notes the fragmentation that occurs in our overly mechanistic approaches to agriculture and other enterprises.

> What happens under the rule of specialization is that, though society becomes more and more intricate, it has less and less structure... The community disintegrates because it loses the necessary understanding, forms, and enactments of the relations among materials and processes, principles and actions, ideals and realities, past and present, present and future, men and women, body and spirit, city and country, civilization and wilderness, growth and decay, life and death – just as the individual character loses the sense of responsible involvement in these relations. (Berry 1977)

In contrast to this fragmentation, it is argued that alternative agriculture fosters a greater coherence and integration of goods.

For Berry, Jackson, and others, family farming is an agrarian way of life that is informed by a comprehensive notion of the good. "The good" here includes both human and nonhuman well-being. Common to many advocates of family farming is the project of living with and in nature, not over and against natural processes. In *Small is Beautiful*, E.F. Schumacher commends a wide view of the tasks of agriculture.

A wider view sees agriculture as having to fulfill at least three tasks:

- To keep man in touch with living nature, of which he remains a highly vulnerable part
- To humanize and enable man's wider habitat
- To bring forth the foodstuffs and other materials which are needed for a becoming life

> I do not believe that a civilization which recognizes only the third of these tasks, and which pursues it with such ruthlessness and violence that the other two tasks are not merely neglected but systematically counteracted, has any chance of long-term survival. (Schumacher 1973)

Schumacher locates the good of farming in the greater context of the general good of civilization and nature.

The kind of farming that Schumacher, Berry, Wes Jackson, Jim Hightower, and others commend is one that emphasizes the ways in which the goals of profitability can be melded with natural processes. In working with nature, by employing integrated pest management as opposed to intensive use of chemicals, for example, farming can be both ecologically healthy and economically rewarding. The agricultural industry has been facing increasing attacks from an array of sources to exercise greater ecological care, and this attack has been just what contemporary family farming advocates have sought to exploit in making their case for small and medium sized, sustainable farms. We are now at a point where almost all parties to the debate realize the importance of an overall ecological ethic. As Paul Thompson observes, "Agriculture cannot continue without an environmental ethic, or at least it cannot continue happily" (Thompson 1998). Some environmentalists look to this broader, ecological context "to see if an argument for preserving the small farm can be found" (Hodne 1987). Marty Strange in *Family Farming: A New Economic Vision* stresses how smaller farms are more likely to safeguard the soil, and seek out long-terms goods. Strange is well aware of cases when abuses have been perpetrated by family farmers, whether in soil erosion, ground water contamination, and the like. But he and others have focused on ways in which small- or medium-sized farms lend themselves well to crop rotation, terracing and such, and how larger farms have difficulty accommodating more ecologically sensitive practices (Hightower 1973, 1975; Krebs 1992; Strange 1988).

Two additional positions need to be brought to the fore in the family farm debate: agrarian democracy and religious stewardship. Both have been cast as favoring family farming.

Agrarian democracy: Early American colonial life was comprised of family farming and this was appreciated by some early founders of the United States, the most famous being Thomas Jefferson. In his *Notes on the State of Virginia*, Jefferson described the family farmer in these high terms:

> Those who labor in the earth are the chosen people of God, if ever he had a chosen people, whose breasts he has made his peculiar deposit for substantial and genuine virtue... Corruption of morals in the mass of cultivators is a phenomenon of which no age nor nation has furnished an example. (Jefferson 1984)

Jefferson's reasons were largely pragmatic. He thought that if one owned one's land and earned one's living from it, then it was highly likely that one would exercise great prudence and care in government. Jefferson had deep suspicion of industrial culture where persons may be treated as replaceable parts, highly mobile, and thus easily directed to pursue merely economic as opposed to richer political and cultural ends.

Jefferson's position has been echoed in some family farm literature. But it has also been supplemented by attaching it to points brought up earlier about family farming's promotion of virtue. While the end of the twentieth century has witnessed a growth of nationalism and tribal identity as well as powerful radical religious groups, we have also seen the flowering of a more cosmopolitan ethic that highlights global or universal citizenship. Any political theory that stretches our commitment to democracy in our own republic to a broader opposition to despotism and promotion of global republicanism must be built on a compelling view of the virtues of individuals. It may be argued that the kind of civic virtues that are promoted in family agrarianism – environmental and personal accountability, responsible stewardship for the community and future generations – bolster a broader republicanism that promotes human flourishing across national boundaries. As idealistic as Berry and others may at times sound, it may well be that nothing else will do if we are to adopt a global republicanism.

Some advocates of family farming have argued that the practice does more to ensure liberty than corporate agribusiness. The latter risks the development of monopolies that can stifle free competition between relatively independent parties (Scheffler 1982).

Religious Stewardship: The above arguments may be developed in the framework of humanistic naturalism, that is a view of nature that does not include any God. One can rephrase Jefferson's claim about "the chosen people of God" and simply refer to the people whom human evolution has favored; perhaps it is "nature" that has made "the peculiar deposit for substantial and genuine virtue." But much of American family agrarianism has been theistic. According to theism, there is an omniscient, omnipotent, all good, God who has created and conserves the cosmos. As revealed in Judaism and Christianity, this God conserves a cosmos that is fundamentally good, though it is marked also by profound evil, some of which is due to human action and irresponsibility. Christianity has fostered at least two environmental ethics, often referred to as a dominion ethic and stewardship ethic. On the dominion model, human beings are given primacy over other creatures and, within limits, allowed to use them for human welfare. Responsible use is promoted over against waste and over-use of natural resources that leave little or nothing to future generations.

On the stewardship model, human beings may have some primacy over other creatures, but we also have the privilege and duty to be good stewards, caring for other life forms and living humbly among other, nonhuman goods.

Christian theists have adopted an array of environmental philosophies (Comstock 1996, 1997; Paddock et al. 1988). But both a dominion and stewardship ethic can be used to bolster family agrarianism. A dominion model can appeal to family farming's promotion of values and commitment to the welfare of future generations. A stewardship model can be joined with the earlier ecological case for family farming. In these respects, theism would serve not to add an entirely new argument for family agrarianism, but to offer additional strength to the positions just outlined. It would intensify the case for family agrarianism (Taliaferro 1992a, b).

We have reviewed many, interrelated reasons why one would back family agrarianism, and why we should not regard the loss of family farms as a matter of mere *adiaphora* or indifference. It may be summarized by making a point about the root meaning of the words "obligation" and "duty." Today, we do not distinguish these in terms of meaning, but they were once quite distinct. The concept of "duty" (like its Latin equivalent *officium*) was used to designate particular actions one should do. One may have a duty to care for the vulnerable, for example. But "obligation" (like its Latin equivalent *obligatio*) refers to the bond or relationship in virtue of which one has particular duties. So one's duty to care for the vulnerable may be in virtue of one's obligation as a fellow citizen, a fellow human being, or (for the theist) being a creature of God. The reasons for promoting family agrarianism rest largely on the grounds of the greater picture of one's obligations to oneself, family, neighborhood, civic society, and perhaps even as one vocation among others to the glory of God.

Impartiality and Particularity

The above case for family agrarianism and stewardship draws on a variety of sources, from the ecological to the testimonial. It can be assessed within a broad, impartialist ethical framework, but it also invites reflection that is at odds with impartialism. Impartiality appears to be the bench mark of moral reflection. That is, it seems as though an essential condition for ethical reflection is that one seek to minimize the influence of particular, personal commitments. We do not permit a judge to settle a case in which her own family is involved. The impartiality that is at work in ethics is evident in Kantianism, utilitarianism, virtue theory, and so on. For example, the British philosopher who founded modern utilitarianism, Jeremy Bentham, steadfastly opposed giving moral authority to the claims of friendship and family unless these could be vindicated by an appeal to the greatest good. No single individual or community can have a value that is independent of what would be detected from an impartial, abstract point of view.

But if we focus on the whole, and construct what amounts to a kind of ethical aerial perspective, what are we to do with the testimony from the ground, the specific commitments that we each have and the testimonies of friendship, family and community? Gary Comstock writes about the lived experience of family farming and the difficulty of capturing such experience in terms of economics, the sciences, or in purely intellectual contexts.

> Being a family farmer means caring for one's land. Such love cannot be taught in agricultural colleges; it is a practice that one learns at the feet of a master. It is knowledge of the heart, not the head, and it is best passed from generation to generation, not from agribusiness expert to agricultural student. This does not mean that newcomers cannot love the land; only that their doing so requires that they learn right emotions and intentions, not just right equations and ratios. This sort of care comes from lived experience and tradition – from memories, from the past. This provides a clear moral justification for giving preferential treatment to those farms that have long histories of having been family undertakings. (Comstock 1987)

Comstock is backed up by other critics of an abstract impartialism.

Samuel Scheffler, for example, has noted how we are deeply invested in our particular projects and this conflicts with the universalizing tendency of utilitarianism (Scheffler 1982). If we only allow moral reflection to take place on an abstract level that is "unencumbered" by our individual projects and forms of life, then we risk cutting off moral reflection from what gives our lives meaning.

We shall briefly describe four contemporary movements in ethics and one in the philosophy of language and meaning that seem to give prominence to what may be considered the personal and particular. If any of these have warrant then they provide some reason to believe that the impartialism of an ethical point of view needs to be hedged or at least informed by specific personal or particular claims.

Communitarianism: Communitarians have proposed that we are shaped by our particular traditions in a fashion that anchors us and gives us a moral balance (Bell 1993; MacIntyre 1981). One conclusion of this movement is that the sources of our moral identity consist of specific communities and social conditions and not abstract, ahistorical moral impartialism. Daniel Bell writes: "If you ask yourself what matters most in your life ... the answer will involve a commitment to the good of the communities out of which your identity has been constituted" (Bell 1993).

Covenantal ethics: This school of ethics is most common in Christian religious traditions; it is like communitarianism but in a specific religious form. Both Catholics and Protestants look to ancient narratives of a covenant that involves God and the people of God that secures a particular identity and subsequent view of social and ecological responsibility. The Biblical background is located in Exodus 19–24 (see also Exodus 34:5 and Joshua 24:1–13). Ed Langerak offers the following picture of the covenantal community.

> Covenanting puts people in moral community with each other, a community in which both the common good and the good of each individual member are sought. Thus individuals' identities are shaped by their communities – they *are* their caring relationships – and communities' identities are shaped by the individuals the communities encompass... Covenants, by their identity-shaping privileges and responsibilities, tend to endure over time and are influenced by new developments in unspecifiable and open-ended ways. (Langerak et al. 1989)

This diverges from relations that are defined by explicit contracts. A covenantal ethic diverges from an ahistorical impartialism, and be used to bolster an ethic that is defined and developed within specific moral traditions. Such an ethic seems to inform the 1986 National Conference of Bishops and their stewardship ethic (Comstock 1987).

Feminism: Feminism today has been largely fueled by the conviction that an abstract, strict impartialism is not gender-free but has tended to advance a male agenda. Over against an ethic of justice as a set of rules, some feminists promote an ethic of care (Carol Gilligan and Nell Noddings), maternal thinking (Sarah Ruddick), and the loving or personal gaze (Maria Lugones). Whether of not one adheres to a form of feminism, the testimony of these philosophers is that an overriding impartialism that does not take specific relations and particularized emotions seriously is incomplete.

Contemporary Judaism: Martin Buber (1878–1965) and Emmanuel Levinas (1906–1995) have introduced fascinating work on the importance of personal as opposed to impersonal relations, the I–You as opposed to I–It relation, in Buber's terminology. Levinas has focused his attention on the importance of encountering the face of the other person. The resulting picture of the ethical life is profoundly personal and specific. Also in this school, Lawrence Blum has made great strides in highlighting the importance of particular moral perceptions, especially as these are represented in literature (Blum 1994).

This more particular, personal outlook seems to allow for just the kind of reflection that family agrarians need to advance their position. The family agrarian position may also be strengthened by some recent accounts of language and meaning. Stanley Cavell insists that our language and social life are not grounded in codified rule-following. We are, rather, shaped by specific "forms of life." This appreciation for the practical context of our forms of life provides further reason to take seriously the accounts of farming and other practices from the people themselves and an engaged investigation into people's stories of their lives as opposed to simply examining the case for and against family farming in the abstract.

> We learn and teach words in certain contexts, and then we are expected, and expect others, to be able to project them into further contexts. Nothing insures that this projection will take place (in particular, not the grasping of universals nor the grasping of books of rules), just as nothing insures that we will make, and understand, the same projections. That on the whole we do is a matter of our sharing routes of interest and feeling, modes of response, senses of humor and of significance and fulfillment, of what is outrageous, of what is similar to what else, what a rebuke, what forgiveness, of when an utterance is an assertion, when an appeal, when an explanation – all the whirl of organism Wittgenstein calls 'forms of life'. Human speech and activity, sanity and community, rest upon nothing more, but nothing less, than this. (Cavell 2002)

A preoccupation with impartialist rules will not give one a credible view of language and basic human activity. If Cavell is right, then if family agrarianism rests on a form of life as opposed to impartialist, rule-governed reflection, it still may be no worse for that.

Constructing a picture of a form of life will involve different skills than abstract, utilitarian calculation. Field experience may be crucial. This tendency to incorporate field experience philosophically and ethically seems to be a vital point among some environmentalists at large, e.g., Holmes Rolston's appeals to the experience of the "wild" as an irreplaceable resource for environmental philosophy (Rolston 1986). The case for a family farming form of life may also involve literature and poetry. Thomas Auxter has made strides in showing how poetry can shape our self-awareness in agricultural settings (Auxter 1985). The poetry of Wendell Berry is especially fitting here. For older literature, Xenophon's *Oeconomicus* is highly recommended for its extolling farm virtues in the fourth century BC. The book consists of a dialog in which the character Socrates articulates and praises agricultural virtues, a dialog not entirely different from our exchange between Doug and Emily. It may be that we need this broader backdrop of experience and literature;

we cannot fall back on the way business ethics is typically taught (debate over the ethics of bargaining, deceit, bribery, advertising, whistle-blowing, trade secrets, and so on). A form of life like family agrarianism requires a broad form of inquiry. In the end, stories by farmers themselves may be the key to our inquiry (Gery 2010; Hart 1991; Rosenblatt 1990).

Berry underscores the need to take seriously the particularity of our positions, as we also come to appreciate the greater framework in which we find ourselves.

> Harmony is one phase, the good phase, of the inescapable dialogue between culture and nature. In this phase, humans consciously and conscientiously ask of their work: Is this good for us? Is this good for our place? And the questioning and answering in this phrase is minutely particular: It can only occur with reference to particular artifacts, events, places, ecosystems and neighborhoods. When the cultural side of the dialogue becomes too theoretical or abstract, the other phase, the bad one, begins. Then the conscious, responsible questions are not asked; acts begin to be committed and things to be made on their own terms for their own sakes, culture deteriorates, and nature retaliates. (Berry 1987)

In this fashion, Berry thinks that the notion of a human economy should be hooked up into a bigger economy, the economy of nature.

> It is only when we think of the little human economy in relation to the Great Economy that we begin to understand our errors for what they are and to see the qualitative meanings of our quantitative measures. If we see the industrial economy in terms of the Great Economy then we begin to see industrial wastes and losses not as "trade-offs" or "Necessary risks" but as costs that, like all costs, are chargeable to somebody, sometime. (Berry 1987)

Here it might well be noted that "economy" and "ecology" all come from "home." By "the family farm" one means a home within a bigger home.

The result of this case for family farms may be less than rigorous, but perhaps no worse than many arguments in ecology. In ecology, various sciences come into play in forming comprehensive descriptions and accounts of natural phenomena, in ways that compel one to expand beyond the limits of one's individual scientific practice.

Family Farming and Ecology: An Empirical Question?

Most people tend to sympathize with family farming and seem to assume that it is or can be environmentally superior to industrial or corporate farming. To what extent should empirical evidence affect our thinking as we look at farming through the lens of environmental ethics?

Agriculture almost by definition upsets the environment and can cause a broad range of ecological problems. Rachel Carson's classic, *The Silent Spring,* famously described an ecological crisis largely based on agricultural practice. Intellectually, the notion that agriculture has a large, often-measurable, and negative effect on the environment cannot be disputed. Some of this ecological damage is reasonably well-documented and often estimated in the dollars and sense calculus of an

economist. (Tegtmeier & Duffy 2004; Pretty et al. 2001; Steiner et al. 1995; Carpenter 1993). For example, runoff of soil and nutrients causes undisputed economic costs to the society, such as expense of cleaning water, or costs from a decline in recreational uses of waterways (Crosson 1995; Pimentel et al. 1995). Pesticides cause economic damage several different ways, including by killing crop pollinators (Pearce et al. 1998; Pimentel et al. 1992). Similarly, there is little doubt that agriculture contributes to the creation of what is now being called a Dead Zone in the Gulf of Mexico, and contributes to the resistance of some bacteria to antibiotics, but the dollar cost to the economy for these problems has not been studied extensively (Greenhalgh & Sauer 2003; National Research Council 1999). Manure and odor problems at animal confinement operations are significant, but not yet the basis of much empirical measurement (National Research Council 2001). It can be argued, in fact, that current agricultural practices are not sustainable over the very long term (Soule & Piper 1991; Jackson 1985). The welfare of animals, obviously a great point of contention, and discussed elsewhere in this collection presents further difficult agriculturally based environmental problems.

A significant literature now describes some of the possibilities for a more sustainable agriculture (National Research Council 1993). This literature convincingly shows that sustainable farms would reduce most of the environmental harms described above. Pesticides are minimized, extensive crop rotations are used, cows and hogs graze in the pastures, and chickens scratch around for worms. A good example of a sustainable alternative is the intensive rotational grazing for dairy farms. Like much of sustainable agriculture, this approach was largely the product of farmers who ignored the advice of the agricultural establishment about how to make a living from dairy cows. Grazing dairies tend to be smaller than conferment operations, and the environmental performance of these farms is admirable (Mariola 2005). The trick for sustainable farms is to make money. Several research reports show that some sustainable strategies, while absorbing lower yields or revenue, more than make up for the deficit by incurring fewer costs. Several studies suggest, for example, that intensively grazed dairies can be profitable. Their milk production is lower than confinement operations, but so are their expenses. In general, however, it is hard to imagine that without some added revenue due to marketing the sustainable character of the farm that these efforts will prove to be as profitable as is sometimes hoped.

How do small and family farms fit into this set of problems? Jim Hall's succinct observation about small farms is telling against Schumacher. "Small, qua small, is not necessarily beautiful" (Hall 1848). A family farm may be the model of sustainability, exercising exemplary water and soil conservation and so on, but it may also use dangerous levels of pesticides, and so on. The family farm is just as capable as agribusiness of going for short term profits at the expense of serious soil erosion, the over-use of chemical fertilizers, and so on. It would be better simply to promote through incentives (or through penalties for failing to achieve) stable, ecologically sound forms of irrigation, crop rotation, animal welfare, and such. If ecological integrity can be achieved competitively through family farms, well and good, but if through agribusiness that is fine as well. If one wants to make the goal ecological

health, why not simply outline and achieve that goal through legislative regulation? Agribusiness may also be better enabled to meet the standards set by society. Let us go back to Roy's dairy farm: Imagine we are concerned with decreased genetic diversity among dairy cattle or we want to promote the general health care of the livestock and cull ill cattle. Wouldn't it be easier to attend to several large farm institutions, rather than a series of farms? Or, thinking more generally, it may help to imagine a fictionalized ideal type of two farm economies: in one there are roughly 5,000 family-sized farms, with 15,000 full time equivalents of work going on these farms. The majority of the hours come from the families themselves. In the alternative one could imagine the same region with only fifty very large farms, with labor provided almost exclusively from, say, 5,000–10,000 wage labor employees. Let's assume, for the sake of argument that in a purely economic sense, the larger farms are somewhat more efficient than the family-sized farms. That is to say, if the farms in each system roughly broke even in their farming operations, the larger farms could likely sell their agricultural products for a bit less than the smaller farms. We will return to this question of economic efficiency in a moment.

Part of the difficulty here is the incredible variation of what goes on on farms. One might suppose that it would be relatively easy to know whether family farms are more likely than larger farms to operate using effective conservation practices. In fact, even this relatively simple question is hard to answer. Almost everyone would agree that dispersed livestock operations provide fewer odor problems than massive livestock operations. In this sense, family farms have an environmental advantage. Regarding other environmental concerns, the question is far more complex. For example, do smaller family-sized dairies provide more humane living conditions for dairy cattle than very large dairies? According to one recent lengthy and detailed study, larger operations are more likely to adopt conservation measures than much smaller farms – apparently an important finding (Lambert 2006). Problems in the study are indicative, however, of the difficulty of measurement in this area. For example, farmers who planted insect- and herbicide-resistant crops were considered adopters of one of only nine conservation practices closely analyzed. Organic production, alternatively, seems not to have been an approved conservation practice. The study is certainly interesting, and convincingly makes the point that larger operations are more likely than smaller operations to seek technical assistance and to apply newer complicated technological strategies that could benefit the environment. It appears, however, that a farmer who dairies on pasture might rank below a nearby grain farmer who bought a global positioning system on a new combine and raises herbicide-resistant corn. The larger point is that as an empirical matter we do not know how good a job family farmers do in protecting the environment. Further, even if we knew and could analyze the practices of every farm in America, it would be essentially impossible to come up with an objective standard on which to evaluate all farms.

It is also possible to put the question somewhat differently. To what extent are family farmers able to adapt to policies that either require or support environmental concerns? In other words, if farms were forced to internalize their environmental costs, would family farmers be better able to adapt than larger operations? The

answer to this question is even more speculative, but is important if one is interested in creating policies that support the environment and support family farms. For example, what if extremely demanding Clean Water Act rules were applied to agriculture regarding runoff from livestock facilities, or restrictions on gases and odor leaving the premises of hog operations were enforced? Family farm advocates often argue that a central cost advantage for industrial agriculture is that it pushes more environmental costs onto the rest of society. Once such costs are internalized, family farmers might be more efficient in a purely economic sense than industrial farms.

For example, twenty years ago most hogs were raised from farrow to finish on a farm that had both crops and livestock. The feed for the hogs was grown largely on the farm. Since 1994 the number of hog operations in the country has dropped from 200,000 to 80,000, even though the total number of hogs remained roughly the same. The largest hog operations, those with 5,000 or more sows, had half of the hogs in the country by 2001. From an environmental point, this transition matters for several reasons, but one in particular concerns the application of manure to farmland (Ribaudo 2003). Smaller hog farms average less than two hogs per acre on the farm. The larger farms have more than fifteen hogs per acre. The largest farms have tended to apply the manure to nearby farmland, and to do so at a level that cannot be absorbed by the land. Thus, there is runoff of manure and then water pollution. A regulatory answer to this problem might simply set limits on the application of manure to fields. This would force all hog farms to internalize at least part of the environmental cost of handling the manure produced on the farm. For a smaller operation, this rule would likely be manageable. The problem for the largest operations is that applying manure over a broader area is very expensive because manure is heavy, and because there is a large volume of it. By legally requiring all hog operations to internalize the environmental cost of putting hog manure on fields, a policy might have the indirect effect of making family-sized hog farms much more competitive with the larger operations.

Without moving into great detail, but sticking for a moment with livestock, experts who have reviewed livestock production technologies – well over two hundred by one count – indicate that methods exist that would allow control of water and odor problems at livestock facilities (CAST 1996). The problem is that this level of control is expensive. The question is, how expensive? If these operations were required to take such steps, and were successful, the pollution problems would be limited, and the cost of production difference between large- and family-sized operations might draw closer.

Despite all that is written about agriculture and all that we know about farming, the continued survival of family-based agriculture is something of a puzzle. Think, for the moment, about a comparison with other segments of the American economy, automobiles, energy companies, and so on. It may be that as long as farms are forced to rely on nature, its rhythms, and its uncertainty, family farmers will be able to compete with industrial alternatives. Where farming literally can be turned into a factory, however, a family may have much little chance against a corporation. Along with the progress of scientific and technical innova-

tion in agriculture, however, often come social and environmental costs. How to calculate these costs, or even what to include in their accounting, is inevitably controversial. To the extent that the replacement of agriculture's reliance on nature with a nature-less set of technologies and industrial methods is itself the key element that makes harmful externalities inevitable, it may well be that industrial agriculture can never be a more efficient way to raise food and fiber than family farming. In the meantime, to the extent we have federal farm programs and publicly supported agricultural research, there is certainly a case for targeting these efforts toward family farming. In the long term, the fate of family farming may well be entwined with how the society comes to think and act on environmental ethics.

Objections, Replies, and Refinements

There are many objections to the above case for the family agrarianism. Let us consider three. Neither the objections nor replies are presented as definitive points on either side, but as points and counter-points that need to be taken seriously in the debate. A final section of this chapter raises some further points to weigh in the case for family farming.

Objection 1: *The case for family farming is built on a highly romanticized, perhaps even sentimental portrait of farm bred virtues*. The family farm in the United States has often housed sexism, racism, and isolationism. The virtues that are at the heart of family farming have been shaped by a father-ruled, traditional patriarchy. Luther Tweeten:

> The personality of the farm sector is basically healthy and has many of the favorable attributes embodied in the image of the family farmer as self-reliant and independent; and as committed to fair play, due process, and democratic ideals. But a darker side of the farm personality emerged in the course of American history and is characterized by scapegoating, armed confrontation, violence, and commitment to ideologies that would bring fewer gains to farmers than losses to consumers, taxpayers, and society as a whole. (Thompson and Stout 1991)

This darker side is especially sinister when one takes note of the implied perfectionism in some agrarian writing. A perfectionist account of property holds that ownership is tied to moral virtue; the vicious are not as clearly entitled to their property. This can be dangerous when we lack a clear-cut account of virtues in our pluralistic culture.

Harkening back to the claims about agrarian democracy, we do well to consider Gary Comstock's comment: "If Jefferson is right, how is it that we still have a democracy when less than 2 percent of us live on family farms?" (Comstock 1987). It may be granted that cosmopolitan republicanism would be bolstered by the kinds of virtues outlined by Berry, Jackson, and others, and yet countered that these virtues may be acquired in non-farming ways of life.

Objection 1 may be furthered by also pressing this point: If the concept of "family farming" is constructed in such a way that values and goodness are already built

into it so that "bad family farming" is a virtual contradiction in terms, then the defenders of family farming have simply begged the question. That is, they have assumed at the outset the very thing that requires argument. A proponent of large-scale agri-business could adopt a similar strategy and simply define such an enterprise as inherently valuable. Defining one's position into moral respectability accomplishes very little.

Reply: Granted, the case for family farming cannot be made through stipulative definition. Clearly Berry, Jackson, et al. do not make this move. The point that Berry and others wish to make is that what they identify as family farming stands for a way of life or practice that is governed by a rich, responsible understanding of the good – good community and good land stewardship. In their view, there is an ideal and dignity to *being a family farmer*; some small owner-operated farms are worthy of this title, some are not. Just as a biological family can become so dysfunctional that it is no longer a family in any culturally and ethically respectable sense, so dysfunctional family farms lose their right to being called family farms. Consider an analogy in the theory of law. One strand of the natural law tradition holds that the very concept of "law" has a dignity and worth such that the concept of an "unjust law" would be like the concept of a square circle, a contradiction. *Lex injusta non est lex* or an "unjust law is not a law" is the traditional claim. On this view, a view adopted with great conviction by Martin Luther King Jr., the enactment of white supremacist laws should be considered "laws" only in sneer quotes. They are, in fact, not *bona fide* laws but simply rules enforced to tyrannize people of color. The tactic Berry adopts of building into the concept of family farming a host of virtues and goods is no more a matter of question begging than a natural lawyer's view of the dignity of law.

Of course, a critic can still charge that there simply are few, if any, such family farms in this enriched, value-laden sense. Empirical scientific and sociological studies, testimony of agricultural communities, and the like, are the place for such an objection and reply to be forged. (For an examination of some of the "darker side" of small American farms see *Agriculture and Human Values* 2:1.)

Perhaps, then, family agrarianism represents an ideal to be worked for. Comstock's question cited in the objection above is appropriate, but we may well pause to consider what kind of democracy we have, and the ways in which our democracy would be enhanced if the land wisdom available in family farming were more integral to our culture.

Objection 2: *The Freedom objection*. This objection does not take aim at the good of family farming, but highlights the perceived good of freedom. Given a liberal, free market democracy, shouldn't any proposal to protect the family farm by legislature (either penalizing agribusiness or employing public monies to fix prices and incomes for family farmers) face an enormous burden of proof? That is, in a context in which freedom is a perceived right, shouldn't the fate of family farms be settled by a free and open market? If family farms falter, this could be due to a Darwinian weeding out of the weak. Perhaps regrettable, but not unfair.

Reply: Two replies may be explored.

(A) One is to argue that *there are many goods that we currently protect from free market exchange because of their value.* If family agrarians can make the case that family farming constitutes and promotes virtues or that it has a vital standing in our heritage and is worthy of pursuit, then they may be on the way to an effective rejoinder. The heritage argument will have to be hedged, though, for clearly family agrarians do not wish to promote the equivalent of a series of museums, but a viable practice. There are many cases in which our society does protect goods that are not given market value (educational institutions, inner cities), and family farm goods may be sufficient to merit protection.

(B) A second rejoinder is to contend that *it is agribusiness, not family farming, that poses a threat to human freedom.* It has been argued that agribusiness threatens the individual because of its tendency to create monopolies. It does not compromise individual civil rights (the right to vote, to be free from arbitrary arrest, and the like), but it does restrict individual liberties in terms of economic activity, the freedom to enter into fair competition (Shrader-Frechette 1991). Another reply that seeks to overturn the freedom objection falls back on the charge that agribusiness tends to be less able to offer food with good nutrition and low environmental costs (Campbell 1979). If this is right, then individual freedom to have access to good nutrition may bolster family agrarianism.

Objection 3: The use of a religious stewardship ethic suffers from two problems. First, *theism seems to lend itself equally well to environmental responsibility and to recklessness.* Second, *it imports religious considerations into public debate; this is not fair in a democracy in which the state is supposed to be religiously neutral.*

Reply: Two very brief replies. There is some reason to believe that Christian theism is generating a growing consensus on the importance of land stewardship. While Christian language has been employed in the past in justifying the exploitation of natural resources, it is increasingly apparent that such appeal to Christianity was politically expedient and not the outcome of deep, authentic Christian convictions. Belief in a loving Creator who upholds a creation that is fundamentally good cannot be easily yoked with ecological exploitation (Attfield 2001; Comstock 1987). Second, even if the appeal to religion should not have a direct role in policy making, it does not follow that it should have no role in public discourse, public philosophy, and culture. Insofar as it does, and it does enhance a case for stewardship-based family farming, then the appeal to religion will be significant in shaping the politically relevant value of family farms. Thus, a liberal secular state (France) may have political reasons to protect certain religious institutions because of their overall contribution to culture.

Considerations for Further Reflection on Farm Policies

This chapter has focused on the structure of the debate about family farming. It has concentrated on the philosophies at stake and the different ways in which testimony and ecological findings can be marshaled. In closing, consider three important

factors that will require attention in furthering more detailed argumentation on either side.

First, the conduct and aim of the debate will depend on the prevailing political and economic framework. A debate on the federal level will aim at uniform national standards, whereas state by state debate may permit great regional differences and employ different accounts of what comprises family farming. One's economic commitments will also play a great role in how to read the case for the family farm. If you are a staunch defender of the free market system with only minimal government intervention, it is likely that you will only protect family farming if you oppose subsidies to agribusiness that disadvantages family farming. My point here is that background political and economic theories will inevitably play a large role in the debate.

Second, if family agrarianism is imperiled today, it will be important to consider who has the responsibility for such a plight. If family farmers themselves bear such responsibility, then the duty to preserve family farming may be diminished. Marty Strange supports aid to the family farm, but he notes that the farmers themselves seem to have brought about these difficulties.

> Farmers … seem to have welcomed the very economic policies that have placed them in such jeopardy. Were they not among the most supportive of President Reagan when he sought reelection in 1984, even as the farm crisis deepened? Did not 70 percent or more of the farmers vote for him in that election when he pledged to reduce the budget deficit by cutting social spending? How could they be surprised and outraged when his first veto in 1985 was of an emergency farm-credit bill that would have added to the deficit? Weren't they being a little hypocritical to think he would cut all social spending *except* agriculture? (Strange 1988)

But if they did not know what they were agreeing to, one might well charge that family farm action was not fully voluntary.

Third, if family agrarianism represents a great good, that is a reason to support it, though perhaps not a decisive one. There are many goods in the world and it may be that a greater good requires our allegiance. (Imagine, for example, that world famine is best addressed through large-scale agriculture.) The loss of family farming may then be rightly deemed regrettable but not, under the circumstances, reversible.

One need not believe that family farming is an unqualified good in order to appreciate this regret. To believe family farming is an unqualified good would appear to be a form of what Luther Tweeten calls: "Farm fundamentalism."

> Farm fundamentalism is the belief that farming is not only a superior way of life but also represents the highest ideals of the nation. Farm fundamentalism holds that the nation's political and social system cannot survive without the type of person the farm way of life produces. (Thompson and Stout 1991)

Without being a farm fundamentalist, one may still hold that family farming represents an enormous good that we should either promote or, if the way of life that Berry and others celebrate is to be lost, deeply regret its passing. At the end of the day, whatever one's conclusion and qualifications, it is hard not to admire and take seriously a way of life that, at its best, incorporates stewardship, a commitment

to long-term productivity, cooperation between neighbors and generations, the cultivation of civic virtues, and wisdom.

Questions

1. Consider Marty Strange's characterization of the family-centered characterization of family farming. To what extent is this notion linked to a specific model of the family (traditional or nontraditional?)

> In a family farming system, farms rely on family labor and management skills. The family lives its life in harmony with its workplace. There is no division between home and work. Children grow up learning to farm by apprenticeship. Formal education is not eschewed; in fact, it is valued as a means of increasing the human skills on the farm. But the practical aspects of farm management and decision making, of work and reward, and of problem solving are learned by doing. Most important, responsibility is shared by all family members old enough to assume any. (Strange 1988)

2. To what extent is a case for family farming affected by the kind of farm involved? For example, does the case for family farming explored in this chapter change if it is not over a dairy farm like Roy's? Imagine the farm is devoted to any of the following: Cash Grain, Tobacco, Cotton, Vegetables, Fruit, Nuts, Nursery or Greenhouse, other crops; Beef, Hogs, Sheep, Poultry, other Livestock. Does the region matter? e.g. Northeast, Appalachia, Southeast, Delta, Corn Belt, Lake States, Northern Plains, Southern Plains, Pacific?
3. Adam Smith, the great eighteenth century Scottish philosopher and champion of the limited free market, was critical of specialized labor. His views reinforce Berry's as cited in this chapter. Assess the following claim by Smith:

> In the progress of the division of labor, the employment of the far greater part of those who live by labor, that is, of the great body of people, comes to be combined to a few very simple operations, frequently to one or two. But the understandings of the greater part of men are necessarily formed by their ordinary employments. The man whose whole life is spent in performing a few simple operations of which the effects too are, perhaps, always the same, or very nearly the same, has no occasion to exert his understanding, or to exercise his invention in finding out expedients for removing difficulties which never occur. He naturally loses, therefore, the habit of such exertion, and generally becomes as stupid and ignorant as it is possible for a human creature to become. The torpor of his mind renders him, not only incapable of relishing or bearing a part in any rational conversation, but of conceiving any generous, noble, or tender sentiment, and consequently of forming any just judgment concerning many even of the ordinary duties of private life.. His dexterity at his own particular trade seems, in this manner, to be acquired at the expense of his intellectual, social, and martial virtues. But in every improved and civilized society this is the state into which the laboring poor, that is, the great body of the people, must necessarily fall, unless government takes some pains to prevent it. (Smith 1933)

4. Along with assessing a position like Adam's, you may wish to develop an educational program (or perhaps a course or series of courses) that would introduce agricultural knowledge and technology to the general public. Marty Strange writes: "Only an informed and alert public can defend itself against the misuse

of either technologies or regulations" (Strange 1988). Address Strange's proposal below. In your region of the country, is there any extant program now in place (or in development) that would secure what Strange describes as public-public relations?

> Better to focus on the broader educational needs of society to understand technology than to train only the brightest to use it. Instead of private-public partnerships that corrupt the research process, why not public-public relationships between agricultural universities and public schools in which the universities help students grasp the meaning of technologies and the alternative paths to technical development? (Strange 1988)

5. To what extent do you think that the debate over family farming should be affected by esthetics (judgments of beauty and ugliness)?

   If so, to what extent can the case for or against the family farm be bolstered through esthetic experience or through art, literature, theater, music, film or poetry? In what respects may any of these have not merely an emotional, persuasive force but raise important reasons and arguments for debate? You may wish to consider some of the following works: *Remembering* by Wendell Berry, *The Grapes of Wrath* by John Steinbeck, *A Thousand Acres* by Jane Smiley, *Founding Farms; Portraits of Five Massachusetts Family Farms* by Michael Gery, photographs by Stan Sherer. From antiquity, you may wish to engage Virgil's extended poem on farming, *Georgicas* (first century BC).
6. Family farmers have sometimes been led to protest government policies. See, for example, Dianna Hunter's *Stories of the Minnesota Farm Advocates.* Sometimes protests have involved destroying crops and livestock to affect the market and general population, sometimes protest marches, and the like. When do you think it is ethically permissible for a farmer to destroy livestock in protest of a government policy? Imagine Doug's father is upset at the price control of milk...
7. If Berry is right about virtue, how should this influence a philosophy of agricultural education?
8. How strong do you think familial obligations are? Imagine Doug's parents are good and kind. He is divided. He would enjoy farming, but also some other occupation. His parents ask him to farm. Is he obliged to do so?
9. Utilitarianism was presented as an impartialist ethic, that highlights the overall good. One objection to this is that it does not seem to leave sufficient space for other goods and rights like the good of integrity. In one well-known exchange, Bernard Williams held that a utilitarian would have to sacrifice the integrity of an individual to promote the greater good (Tweeten 1989). To what extent do you think that utilitarianism would be able to take seriously family agrarian claims about the integrity of personal identity and land use?
10. List some of the virtues that you think are integral to family farming. How may the case for family farming differ from or be in league with the case for protecting small businesses?
11. Some philosophers have advanced wager arguments designed to tip the scales to one side or the other. Thus, the French philosopher Blaise Pascal (1623–

1662) held that when in doubt whether God exists and given the choice to believe or disbelieve, it would be wiser to believe because the opportunity to net good would be greater and the risk of ill lessened. Can a wager be formulated in the case of family farms? Imagine that the case for and against preserving family farming is otherwise equally balanced except that the loss of family farming involves a risk of losing an important, good component of our heritage and national identity. It is not *known* to incur such a loss, but the loss is a live possibility. Under such conditions, is it better "to be safe than sorry" and to preserve family farms?

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Chapter 8
Food

Hugh LaFollette and Larry May

Abstract An introduction to the ethical issues surrounding the production, distribution, and consumption of food.

Keywords Ethics • Starvation • Malnutrition • Need • Responsibility

Case: Dhruva the Destitute

During the discussion with Marie the environmentalist, Emily notices Rich becoming increasingly upset. She is surprised, however, by Doug's reaction. She asks Doug several days later what is bothering him. He says that the environmentalists fail to realize how important agriculture is. "If we can't use water to feed ourselves," he complains, "we won't have the luxury to be worrying ourselves about philosophical niceties regarding the moral status of nonhuman entities. We'll be dead. Agriculture helps us to feed ourselves, and efficient farming provides us with goods so that we can do valuable things like study philosophy."

At the next class, Doug raises this objection to Dr. Wright, who points out that the reading for the next class period addresses that very issue. That night, Doug calls Emily.

"Have you read the Peter Singer essay yet?" he asks.

"Yeah. What'd you think?" Emily replies.

"I really liked his argument that we ought to do everything we can to help people."

"Why?"

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"Well, first, I just think that people have a right to be fed if it's possible to feed them. But I also think that Singer makes the case for the superiority of farmers over environmentalists. Our first job is to take care of people's basic needs, which includes the production of food. That's a big job and it requires using our natural resources in a way that maximizes production. There are millions of malnourished people out there! Who's going to feed them if not farmers?"

Emily has been thinking about this question ever since seeing a story on TV about the state of children in certain developing countries. The story told about a 10 year old boy named Dhruva in one such country, a boy who was abandoned at birth because he was very sick and who now made a living by begging in one of the country's major urban areas. He does not eat well, and his prospects are not good.

"I see your point," answers Emily. "I'm all for feeding people when it is possible. But I'm skeptical about giving my money to relief agencies because they spend it all on these big huge salaries of their executives. And even if they didn't, I wonder whether there is anything I could do that would actually help to feed strangers halfway across the globe."

"You put your finger on it," answers Doug. "It seems we have a duty to help others. But what if there is no mechanism by which we can actually meet this duty? And how far does the duty extend? Should we give to relief agencies until we are impoverished? If we do so, then we will be contributing to the problem, because we ourselves will need someone else's assistance."

"Right," responds Emily. "But, it's possible to overstate the difficulty. Certainly each of us is capable of doing something that will help to alleviate malnourishment in developing countries. The mere fact that we could impoverish ourselves if we gave too much is no excuse for not giving anything. Consider this argument. If we give something, we will save some people. If we give nothing, some people will die. Now what's the difference between murdering someone by attacking and killing them and murdering someone by failing to send five dollars to a relief agency that will give them bread when bread is all they need?"

Case: Discussion Questions

1. Suppose you are Emily. For the moment, forget your doubts about whether any relief agency actually forwards the majority of the money you give to the intended recipients. The immediate question you must answer is very specific: Do you think Emily is right to assume that each of us has the opportunity to do something about the situation? Explain your answer.
2. If Emily's factual assumption is right, is our inaction the moral equivalent of murder?
3. Suppose that letting someone die is not the moral equivalent of murder. It may nevertheless be very wrong. In addition to an obligation not to kill, we may have a separate obligation to help. Do we have a general duty to help all people, including total strangers in distant lands?

4. What might be the limits of a duty to help? According to some philosophers, there are no limits: we should continue to benefit others until further efforts would burden us as much as they would help the others. Do you find this plausible?

Discussion of Issues[1]

Emily, moved by the plight of Dhruva, is not alone in caring for the hungry, and it is a rare person who does not share her urge to help the starving. The faces of the malnourished are compelling, and it would not seem difficult to motivate people to assist them. For children are the real victims of world hunger: at least 70% of the malnourished people of the world are young people. By best estimates seventy-five of every one thousand children in developing countries will die before they are 5 years old (United Nations Development Program 2000: 189). Children do not have the ability to forage for themselves, and their nutritional needs are exceptionally high. Hence, they are unable to survive for long on their own, especially in lean times. Moreover, they are especially susceptible to diseases and conditions which are the staple of undernourished people: simple infections and simple diarrhea (UNICEF 1993: 22). Unless others provide adequate food, water, and care, children will suffer and die (WHO 1974: 677, 679). This fact must frame any moral discussions of the problem.

And so it does – at least pre-philosophically. When most of us first see pictures of seriously undernourished children, we want to help them, we have a sense of responsibility to them, we feel sympathy toward them (Hume 1978: 368–71). Even those who think we needn't or shouldn't help the starving take this initial response seriously: they go to great pains to show that this sympathetic response should be constrained. They typically claim that assisting the hungry will demand too much of us, or that assistance would be useless and probably detrimental. The efforts of objectors to undermine this natural sympathetic reaction would be pointless unless they saw its psychological force.

We want to explain and bolster this sympathetic reaction – this conviction that those of us in a position to help are responsible to the malnourished and starving children of the world. We contend that we have this responsibility to starving children unless there are compelling reasons which show that this sympathetic reaction is morally inappropriate (Ibid.: 582). This requires, among other things, that we seek some "steady and general point of view" from which to rebut standard attempts to explain away this instinctive sympathetic response. By showing that assistance is neither too demanding nor futile, we think more people will be more inclined to act upon that pre-philosophical sense of responsibility. And, by philosophically championing that sense of responsibility, we will make most people feel more justified in so acting.

[1] Originally published as "Suffer the Little Children," in *World Hunger and Morality*, ed. William Aiken and Hugh LaFollette (Prentice-Hall 1996).

Vulnerability and Innocence

Our initial sense of responsibility to the starving and malnourished children of the world is intricately tied to their being paradigmatically vulnerable and innocent. They are paradigmatically vulnerable because they do not have the wherewithal to care for themselves; they must rely on others to care for them. All children are directly dependent on their parents or guardians, while children whose parents cannot provide them food – either because of famine or economic arrangements – are also indirectly dependent on others: relief agencies or (their own or foreign) governments. Children are paradigmatically innocent since they are neither causally nor morally responsible for their plight. They did not cause drought, parched land, soil erosion, and over-population; nor are they responsible for social, political, and economic arrangements which make it more difficult for their parents to obtain food. If anyone were ever an innocent victim, the children who suffer and die from hunger are.

Infants are especially vulnerable. They temporarily lack the capacities which would empower them to acquire the necessities of life. Thus, they are completely dependent on others for sustenance. This partly explains our urge to help infants in need. James Q. Wilson claims that our instinctive reaction to the cry of a newborn child is demonstrated quite early in life.

> As early as ten months of age, toddlers react visibly to signs of distress in others, often becoming agitated; when they are one and a half years old they seek to do something to alleviate the other's distress; by the time they are 2 years old they verbally sympathize ... and look for help. (Wilson 1993: 139–140)

Although this response may be partly explained by early training, available evidence suggests that humans have an "innate sensitivity to the feelings of others" (Wilson 1993: 140). Indeed, Hans Jonas claims the parent-child relationship is the "archetype of responsibility," where the cry of the newborn baby is an ontic imperative "in which the plain factual 'is' evidently coincides with an 'ought'" (Jonas 1984: 30).

This urge to respond to the infant in need is, we think, the appropriate starting point for discussion. But we should also explain how this natural response generates or is somehow connected to moral responsibility.

The Purpose of Morality

The focus of everyday moral discussion about world hunger is on the children who are its victims. Yet the centrality of children is often lost in more abstract debates about rights, obligations, duties, development, and governmental sovereignty. We do not want to belittle either the cogency or the conclusions of those arguments. Rather, we propose a different way of conceptualizing this problem. Although it may be intellectually satisfying to determine whether children have a right to be fed

or whether we have an obligation to assist them, if those arguments do not move us to action, then it is of little use – at least to the children in need. So we are especially interested in philosophical arguments which are more likely to motivate people to act. We think arguments which keep the spotlight on starving children are more likely to have that effect.

Moreover, by thinking about hunger in these ways we can better understand and respond to those who claim we have no obligation to assist the starving. For we suspect that when all the rhetoric of rights, obligations, and population control are swept away, what most objectors fear is that asking people to assist the starving and undernourished is to ask too much. Morality or no, people are unlikely to act in ways they think require them to substantially sacrifice their personal interests. Thus, as long as most people think helping others demands too much, they are unlikely to provide help.

John Arthur's critique of Peter Singer highlights just this concern. Arthur objects to moral rules which require people to abandon important things to which they have a right.

> Rights or entitlements to things that are our own reflect important facts about people. Each of us has only one life and it is uniquely valuable to each of us. Your choices do not constitute my life, nor do mine yours…. It seems, then, that in determining whether to give aid to starving persons … [agents must assign] special weight to their own interests. (1977: 43)

Thus, people need not assist others if it requires abandoning something of substantial moral significance. Since what we mean by "substantial moral significance" has an ineliminable subjective element (Ibid.: 47), some individuals may conclude that sending *any* money to feed the starving children would be to ask too much of them. Arthur thereby captures a significant element of most people's worries about assisting the needy. The concern for our own projects and interests is thought to justify completely repressing, or at least constraining, our natural sympathies for children in need.

At bottom, we suspect that what is at issue is the proper conception and scope of morality. Some philosophers have argued that morality should not be exceedingly demanding; indeed, one of the stock criticisms of utilitarianism is that it is far too demanding. On the other hand, some theorists, including more than a few utilitarians, have bitten the proverbial bullet and claimed that morality is indeed demanding, and that its demandingness in no way counts against its cogency (Parfit 1984; Kegan 1988; Cullity 1996). On the former view, morality should set expectations which all but the most weak-willed and self-centered person can satisfy; on the latter view, morality makes demands which are beyond the reach of most, if not all, of us.

We wish to take the middle ground and suggest that morality is a delicate balancing act between Milquetoast expectations which merely sanctify what people already do, and expectations which are *excessively* demanding and, thus, are psychologically impossible – or at least highly improbable. Our view is that the purpose of morality is not to establish an edifice which people fear, but to set expectations which are likely to improve us, and – more relevant to the current issue – to improve the lot of

those we might assist. Morality would thus be like any goal which enables us to grow and mature: they must be within reach, yet not easily reachable (LaFollette 1989: 503–506). Of course, what is within reach changes over time; and what is psychologically probable depends, in no small measure, on our beliefs about what is morally expected of us. So by expecting ourselves to do more and to be more than we currently do and are, we effectively stimulate ourselves to grow and improve. But all that is part of the balancing act of which we speak.

Thus, we frame the moral question in the following way: what should responsible people do? Our initial sympathetic response is to help the starving children. Are there any compelling reasons to think our compassion should, from some "steady and general point of view," be squelched? We think the answer is "No." Are there additional reasons which bolster this initial reaction? We think the answer is "Yes." In short, we think our initial conviction that we are responsible to malnourished children is not only undefeated, it is also rationally justified.

Moral Responsibility

We "instinctively" respond to the needs of starving and malnourished children. But are we, in fact, morally responsible for their plight? There are, of course, two different questions intermingled here: (1) Are we *causally* responsible *for* their condition – did we, individually or collectively, cause their hunger or create the environment which made their hunger and malnourishment more likely? (2) Are we *morally* responsible *to* these children, whether or not we are causally responsible for the conditions which make them hungry?

It is a commonplace of moral argument that people are morally responsible to those to whom they cause harm. If I run a stoplight and hit your auto, then I must pay any medical bills and either repair or replace your auto. If I trip you, causing you to break your arm, then I am expected to carry any resulting financial burden. The principle here is that we should respond to those whose cry for help results from our actions. If others are contributing causes to the harm, we may be jointly responsible to you (Hart and Honore 1959: 188–229). Or, if my action was itself caused by the actions of some other agent – e.g., if someone shoved me into you – then this other person is both causally and morally responsible for the harm. But, barring such conditions, a person is morally responsible for harms he or she causes.

Some commentators have argued that the affluent nations, especially colonial powers, are morally responsible to the starving because they created the conditions which make world-wide starvation possible, and perhaps inevitable (O'Neill 1993: 263–264). We find such claims plausible. But, such claims, although plausible, are contentious. Hence, for purposes of argument, we will assume that we in affluent nations are in no way causally responsible for the plight of the starving. If we can show we are (morally) responsible to the children, even if we are not (causally) responsible for their plight, then our responsibility to them will be all the stronger if, as we suspect, these causal claims are true.

Shared Responsibility

If we are the cause of harm, then we are responsible *to* the "victim" because we are responsible *for* their condition. For instance, we assume biological parents have *some* responsibility *to* children because they were responsible *for* bringing them into the world. However, being the cause of harm is not the only condition which creates a responsibility *to* someone. We are also responsible to those whom we have explicitly agreed or promised to help. For instance, by assuming a job as a lifeguard, I have agreed to care for those who swim at my beach or pool, even if they, through lack of care or foresight, put themselves into jeopardy.

More important for the current argument, responsibilities also arise from actions which, although not explicit agreements, nonetheless create reasonable expectations of care. For example, although *some* of the parents responsibilities to their children is explained by their being the cause of the children's existence, this clearly does explain the full *range* of parental responsibilities. For even when an agent is indisputably responsible *for* the harm to another, we would *never* think the agent is obliged to change the "victim's" soiled pants, to hold her at night when she is sick, or to listen patiently as her recounts her afternoon's activities. Yet we *do* expect this – and much more – of parents.

Our ordinary understanding of parental responsibilities makes no attempt to ground specific responsibilities *to* the child on any causal claims about the parents' responsibility *for* the child's condition. Rather, this understanding focusses on the needs of the child, and the fact that the parents are in the best position to respond to those needs. This is exactly where the focus should be.

Although for any number of reasons these responsibilities typically fall to the child's biological parents, the responsibilities are not limited to the parents. Others of us (individually or collectively) have a responsibility to care for children whose parents die or abandon them. It matters not that we neither brought these children into the world nor did we voluntarily agree to care for them. Rather, as responsible people we should care for children in need, especially since they are paradigmatically vulnerable and innocent. This is our natural sympathetic reaction. "No quality of human nature is more remarkable, both in itself and in its consequences, than the propensity we have to sympathize with others" (Hume 1978: 316).

This helps explain our shared moral responsibility to care for children who are not being cared for by their parents. Since the range of parental responsibilities cannot be explained either by the parents' being the cause of the child's existence or by their explicitly agreeing to care for the child, it should not be surprising that our shared responsibility likewise does not depend on an explicit agreement or an implicit assumption of responsibility. We assume responsible people will, in fact, care for abandoned children. This shared responsibility springs from our common vulnerability, and from our ability to respond to others who are similarity situated.

Acute Need

Until now we have spoken as if all starvation and malnutrition were created equal. They are not. The hunger with which we are most familiar – the hunger whose images often appear on our television sets – is hunger caused by famine. And famines tend to be episodic; often they are unpredictable. An extended drought or a devastating flood may destroy crops in a region, so that the people of that region can no longer feed themselves. (Or, as is more often the case, these environmental catastrophes may not destroy all crops, but primarily that portion of the crop which is used to feed the local population; crops used for export may be protected in some way.) In these cases the problem may emerge quickly and, with some assistance, may disappear quickly. Such need is acute.

The nature of our responsibility to the starving arguably depends on the nature of their need. Peter Singer offers a vivid example of acute need and claims his example shows we have a serious moral obligation to relieve world starvation.

> If I am walking past a shallow pond and see a child drowning in it, I ought to wade in and pull the child out. That will mean getting my clothes muddy, but this is insignificant when the death of the child would presumably be a very bad thing. (1972: 231)

This case, Singer claims, illustrates the intuitive appeal of the following moral principle: "if it is in our power to prevent something bad from happening, without thereby sacrificing something of comparable moral importance, we ought, morally, to do it." In the case in question, this is sage moral advice. If muddying my clothes saves the life of an innocent child, then it is time for me to send the cleaners some additional business.

Singer's example vividly illustrates our fundamental moral responsibility to meet acute need, especially the acute need of children – those who are paradigmatically vulnerable and innocent. In Singer's example, the child is in immediate danger; with relatively little effort we can remove her from danger. As we argued earlier, we have a shared moral responsibility which arises from our common vulnerability. None of us has complete control over our lives. All of us are vulnerable to circumstances beyond our control: floods, hurricanes, droughts, etc. Through no fault of our own, our lives and welfare may be jeopardized. Admittedly some acute need results from our ignorance or stupidity. Even so, others should assist us when feasible, at least if the cost to them is slight. After all, even the most careful person occasionally makes mistakes. When need is caused by natural disaster or personal error, we each want others to come to our aid. Indeed, we think they *should* come to our aid. If, upon reflection, our desire for assistance is reasonable when *we* are in need, then, by extension, we should acknowledge that we should help others in similar need. Shared responsibility and sympathy conspire to create the sense that we should go to the aid of those who cannot alleviate their own acute needs.

Although we are here emphasizing responsibility rather than justice (narrowly defined), it is noteworthy that the conditions which generate responsibility to help others in acute need resemble the conditions Hume cites as generating our sense of justice: "... *'tis only from selfishness and confin'd generosity of man, along with the*

scanty provision nature has made for his wants, that justice derives its origin" (1978: 495; emphasis his). Our common vulnerability to circumstances and to the "scanty provision nature has made" leads us to seek ways to protect ourselves against misfortune and error. Natural disasters occur. They may occur where I live; they may not. Prudent people will recognize that we are all more secure, and thus, better off, if we recognize a shared responsibility to assist others in acute need.

As we have suggested throughout this essay, this responsibility is all the more apparent when those in need cannot care for themselves and are in no way responsible for their plight. In short, the responsibility is greatest (and less contentious) when children are the victims. In fact, when children are in acute need, especially when many are in a position to help, there's little moral difference between the responsibility of biological parents and others. If a child is drowning, then even if the parents (or some third party) tossed the child into the pond (and are thus singularly responsible for the child's plight), we should still rescue her if we can. Likewise, if a child is starving, and her need is acute, then even if the child's parents and its government have acted irresponsibly, we should still feed the child if we can.

Arguably the problem is different if the acute need is so substantial and so widespread as to require us to make considerable sacrifices to help those in need. In this case our responsibilities *to* the children in acute need may resemble our responsibilities to children in chronic need.

Chronic Need

Acute need arises once (or at least relatively infrequently). It requires immediate action, which, if successful, often alleviates the need. But most hunger is not acute, it is chronic. Chronic hunger is the hunger of persistently malnourished children, where the causes of hunger are neither episodic nor easily removed. If the need can be met at all, it can be met only through more substantial, sustained effort, and often only by making numerous (and perhaps fundamental) institutional changes, both within our countries, and the other countries in need of aid.

That is why Singer's case is disanalogous with most world hunger. The drowning child is in acute need. Suppose, however, that Singer's fictional child lives on the edge of a pond where she is relatively unsupervised. We cannot protect this child by simply dirtying our clothes once. Rather, we must camp on the pond's edge, poised to rescue her whenever she falls or slips into the water. However, can we reasonably expect anyone to devote her entire life (or even the next 6 years) as this child's lifeguard? It is difficult to see how. The expectation seems even less appropriate if there are many children living beside the pond.

Likely the only sensible way to protect the child from harm is to relocate her away from the pond. Or perhaps we could teach her to swim. But are we responsible to make these efforts? Do we have the authority to forcibly relocate the child or to erect an impregnable fence around the pond? Can we *require* her to take

swimming lessons? Can we *force* her government to make substantial internal economic and political changes? In short, even though we are morally responsible to assist those in acute need (and especially children), we cannot straight-forwardly infer that we must assist those (even children) in chronic need.

For instance, if we try to save a child from famine, we may have reason to think that quick action will yield substantial results. Not so with chronic hunger. Since we are less likely to see the fruits of our efforts, we may be less motivated to assist. Moreover, some have argued that we can alleviate chronic need only if we exert enormous effort, over a long period of time. If so, expecting someone to respond to chronic need arguably burdens her unduly. Responsible people need not spend all their time and resources helping those in chronic need, especially if there is only a small chance of success. This is surely the insight in Arthur's view.

Consider the following analogy which illuminates that insight. Suppose an adult builds a house by the side of a river that floods every few years. After the first flood we may help them, thinking we should respond to someone who appears to be in acute need. However, after the second or third flood, we will feel it is asking too much of us to continue to help. We would probably conclude that this adult has intentionally chosen a risky lifestyle. They have made their own bed; now they must sleep in it. Although this case may well be disanalagous to the plight of starving adults – since most have little control over the weather, soil erosion, or governmental policy – nonetheless, many people in affluent nations think it is analogous.

What is indisputable, however, is the case is totally disanalogous to the plight of children. Children did not choose to live in an economically deprived country or in a country with a corrupt government. Nor can they abandon their parents and relocate in a land of plenty, or in a democratic regime. Hence, they are completely innocent – in no sense did they cause their own predicament. Moreover, they are paradigms of vulnerability.

Since they are the principal victims of chronic malnutrition, it is inappropriate to refuse to help them unless someone can show that assisting them would require an unacceptable sacrifice. That, of course, demands that we draw a line between reasonable and unreasonable sacrifice. We do not know how to draw that line. Perhaps, though, before drawing the line we should ask: if it were our child who was starving, where would we want the line to be drawn?

A Dose of Reality

Evidence suggests, however, that this whole line of inquiry is beside the point. Although it would be theoretically interesting to determine how to draw the line between reasonable and unreasonable sacrifices, this is not a determination we need make when discussing world hunger. Doomsayers like Garrett Hardin claim we have long-since crossed that line: that feeding starving children requires more than we can reasonably expect even highly responsible people to do; indeed, Hardin claims such assistance is effectively suicide (1974). However, the doomsayers are mistaken.

Current efforts to alleviate hunger have been far short of efforts which would require a substantial sacrifice from any of us. Nonetheless, even these relatively measly efforts have made a noticeable dent in the problem of world hunger. And these successes have been achieved with smaller than anticipated growth in population. According to the FAO:

> The number of chronically undernourished people in developing countries with populations exceeding 1 million is estimated at 786 million for 1988–90, reflecting a decline from 941 million in 1969–71 and a lowering of their proportion of the population from 36 to 20 percent... (FAO 1992b: 1).
>
> During the same period, the average number of calories consumed per person per day went from 2,430 to 2,700 – more than a 10% increase (FAO 1992b: 3).

Since the relatively meager efforts to assist the starving has made a noticeable dent in the incidence of world hunger, then, although enormous problems clearly remain, we have good reason to think that heightened efforts – efforts still *far* short of those requiring substantial sacrifices from the affluent – could seriously curtail, if not completely eliminate, world starvation. If so, we do not need to decide where the line should be drawn. We are still some distance from that line. Put differently, many of the world's poor are not like the unsupervised child who lives on the side of the lake. Even though their need may be chromic, their needs can be met short of the enormous efforts that would require us to camp next to the pond for the remainder of our days. To that extent, our responsibility to chronically starving children is, despite first appearances, similar to our responsibility to children in acute need.

How to Act Responsibly

Many people are already motivated to help others (and especially children) in need. Indeed, this helps explain the influence and appeal of Singer's essay more than two decades after its publication. Thus, the claim that we have a shared responsibility to meet the needs of others in acute need is psychologically plausible. Even so, it is often difficult to motivate people to respond to others in chronic need. Many in affluent nations feel or fear that aid just won't do anything more than line the pockets of charitable organizations or corrupt governments. Doubtless some money sent for aid does not reach its intended source. But that may simply reflect our inability to determine which relief agencies are most effective. Moreover, even if some aid does not reach those in need, it is even more obvious that most relief aid *does* reach its desired target. That is what the statistics cited in the last section demonstrate.

We suspect that the strongest barrier to helping those in chronic need is more psychological than philosophical: most people just don't feel any connection with someone starving half-way around the world (or, for that matter, in the ghetto across town). As Hume noted, most of us we do tend to feel more sympathy for what we see than for what we do not see. This at least partly explains why many of us are less willing to help starving children in foreign lands – we don't see them,

and thus, don't feel a tie or connection to them. As we have argued through the paper, this is the core insight in Arthur's view: moral obligations which require us to abandon what is important to us, especially in the absence of some connection with those in need, will rarely be met by many people – and thus, will make no moral difference. Someone might argue, on more abstract philosophical grounds, that we should not need that link. Perhaps that is true. But, whether we should need to feel this connection, the fact is, most people do need it. And our concern in this paper is how to help meet the needs of the children. Thus, we want to know what will *actually* motivate people to act.

Of course, just as we should not take our initial sense of responsibility *to* children as *determining* our moral obligations, neither should we put too much weight on the unanalyzed notion of "normal ties." Doing so ignores ways in which our moral feelings can be shaped for good and for ill. So perhaps the better question is not whether we have such feelings, but whether we could cultivate them in ourselves and perhaps all humanity, and, if so, whether that would be appropriate. We suspect, though, that many of us cannot develop a sense of shared responsibility for *every* person in need. More likely we must rely on a more limited sense of shared responsibility; certainly that is not beyond the psychological reach of most of us. Indeed, it is already present in many of us. Thus, working to cultivate this sense of responsibility in ourselves and others would increase the likelihood that we could curtail starvation.

Since people have a natural sympathetic response to the cry of children, the best way to cultivate this connection is to keep people focussed on children as the real victims of starvation and malnutrition. If we keep this fact firmly in the fore of our minds, we are more likely, individually and collectively to feel and act upon this sense of shared responsibility.

But even if we acknowledge this responsibility, how should we meet it? Should we provide food directly? Perhaps sometimes. But this direct approach will not solve chronic starvation. More likely we should empower the children's primary caretakers so they can feed and care for their children. To this extent our shared responsibility to hungry children is mediated by the choices and actions of others. Thus, it might be best conceptualized as akin to (although obviously not exactly like) our responsibility to provide education. Our responsibility is not to ensure that each child receives an education (although we will be bothered if a child "slips through the cracks.") Rather, our responsibility is to establish institutions which make it more likely that all will be educated. By analogy, since it is virtually impossible to feed children directly, our responsibility is not to particular children, but a responsibility to change the circumstances which make starvation likely.

Changing those circumstances might occasionally require that we be a bit heavy-handed. Perhaps such heavy-handedness is unavoidable if we wish to achieve the desired results. OXFAM, for example, provides aid to empower people in lands prone to famine and malnutrition to feed themselves and their children. If the recipients do not use the aid wisely, then OXFAM will be less likely to provide aid again. This is only a bit Draconian, but perhaps not so much as to be morally objectionable.

Conclusion

In both cases of chronic and acute need, we must remember the children who are the real victims of world hunger. The suffering child is paradigmatically vulnerable and innocent. Since we can, without serious damage to our relatively affluent lifestyles, aid these children, we should help. We share a responsibility *to* them because we are well-placed to help them, and because we can do so without substantially sacrificing our own interests. This is so even if we in *no way* caused or sustained the conditions which make their hunger likely.

However, if the stronger claim that we *caused* their starvation (or created the conditions which made their starvation more likely) can be defended – as we think it probably can – this responsibility becomes a stronger imperative. Thus, if the views of Sen, Crocker, and Balakrishnan/Narayan (all in Aiken and LaFollette 1996) are correct – and we suspect they are – then most of our responsibility is to cease supporting national and international institutions which cause and sustain conditions which make hunger likely. And *this* responsibility could be explained much more simply as a responsibility to not harm others.

We should also mention that the issue of hunger is deeply connected to the issue of animals and the environment, discussed by Varner and Russow. Here's how. According to agricultural scientist Paul Waggoner, "a vegetarian diet for 10 billion could be furnished by present agricultural production …" (1994: 15). That is, by changing our diets we could have enough food to feed not only everyone currently alive, but everyone predicted to be alive at mid-century. How could that be? Simple. Animals raised for food consume far more human edible protein than they yield. If that food went to feed humans rather than farm animals, we could quickly meet any foreseeable human demand for food. And, we could meet that demand without further damaging our environment.

Thus, although the arguments for vegetarianism and the environment are rather different from the arguments for feeding the hungry, their solutions are mutually supportive. By changing our eating habits we have a way to diminish animal and human suffering, without gobbling up more land, further polluting our rivers, cutting more trees, or destroying more plant species. Morally that is a happy coincidence.

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Chapter 9
Biotechnology

Fred Gifford

Abstract An introduction to ethical issues surrounding the nature, production, and distribution, of genetically modified crops and foods.

Keywords Ethics • Agricultural biotechnology • Genetic engineering • Foods • Crops

Case: Dr. Krista the Scientist

The next guest speaker in Dr. Wright's class is Bo Krista, a full professor of Molecular Biology on campus.

"I understand," she begins, "that you have talked about many issues this term, including animal rights, environmental ethics, and duties to the poor and hungry in the developing world. I'm here to tell you that we may have a solution to world hunger that respects animals and nature. That answer is agricultural biotechnology."

Emily sees Rich look up expectantly. Indeed, the entire class seems to be leaning forward. Doug, on the other hand seems unimpressed.

"Agricultural biotechnology may be able to produce cost-effective nutritious food in a way that does not exploit animals or farmers or the land. For example, consider the following scenario."

Dr. Krista looks around the room. "Imagine yourself fifty years from now standing in the middle of a huge antiseptic warehouse staring at rows of tan colored objects that look something like footballs. Shiny stainless steel pipes descend from the ceiling and disappear into mouth-like orifices on top of each object. Black rubber tubes are attached by suction cups to the bottoms. The only attendant in the building tells you that the pipes bring water and rations to what he calls 'the birds,'

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while the rubber tubes carry excrement and urine to a sewer beneath the floor. Every twelve hours each bird drops a no cholesterol egg onto a conveyor belt. 'Regular as clockwork,' he adds with a wink."

Dr. Krista continues. "You are staring at thousands of living egg machines, transgenic animals genetically engineered to convert feed and water into eggs more efficiently than any of their evolutionary ancestors, layer hens. The science fiction objects I am asking you to imagine are biologically descended from the germplasm of many species unrelated in nature, including humans, turkeys, and today's chickens, so the worker is not speaking in mere metaphor when he calls the objects 'birds.' But unlike today's poultry varieties, which are only treated as machines, the brave new birds I have in mind really seem to be more machine than animal. For, in coming up with the new birds, poultry scientists have not only selected for the trait of efficient conversion of feed into eggs; they have also selected for lack of responsiveness to the environment."

"The result is not a bird that is dumb or stupid, but an organism wholly lacking the ability to move or behave in dumb or stupid ways. Scientific research shows that the egg machine's complete lack of any externally observable behaviors is paralleled by its lack of physiological equipment necessary to support behavioral activity. The brain of the bird is adept at controlling the digestive and reproductive tracts, but the areas of the brain required to receive and process sensory input and initiate muscular movement have been selected against, bred away. The new bird not only has no eyes, no ears, no nose, and no nerve endings in its skin; it has no ability to perceive or respond to any information it might receive if it had eyes, ears, or a nose."

Doug raises his hand.

"That seems pretty unlikely," he says. "And, speaking as a dairy farmer who loves to see calves chasing each other around in the pasture, pretty disgusting, too."

"You're right," answers Dr. Krista. "The organism I have just described is a philosopher's fantasy, inspired by a remark of Bernard Rollin's, and it has a big 'yuck' factor attached to it. I have never heard a poultry scientist or agbiotech enthusiast describe anything like it as a viable goal at which agricultural genetic engineers should aim. But why not? Are the moralists ahead of the gene-splicers here? Suppose that a team of poultry scientists sees possibilities in the idea. Should we find them some funds, set them up in a lab, and encourage them to get to work?"

Rich makes a fist and murmurs "yes!"

Doug rolls his eyes.

Case: Discussion Questions

1. For the moment, forget your doubts about whether it is possible to make transgenic egg machines. The immediate question you must answer is very specific: Do you think Dr. Krista is right to assume that egg machines might be a good idea from a moral point of view? Who would be the affected stakeholders? Write down as many individuals as you can. Be prepared to defend your answer.

2. If Krista's factual assumptions are correct that the egg machines are feasible and they would lack any feelings or consciousness, should we adopt public policies that would provide poultry breeders with funds to engage in molecular engineering with the goal of producing nonsentient animal-derived organisms capable of producing industrial quantities of foods? Who might benefit from this policy? Who might lose?
3. Do you find the imaginary scene in the warehouse repulsive? If so, why? If not, why not? What role do you think our emotions should play in deciding which agricultural vision to pursue?
4. Do you find the imaginary scene in the warehouse scary? Do you think poultry gene splicers are "playing God" with nature in a way that may be objectionable on theological grounds? Do you think it is morally impermissible to make transgenic animals at all? If so, why? If not, why not? What role do you think religious beliefs should play in secular discussions of ethics and public policy?
5. Who should own the products of genetic engineering? The communities of the women farmers in developing countries that hand selected chickens for breeding over hundreds of years? The corporations that invest millions in research to change a gene or two, patent the product, and then sell it? The governments that sponsor the basic research at universities on which the private sector builds its applied research? The taxpayers who fund the government's basic research? How should our basic social institutions be set up so that all stakeholders benefit fairly?

Discussion

Introduction

Dr. Krista's futuristic farm vision of a warehouse full of bird-like machines (or machine-like birds) evokes in many of us an emotional, visceral reaction. Something seems morally askew here; something is not quite right. And yet, as we shall see, it is not easy to pinpoint what is so objectionable.

These Egg Machines, or football birds, are science fiction, but agricultural biotechnology is not. Ag biotech is made up of a broad set of technologies and industries. At its heart are the techniques of recombinant DNA, or genetic engineering. These techniques enable the transfer of genetic material between organisms, whether microbes, plants or animals. And such transfers, in turn, make possible changes that are much more substantial and precise than those made with traditional breeding methods.

The kind of agricultural biotechnology products already developed include tomatoes with increased shelf-life, herbicide-resistant soybeans, insect-resistant corn, ice-minus bacteria to help prevent frost formation on crop plants, and a synthetic version of bovine growth hormone. Proponents claim that these and other products – crops which are resistant to pests and drought, or require less fertilizer

– will aid in addressing a whole range of agricultural problems, thereby increasing agricultural productivity and helping to feed the world's hungry.

Critics object that this whole enterprise involves "tampering with nature" in a way that may have unanticipated consequences: engineered microorganisms may escape into the environment, genes for herbicide resistance may get transferred to weedy relatives of the genetically modified crops, or there may be serious negative economic impacts on small farms or developing nations. Some criticize particular products as being motivated purely by commercial concerns, rather than by the desire to enhance the public good. This is said, for instance, of such products as crops with sterile seeds, which make it impossible for farmers to collect the seeds from their crops for the following year (Service 1998). Some critics give more prominence to such notions as "tampering with nature", or to "in principle" arguments that genetic engineering is "inherently" wrong. For all these reasons, biotechnology, including its application to agriculture, often provokes strong emotional reactions.

In what follows, we will explore various of these criticisms and try to evaluate whether they provide us with good reasons. We begin by describing a traditional set of issues concerning the evaluation of the costs and benefits of ag biotech.

But the case of the Egg Machines described above suggests another point of view, so a consideration of this will lead us to consider various in principle arguments. Finally, we will examine some questions about ownership and patenting that will lead us to consider yet further issues, including those of global justice.

Technology Assessment of Biotechnology

Technologies are often assessed in terms of "cost/benefit analysis", where we assess alternative actions in terms of the overall positive and negative consequences that are expected to ensue from them. Let us apply this to ag biotech.

Since it is a general and powerful tool for making changes in agricultural organisms, biotechnology will have impacts on all of agriculture and everything that agriculture affects. Thus the ethical issues to be addressed cover a broad range. Sometimes ethical concern focuses on environmental effects. Sometimes it focuses instead (or in addition) on economic impacts, such as those on small farms or on developing nations. Concerns are also sometimes raised over the safety of the food produced. And, in the case of animal biotechnology, questions are asked about whether the genetic changes could compromise the animals' health or cause them to suffer. There are many things to be said about each of these sorts of consequences and the ethical and policy issues they generate. Several of these have been addressed in earlier chapters.

The case of bovine somatotropin (BST) (or bovine growth hormone) can be used to illustrate the broad range of consequences involved. It also illustrates how ag biotech includes different sorts of techniques. For this case differs from the others mentioned above in that it does not involve creating an organism which has had

genetic material from some other type of organism inserted into its DNA. Rather, genetic engineering is used to create a synthetic version of a naturally occurring hormone, and this hormone is injected into cows in order to increase their milk yield. In the controversy that emerged as BST was being introduced, there was discussion of a broader set of consequences beyond increase in milk yield: that the farm price of milk would decrease, that a number of dairy farmers will be forced into bankruptcy, having an effect on rural America generally, but also shifting the dairy industry to the Southwest, that the dairy industry that resulted might be more efficient, that consumer milk prices would go down (Comstock 1989; Shulman 1989). Some claimed that there would be effects on the health of the cows (mastitis due to increased milk production), and further that this could have a detrimental effect on the quality of the milk (due to the possibility of increased amounts of antibiotics).

Analogous stories can be told in other cases. Consider a few of the possible consequences of herbicide resistant crops (Reiss and Straughan 1996). One important effect is that on the amount of herbicide used, and this has been controversial (Krimsky and Wrubel 1998). Some say it will increase use of those herbicides, with bad consequences for both worker safety and the environment. But others point out that we will be able to use *safer* herbicides as a result, and hence the consequences in these areas will be positive. A different concern is that mentioned earlier: that the genes for herbicide resistance might get transferred to weedy relatives of the genetically modified crops, as a result of naturally occurring gene transfer between plants (Reiss and Straughan 1996, pp. 142, 147). Finally, farmers will have to buy as a package the herbicide and the variety of seed created specifically for that herbicide, constraining their choices about how to farm.

Note that the consequences that need to be evaluated include both *direct* ones on the product, more *indirect* ones on our lives as consumers, and *side effects* on the methods of production and the ability of certain groups of farmers to make a profit or stay in business. Clearly a number of different consequences have to be weighed against each other. (For instance: do gains in productivity or economic prosperity outweigh the fact that there is a certain chance of ecological damage?) This prompts us to think about this in terms of a cost/benefit framework, a way of thinking which has a rationale in utilitarianism. Utilitarianism is a common starting point in discussions of ethical theory. Moral concerns surely have at least substantially to do with the *consequences* of our actions. According to utilitarianism (or, more broadly, consequentialism[1]), *all* moral considerations are solely a matter of the consequences of the action. For a utilitarian, we morally ought to do that which brings about the greatest good (or the greatest balance of good consequences over bad consequences) for the greatest number of people. Some utilitarians broaden this framework to include the welfare of other sentient animals in the calculation as

[1] Utilitarianism gets defined in different ways, sometimes including a particular view of what good is to be maximized. The main point for us in this chapter concerns consequentialism, the claim that right and wrong actions are to be defined in terms of the consequences of those actions.

well, since these creatures can also experience pleasure and pain. Other utilitarians expand the boundaries even further, to include other inherently valuable states of the world, such as those in which there is a diversity of species and ecosystems. But in all cases, the core of utilitarianism is that all that matters in morality is maximizing good consequences.

This is not to say that this will give us a simple and straightforward algorithm for generating the answer to what we should do. There are serious difficulties – both practical and conceptual – with carrying out such an evaluation. Sometimes these difficulties are used to challenge cost/benefit analysis as an appropriate method for assessing what we ought, all things considered, to do. First, we need to be able to assess various factual claims: the potential outcomes (e.g., that herbicide resistance will be transferred to weedy relatives, or that there will be a negative effect on human health) and the probabilities of each such outcome. These facts may be hard to assemble and even harder to assess objectively.

As a result, a central theme in discussions of biotechnology is scientific controversy and how properly to deal with this. Different scientific experts may not come to a consensus as to what the facts are. Even if most of those in the scientific community *do* come to such a consensus, there may remain skepticism by outsiders. For example, there was a consensus amongst essentially all of the scientific community that BST was safe (NIH Technology Assessment Conference Statement on Bovine Somatotropin 1991), but this did not prevent continued public concern.

Second, we must be able to assess the values associated with each outcome – how good or bad that outcome would be, compared with other outcomes – and ultimately we must assess on a common scale such things as the extent of environmental damage, the increase in overall crop yield, and the change in product quality. Even if this is possible in principle, as a practical matter there is a tendency to focus only on those aspects of the consequences which are readily measurable; this can overrate the importance of such considerations as productivity and economic consequences.

Distributive Justice. Note that the consequences in our examples above included not only those for *overall* production and overall quality of life of consumers, but also for *distribution* of risks and benefits. Should we say that it is acceptable that many small farmers will go bankrupt, on the grounds that overall production is maximized? This prompts many people to deny that we should in fact use utilitarianism as a moral standard, for this only concerns itself directly with *overall* good. They have the moral intuition that what matters morally is not just how much good is produced, but how that good is distributed; they think that there ought to be a more equal distribution of welfare. As a result, they say that, at the very least, we need to add another moral principle along side utilitarianism, such as a principle of equality, or a principle which tells us to reduce the gap between the rich and the poor as much as possible. Or they might adopt John Rawls' social contract theory, which says that the most just society is the one which treats its least well-off members as well as possible (Rawls 1971). We will return to the question of distributive justice at the end of the chapter.

Another ethical question to ask is: What is the appropriate kind and degree of *public involvement* in assessments about biotechnology? For it might be said that people have a right to consent, through some sort of democratic process, to actions that will have a profound effect on their lives (Kline 1989).

We have now mentioned three different general moral views or principles: (1) that utility, or welfare should be maximized for the whole, (2) that goods should be distributed fairly (for example, that there should be a concern not to allow too great an inequality), and (3) that people should have some say over technologies that have a major impact on their lives.

Sometimes there may be conflicts between these three principles, so it might be thought that we can't make moral judgments until we have decided which is the correct principle. But it's worth noting that when people criticize a given biotechnology, they often give reasons to believe that *none* of these principles is satisfied. For instance, they may suggest that there may be harm to our common environment, while profit will go to a few in a way that neither maximizes overall utility nor allows a just distribution of welfare, and that the technology would not be chosen by the people affected if they were told the facts. Similarly, arguments *for* a biotechnology often claim that its introduction will bring about benefits in a broad-based way. Proponents often emphasize products or innovations that could prevent world hunger, or keep food prices low; this helps *a lot* of people, and it helps the *least well-off* people.

Still, whichever of these principles we utilize, our moral assessment is likely to have to do with the assessment of consequences of the technology.

Egg Machines

> "I agree with all this", says Emily. You're making a lot of interesting points about how to think about whether developing or introducing a technology is a good idea, or how we might argue for or against it. I can think of a lot of cases where this would help me think about that. But my reaction to these Egg Machine doesn't seem to have to do with any of these things."

We might describe Emily's idea here by saying that the case seems to be constructed in such a way that these concerns cannot be what are driving our intuitions. Here is why. The Egg Machines don't appear to present a threat to the environment. No doubt there would be economic impacts, but what these are is so completely unclear that this cannot be what is brought to mind here. The main issue might *seem* to be the way the "animals" are treated, but in fact there is no harm to the animals, for there is no conscious experience of pain or stress. Indeed, the suggestion is that the use of Egg Machines is a great improvement over our present conduct in this regard. So just what could be wrong about it?

Yet we may find the prospect of these inert, unfeeling "Football Birds" quite disturbing, distasteful, repugnant, and "creepy". Our reaction may be even more intense if we fill out the thought-experiment and imagine this practice on a *large*

scale, if we imagine that we have transformed our egg production to be done almost exclusively in this manner, or perhaps even that something analogous occurs for *all* of our animal food production.

Some may decide, on the basis of such reflection, not to go down such a road. But since it is hard to say exactly why Dr. Krista's vision involves any sort of *moral* wrong, one is challenged to explain what could be the basis of one's moral intuition here. One is challenged to answer the charge that one's intuition is a mere emotional reaction, an irrational prejudice.

Why Even Consider This Kind of Case?

> "But this case isn't real," says Doug. "This sort of thing isn't going to help to feed the world's hungry. But there's nothing to worry about, either. It'll never happen."

Now, this scenario is indeed quite a strange one, and while the vivid image may make it seem interesting or even powerful, this might also be thought to be a problem – a symptom that this line of thought will simply get us off track in our attempt to think about ethics and biotechnology. In particular, it will be said that this example is simply too unrealistic or "sci fi", or too different from the actual cases of biotechnological innovations being introduced at present.

First, it will be said, we have no reason to believe that this particular technology will be developed by anyone. We don't even know at this point whether this would be technically feasible. Second, even if it is admitted that something like this might occur someday, it's too unlike present reality for us to have clear intuitions about it, so our moral intuitions – our intuitive judgments about the moral acceptability of the practice, based simply on our confronting it in our own minds – will only be misleading. Finally, it will be said that focusing our attention on this sort of case distorts our view of biotechnology by making us think that this is the sort of thing biotechnology usually is, when in fact it is not. One consequence of this might be less attention paid to the more immediate and real challenges posed by biotechnology.

These are important points, and they must not be lost sight of. Still, there are several reasons not to simply dismiss the case. First, it doesn't seem to be wise counsel to wait until a technology is upon us before considering whether to bring it about. It is often pointed out that in the case of biotechnology, we thankfully have the opportunity to reflect on these moral issues early on before we are too far along, unlike our predicament with the power of the atom. And while we should surely keep the speculative nature of our thinking in mind, it may nevertheless be a quite useful thought experiment to reflect on cases that are in some ways extreme. After all, if we only consider such cases as new crops with one or two altered genes to improve on one or two traits, such as shelf life or pest resistance, we might not adequately anticipate or comprehend the cumulative effect of many such products added to each other year after year.

Finally, it may be worth exploring our attitudes and our reasoning with respect to such cases as this, for it illustrates in a vivid way a more general phenomenon.

The sorts of not easily expressed concerns that are evoked here play a role in discussions of biotechnology more broadly, whether they be about the patenting of life, or of living things or animals, or of human genes, or about cloning or other artificial modes of reproduction, or just about altering genes at all. Polls over the years have shown many members of the general public to be uncomfortable about biotechnology (Hoban and Kendall 1992; Lee et al. 1985). Biotechnology as a whole tends to evoke deep concern or fear. We need to think about this carefully.

Things That Could Be Wrong About the Egg Machines, and Sources of Moral Concern

So, suppose that coming "face to face" with a roomful of Football Birds arouses strong feelings and leaves us with the intuition that it is the wrong thing to do, that we should not go there. What could it be that we are doing in creating and using these Birds that might be picked out as of moral concern? Here are some candidates:

- We are mixing genes from different species. Indeed
- We are mixing *human* genes with those of other species
- We are creating a "species" that did not exist before
- We are creating a living entity specifically so that it will have a diminished capacity
- We are blurring the line between animal and machine, or we are treating the animals as machines

While these concerns might all come to mind together, or in rapid succession, they are nevertheless distinct from one another. When we look deeper, we may find quite different sorts of concerns or rationales underlying them. And we might decide that some are more significant than others. Mixing genes from different species (creating transgenic organisms) is common in biotechnology; this is done in the products already brought to market. But to do this with *human* genes might raise the level of moral concern. And to create a "species" that did not exist before raises still further questions. The blurring of animal and machine perhaps takes us in yet another direction.

Do any of these things count as reasons to object to this practice from the moral point of view? What sort of argument could be given, what sort of moral principle could be cited, to ground claims such as "It is wrong to mix human genes with those of other species", or "It is wrong to blur the distinction between animals and machines"?

Some might say that it's just obviously wrong; you don't need to say anything more. But others might claim that they don't find anything wrong here. So one has a responsibility to try to say more than this.

Here are some further rationales that might be cited as underlying our concern about such things:

- It is "playing God".
- It is *unnatural*, or it involves interfering with Nature.
- It involves crossing species *boundaries*.
- It does not exhibit proper respect for life, or, it is sometimes said, it does not respect the *telos* of the animals or the integrity of species.
- It "commodifies" life.
- It involves a *reductionistic*, *mechanistic* view of living things or of nature.

These purported moral considerations share a number of features.

First, on the face of it, they are distinct from "consequentialist" considerations, the sorts of considerations that were cited in relation to BST and herbicide resistant crops above. Apparently the Egg Machine practice is being said to be *inherently* wrong, an assessment to be made *independently* of consequences. They can be called "intrinsic" concerns, as contrasted with "extrinsic" or consequentialist concerns (Reiss and Straughan 1996, Chapter 3).

It might be thought that any inherent or in principle consideration cannot be reasonable, because morality is more complicated and nuanced than that. But note that to say that something is inherently wrong, wrong "independent of the consequences", need not mean that it cannot be done "*whatever* the consequences". It is to say that at least part of the reason the action is wrong is not due to the bad consequences that will ensue, but due to the very kind of act involved. For example, we sometimes say that lying is wrong *per se* – because of the kind of act that it is, not simply due to bad consequences which are likely to occur. And yet we might hold that if the consequences were weighty enough, they could override this.

So the person who is disturbed by and thus questions Egg Machines or mixing genes from humans and other species need not be saying that it should be forbidden even if it were important or necessary for creating a sufficient amount of nutritious food while avoiding the problems of harm to animals. Rather, they might only be saying that there are some real considerations against it which should be taken seriously, so that one should only do it if the potential gain is important and not well achievable in some other way.

A second feature of all these rationales is that some will be skeptical about whether they should really count as genuine moral concerns, or as a reasonable justification.

This doubt may arise in part due to the *kinds* of rationales or sources for the view. This might be said of a rationale which is religious (or quasi-religious), as in the case of Playing God. And there is a similar worry arising from the fact of being based on emotion or intuition.

Further skepticism arises from these principles being somewhat vague, metaphorical, and difficult to grasp completely or state precisely, or their being open to alternative interpretations. As we shall see, this makes them difficult to evaluate. And yet, for all this, we may not be comfortable simply dismissing them as having no force at all.

Finally, note that another feature shared by each of these rationales is that they seem to apply to a broad range of biotechnologies – not just the Egg Machines.

I will say some things about each of these things as we go along, as I consider several of the above candidate rationales.

Unnatural

> "Well, yes, I guess that one of the things that strikes me about these Egg Machines is that it's so unnatural. The natural thing is to have a bunch of chickens running around and laying eggs."
>
> "This is definitely the sort of thing that would not occur in nature," agrees Doug.

Let us consider this claim of unnaturalness. This can be put as the claim that we are creating some product that is "unnatural" (the Football Birds), and that we shouldn't do this. Or sometimes it can be put as the claim about the *process* – that we should not *interfere* with Nature. Doing things naturally can seem like a good idea. And it may seem reasonable enough to say that the Egg Machines are unnatural. But what exactly is being said? What is it we are doing when we are carrying out an unnatural intervention? One interpretation that makes some intuitive sense is that we are making some change in the world that could not have occurred without the intervention of humans. When humans do not interfere, the world goes on naturally.

But this makes building and using cars and airplanes and selective breeding count as unnatural as well. Yet we are not even tempted to say that there is anything wrong about these things; nor are we likely to call them unnatural. On the face of it, we have a counterexample to our principle, an implication of our principle that we cannot accept. If *this* is what 'unnatural' means, then we simply cannot possibly avoid doing unnatural things, and hence it can't be *wrong* to do them.

So, how can this be responded to? Why should these things (planes and selective breeding) *not* count as unnatural? Well, perhaps, because it's actually very much the nature of humans to invent new sorts of entities like this. Technology is natural to humans. It's statistically normal. It might even be said to be what distinguishes humans from other species. Further, it presumably has been adaptive for our species, and it appears to arise "naturally" out of our very human qualities of curiosity and intelligence.

But then, is there any reason to deny that more high tech endeavors, such as genetic engineering, and even Egg Machines, will be natural as well?

In response, one is still likely to say that *this* isn't what we meant by 'natural' or 'unnatural'. We had in mind some more specific sense of 'natural' in which building cars and planes (and carrying out selective breeding) would be natural, whereas the Egg Machines would not. After all, surely there is something to the difference between small-scale sustainable organic farms and Egg Machines. And if the above definition ignores this, then there must be some other way to make the distinction.

But it is very difficult to make this out. And if we cannot give a principled distinction, then we will worry that this is mere prejudice, disguising a value judgment

as a factual claim. The worry is that we first make a judgment that the Egg Machines are bad, and then, on the basis of this judgment, we label them 'unnatural'. But this is unfair, because the assessment of its being unnatural was supposed to be the justification for the claim that it was bad. One wonders whether 'natural' here just means the way we are *supposed* to farm (or *used* to farm). It is not at all clear that we can give a definition of natural that will show why Egg Machines stand out as unnatural.

In any case, note that most of what has been considered so far is whether a line can be drawn, between natural and unnatural, in a way that fits our intuitions. But even if we were able to give a clear definition of what counted as natural and what not, it would not follow that we had picked out something good or bad. Why is the natural thing good? Indeed, *are* natural things necessarily good? Consider earthquakes, small pox, or deer flies.

One answer might be that the unnatural thing had a greater likelihood of leading to bad consequences. This has certainly been a common theme concerning high tech innovations. Of course, this is an extrinsic, or consequentialist, reason. And the idea here was to uncover intrinsic considerations. But let's leave that aside for now. Perhaps what underlies the intuitive negative reaction to things that don't seem natural is in fact the fear that this is more likely to be dangerous. And if being unnatural were a good predictor of being harmful or dangerous, we might have succeeded in uncovering what is operating here. But in fact it doesn't seem to be that good a predictor. For lots of (intuitively) natural things can be dangerous (earthquakes, small pox). Still, it might be argued that there is a *greater uncertainty* about unanticipated consequences when something is unnatural in the sense of new and untried.

In any case, insofar as the real issue is "significant likelihood of unanticipated consequences", then we should say that that is the issue, and make our evaluations in those terms: Will Egg Machines have unanticipated consequences? Throwing in the term "natural" appears only to confuse things. And there is a worry that "natural" simply gets used as a general statement of praise, and "unnatural" as a general sort of condemnation.

So it is quite questionable whether we can use the term 'unnatural' to criticize such things as the creation of new species or the mixing of human genes and genes from other species. For given the unclear meaning of 'natural', it doesn't seem that it can be used to make the distinction clearly and in the right place, and it is not clear what is bad about being unnatural.

Factories and Telos

> Doug says, "What's wrong here, in my opinion, is that the Egg Machine system treats animals as factories". Emily agrees. "Yes, that's something more specific than whether it's natural or not. I think that maybe that's what's more unique to what we're doing in this case."

Now, to say that "We should not treat animals as factories (or perhaps as machines)" might seem to have a certain proper moral ring to it. It suggests that we

should properly respect our fellow creatures. And it seems like a less all-encompassing critique than that it's "unnatural", so perhaps it can avoid the problems of that view.

But can we hold such a principle, and expect it to help us make judgments? Just as in the case of "natural", we need to consider each of two challenges. First, can we accept the whole set of implications of this principle, or are there "counterexamples"? (For instance, are there cases which we are clear are morally acceptable even though the principle forbids them?) Second, is it really clear what advice the principle provides, or does it end up being too vague or ambiguous?

There do indeed seem to be counterexamples to the "don't treat animals as factories" principle. For don't we already treat many animals as factories? Isn't this a correct description even of our use of dairy cows? Or, indeed, of all of our raising of animals for products for food and clothing? Is there any way to avoid treating animals as machines?

> Emily: "Yes, we use animals this way, but I'm not sure we should use animals this way. The arguments from the defenders of animals are starting to convince me. We can get all the food and other products that we need from plants."
>
> Dr. Krista: "But isn't the reason that it's OK to treat plants this way that they lack consciousness, so that the process can't cause them suffering?"
>
> Emily: "I guess I still don't think you should treat animals as plants."

It might be objected that the sort of thing that goes on with raising milk cows, etc. is not necessarily wrong because farmers treat their animals with proper respect. If all farmers were like Doug, and shared his attitudes toward animals, then farming would not necessarily involve viewing animals as machines, or as factories.

We are raising some important questions about character, about the kinds of attitudes we ought to take towards animals. This is important, but it might be said to be a separate issue from what particular technology to use. For instance, consider this question: might it be possible for our tender of the Birds to take the right attitude towards *them*, and would this then solve the problem?

Or it might be argued that, with the move to large-scale agribusiness, we have for the most part already lost the ability to have this right attitude. Thus, it might be argued, this particular technology is not really going to make a significant difference in this regard.

Can we say what would be *wrong* with treating the Football Birds as factories? After all, the so-called Birds are unconscious. It is sometimes said that there are certain ways an animal ought to be treated – because of its nature or "telos" (Fox 1990; Rollin 1995). As an analogy, human beings, given their telos or nature, should (according to Kant) be treated as autonomous beings; it's wrong to treat them as mere means to an end and not at the same time as ends in themselves. And the reasons one must do this are quite independent of the consequences of doing so. Other animals don't need to be treated with *that* kind of respect, but there is such a thing as treating them inappropriately given the kind of entity they are, so the claim goes.

Of course, one problem here is whether there is such a thing as a telos that really gives us a reason to treat them a certain way. We will not take this up here. But there is a special problem for using this rationale in thinking about the Egg Machines. Consider: Even in the case of "unmodified" species of animals (and we are stretching it to call domesticated animals unmodified), it is not clear how we are to show that a certain way of treating them is the right way (leaving aside pain and suffering). But there is yet another difficulty in applying this to a Football Bird. It would be one thing if we had anesthetized the organism or even made it unconscious. We might then say that it is not expressing *its* telos. But the situation here is different. For here it seems that we have *simply created a new kind of organism entirely*, and it is not clear why we should say it has the same telos. Perhaps it has *no* telos, perhaps it has a different telos, but if the latter, on what grounds can we say that it is not expressed here? So it is unclear how this helps us ground the claim that there is some particular way it ought to be treated.

One might conclude that the issue is not one of how we may treat certain animals, but of whether we may *create* certain kinds of entities, whether we may make "plants" (or mere unconscious factories) out of animals, create vegetative beings out of the raw materials of animals. Some may have the intuition that it is wrong, intrinsically, to change the telos or nature of the animal. But I am not sure we have yet been provided with a sound argument to justify this intuition.

The Environmentalist Analogy (and "Stewardship")

The general difficulties here bear some resemblance to some general dilemmas environmentalists face when they make claims about our moral obligations concerning the environment. In that context, we may have intuitions that such entities as plants and species and ecosystems (even the "Land" (Leopold 1949)) ought to be preserved (or respected, or held to be valuable) for reasons over and above their instrumental value to human beings. And yet these entities have no consciousness and thus cannot be made to experience harm. So perhaps our problem here could be amenable to solutions designed for the environmental case.

Many hold that we should in fact preserve the environment – and not just for instrumentalist reasons – even though it is somewhat unclear what the basis is for this obligation. Sometimes this obligation is seen as arising from "stewardship": we ought to act as a steward of the living world, of the species of our planet. But the general point can be made here even if we don't think about it in terms of stewardship. Just suppose we find some analogous reason or justification for an obligation toward the environment. If we find this reasonable, perhaps something analogous can be said concerning our question concerning Egg Machines.

But there are various problems with any such approach. First, and most generally, there is a problem of specifying *just what counts as* stewardship here, or just what our obligations are here. (How strong is our obligation to preserve other species when this is weighed against other things, such as other usages for a given area of land?) And if we cannot do this, it is hard to see how we could show that this responsibility would apply to the Egg Machine case, or any other particular

case. But second, there is a more specific problem for our use of this analogy: the "stewardship of our natural resources" approach is presumably a way of grounding preservation, and yet this is not really what is at stake here. For again, we are talking about *creating* a *new* species, not destroying an already present one.

Of course, one might imagine that the agricultural species are only in existence because of their continued use for human consumption; we might well not continue them if we don't need them any more. So perhaps there *is* an issue of preservation. On the other hand, this might also be a consequence if we all became vegetarian. In any case, it is not necessary that we terminate those original species in order to create the Football Birds, so, ultimately, it's a separate question.

It appears that neither the stewardship concept nor the environmental analogy will apply to our case in a straightforward way.

Religious Concerns

> "So maybe it really comes down to something religious", says another classmate. "Creating these new kinds of creatures does seem like 'Playing God.' "
>
> Emily interrupts: "But so many things get called 'playing God'."
>
> "But does that mean it's not important?"

It was said above that several of these concerns seem to have their source in religious views. The most obvious is "Playing God", but this can be said of others as well. For example, if someone says that the making of Egg Machines doesn't properly respect life, this might be interpreted as there being something *sacred* about life. And the species boundaries which we are not to cross might be seen as laid down by God.

It is worth mentioning that polls show that members of the public do indeed express religious concerns about biotechnology (Hoban and Kendall 1992). Of course, the religious basis might explain the depth of feeling involved here.

But moral objections or concerns based on religious views are often criticized for a variety of reasons. For some, of course, one reason for this would be that they don't believe that there *is* a God, or at least that they are not confident about this. But all must accept the following reason: we in fact live in a pluralistic society, with different people having different religions and some people having no religion at all. Therefore one cannot rely on such arguments to reason in a way that all will agree with. As a result, it seems that those who put forth such concerns may need to recast them as secular or perhaps consequentialist.

Playing God

Let us consider first the case of Playing God. This issue is sometimes understood in terms of the claim that we are trying to "improve on God's creation". One can read this in such a way that it sounds sacrilegious, and thus the principle appears to

be a profound one. Yet it might be objected that the pronouncement that we should not improve on God's creation will imply that we shouldn't engage in *any* technology. Surely this is not what is intended. So why is changing God's biological creation different? And why is selective breeding different? Is there any principled answer to this? For instance, could one find such an answer by examining scripture? At present, we don't have agreement on what would count as Playing God, or how to find out.

An important worry here is that appeal to this claim will function to cut off debate (not just in society, but also for oneself). For one thing, we are loathe to question publically the religious beliefs of others. Further, a phrase such as "playing God" is metaphorical and ambiguous (as is the term 'natural'). As a result, such claims tend not to get pushed further, and thus some might be skeptical of such considerations, taking them not to be fully thought through, not subjected to critical reason, and difficult to elaborate further.

Still, one can be left with the feeling that there may be something very profound or important concerning this and other seemingly religious concerns, and that perhaps they should not be dismissed. It may be worth noting that Bernard Rollin, in discussing this sort of issue, quotes John Dewey as saying that "putatively religious concerns may well be metaphorical ways of expressing social moral concerns for which no other ready language exists." (Rollin 1995, p. 24, cf. 2). Perhaps over time, as a result of critical discussion, we might come to see that there *is* a rational and generally communicable basis for them. But others may say: perhaps not.

Boundaries

> Emily suggests a different tactic. "OK. Let's not put our argument in terms of playing God. How about the idea that we should not "cross species boundaries"? That seems more specific, so maybe it will be more helpful. Is there anything wrong with *that* principle?"
>
> Krista: So our question, I take it, is whether we can appeal to this as a reasonable general moral principle. It will have to explain why the Egg Machine practice is wrong, and it must not forbid activities which we are pretty sure are perfectly acceptable."

First, actually, we will have to clarify the nature of the claim: the nature of these boundaries, how we know they are there, and what their significance would be. Different people claiming that "we shouldn't cross species boundaries" might have different things in mind. We must be sure not to run them together.

One contrast is the following: There are two different kinds of things one can mean by "crossing species boundaries": First: taking genes from one species and putting it into the DNA of another (moving genes across species lines). Second: creating a new species in what might be called the "gaps in phenotypic space", creating a new type of individual that might share some properties of each of two or more species, but that is significantly different from any one of them. The former is commonplace in genetic engineering, while the latter is not. And the Egg Machines involve both.

It is important to keep this distinction in mind. For instance, suppose one succeeds in generating an argument that moving genes across species lines is intrinsically wrong, that boundaries should not be crossed in this sense. Then those who don't see transgenic animals *per se* as posing a problem, but do worry about the Egg Machines, will see the line as drawn in the wrong place.

The other important ambiguity about what is meant by crossing species boundaries is this: The objector might say that there are boundaries placed there by God. This would of course require an explicit religion-based view; this then inherits the problems of a religious-based view in that context, including that of there being no way to debate it in the society as a whole. On the other hand, one might instead offer a more scientific version of this, saying that there are boundaries established by evolution (Shulman 1989).

As long as the issue is put in terms of a factual or scientific claim about what evolution has wrought, we can look more carefully at the facts involved. Actually, there are various natural processes whereby genes have always been transferring between very closely related species; this was the basis of the concern referred to above concerning herbicide resistant crops, where, due to hybridization, genes could possibly spread to the weedy relatives of the target crop. Now, the question of whether evolution has erected a complete and absolute barrier to gene flow across species is complicated somewhat by disagreement about just where species lines are to be drawn. But on any definition of species, there is very little such transfer.

So some might argue that there is not an absolute, impermeable wall there, but that there is still in this sense an objective barrier out there in the world. Similarly, it's an objective fact that there are between most species a significant distance in phenotypic space; most species don't completely gradually fade into one another.

But what do these scientific facts tell us about what we should do? What is the argument that these are boundaries not to be crossed, rather than spaces to be filled in? It is not clear what this could be, except for the claim that as a matter of fact, it could be a dangerous thing to do, due to the consequences that might result, or perhaps the fact that we simply don't know what the consequences would be. And, as in the case of the argument from unnaturalness, it would be more honest to say that and try to evaluate it on those terms.

The Role of Emotion

> "So, I'm drawn back to this idea you mentioned at the beginning that our reaction to the case is a mere emotional reaction. What does this mean? I think we rely on emotion when we judge what's morally right. I'm not sure that's a bad thing."

Let us explore this. Suppose we were confronted with *conscious* organisms strapped to tubes and otherwise like the Egg Machines. Noting the sort of existence we would be subjecting these beings to, surely we would see this as a serious moral wrong, and no doubt this would be attended by an emotional reaction or revulsion.

But these reasons don't apply to the Football Birds. There's nobody home. If we nevertheless have an emotional reaction, if we still have moral intuitions against doing this sort of thing, this might be said to be simply a sort of "carry over": the reaction is due to the case being *similar* in various ways to the cases described above which *are* morally problematic. But since the features that make those cases morally problematic are exactly what are missing from the Egg Machine case, the carry over is *merely* psychological and we should not give credence to it. It is a confusion in our reasoning, resting on a mistake. (Note that we can say that this is a mistake even if we think that it's a good and healthy thing that we have this emotional reaction.)

Now, it should be pointed out that, actually, to assess this as merely psychological begs the question. The Egg Machine opponent can simply say that, while the "animal welfare" features have been eliminated from the case (and hence it is *less* disturbing), there remain other things wrong or worrisome about it. (The challenge, again, is to say what.)

Nevertheless, our skeptic might push further, arguing that emotion should be viewed as something that *gets in the way of* good moral reasoning, by distorting our judgment. Now, there are certainly emotional and intuitive judgments that we need to discount. For example, some people have visceral reactions to people who are very different from them. We don't want to say that there must be something to their moral view that these other people should be treated badly or as inferior.

Still, it might be thought that we should listen to our feelings or impulses, other things being equal, for they appear often to be informative. If we have an emotional reaction to seeing starving people or tortured animals, and we are moved to believe that something should be done about it, this seems perfectly appropriate and we shouldn't feel a need to squelch those feelings. Emotions play an important part in morality.[2]

Perhaps the appropriate view is that we should take an emotional or intuitive reaction only as a starting point, or as suggestive of something to explore further. We surely must be willing to overrule such a reaction if there are good reasons to, but it doesn't follow that it has no merit in general. Yes, we should feel obligated to look for some further rationale that can be shared in an open and rational discussion, but perhaps we should not give up too soon.

But there is another challenge to the use of our emotional reaction. Consider a different kind of "case". Suppose the proposal for a further way to cost-effectively produce the nutritious food was not Egg Machines, but instead the creation of food stuff via a process that was a much more radical shift away from the whole or flourishing animal – the creation of food stuff in a high-tech tissue culture (altering the nutritional content in whatever way we want). And, to make the case otherwise parallel, suppose we will again include in this tissue culture genetic material from a number of higher vertebrates, including humans.

[2] It is sometimes said that all there is to morality is expression of emotion. This is not at all what is being suggested here. (Cf. Rachels 1990, Ch. 3 on subjectivism and emotivism.)

Now, in neither this Tissue Culture case nor the Egg Machine case is there any consciousness to worry about. But in the Egg Machine case, perhaps because there presumably are physical reminders of what particular higher vertebrates are involved, there is more of a tendency to see a "distorted telos", whereas the Tissue Culture case involves processes so far removed from the normal cases (for example, chickens) that we don't worry about it, or don't have the same emotional reaction.

And yet the presence or absence of feathers or recognizable body parts in the one case doesn't seem to be morally relevant. It thus looks like it's "mere" psychological difference that underlies the judgment, sort of like when people have more moral concerns about endangered species if they are cute and fuzzy. So, the argument goes, our reaction in the Egg Machine case should be discounted.

On the other hand, someone might look at all this from the other end. It might be said that the Egg Machine case simply "wears its morality on its sleeve", and is merely a more overt example of the same thing. It's not that the Tissue Culture case is clearly OK and the Egg Machine case differs only in a psychological way, so that we should dismiss the reaction. Rather, it's that the Egg Machines intuitions indicate what's really going on even in the Tissue Culture case, but there it is masked.

> "I don't know", says Doug, "but let's go the tissue culture route, instead of making those icky Birds."
>
> Krista: "Well, perhaps one would not be so unmoved by the Tissue Culture image if what was in fact brought to mind was a massive industrial complex of acre upon acre of this stuff, especially if one imagined it replacing one's image of an idyllic small town farming community."
>
> "Hmmm... it *is* pretty distasteful. OK. I vote for the idyllic small town farming community."
>
> "I'm not sure that's one of your options."

General Strategy: Translating into More Subtle Consequentialist Arguments

Now, suppose we are still of the opinion that our negative reaction to the Football Birds is indeed to be taken seriously here. It doesn't seem to be about some harm to the environment, or diminishing some aspect of the quality of the food product, or some harm to sentient creatures. Appeals to notions of Playing God, naturalness and boundaries seem unsound. We have a concern that our reaction is merely an emotional one, so we need to be able to give reasons which can be evaluated.

One general strategy at this point would be to see if we can explain these concerns (that there is something disturbing about the Football Bird case) in some other way. Can we translate these potentially questionable concerns into consequentialist arguments that might otherwise have been overlooked, or note less obvious consequences which are not typically brought to mind in simple consequentialist analyses?

The alternative explanations we will consider here are the *slippery slope argument*, the problem of how it might *rub off on us,* and the matter of the connection to *world views* and how we think about things. I think we will find that some of

these are suggestive, but I will not be putting forward any of them as a definitive resolution to our problem. Like the earlier suggestions, they present serious difficulties. I hope that they can prompt constructive discussion.

The Slippery Slope to Human Genetic Engineering

> One can imagine Emily saying, "But what I guess I'm concerned about is where this will lead."

Asking where something "will lead" is certainly one way of pointing to more distant or more subtle consequences that are likely not to be part of a straightforward consequentialist analysis. Perhaps there is nothing wrong with this activity *per se*; in particular, it is not that the consequences of this particular practice will be bad (for the animals, for the consumers, for the economy), but if we take this step (engage in this activity, develop this technology), we will be led to take further steps, develop further technologies, and eventually we will be engaging in activities which are indeed clearly wrong (whether intrinsically, or because of the harm they cause).

One is struck by the Egg Machine image, and one envisages going much further. Perhaps this is part of what underlies our reaction, and perhaps this is something we should take seriously.

The argument of this sort that comes most readily to mind says that we will be led to apply such techniques to humans. Genetic knowledge is of course already being applied to humans. Attempts are made to address genetic diseases by genetic screening and genetic therapy, and these endeavors are being aided by the Human Genome Project, the attempt to map and sequence the entire human genome. Despite promise here, serious concerns are being debated about genetic privacy and discrimination, and about genetic enhancement and eugenics. Other aspects of artificial reproduction, including cloning, are sometimes raised here as well. So one might worry about rigorous application of genetic engineering to agricultural contexts leading eventually to something like the wholesale design of our offspring to more and more exacting standards.

This general kind of argumentative strategy is called a slippery-slope argument. Even supposing there is nothing wrong with the present action, if we take that step, each step will become easier and less noticeable, and we will eventually find ourselves in a situation uncontroversially judged to be totally unacceptable.

Presumably this *kind* of argument can sometimes be reasonable. If it really is the case that making Egg Machines would inevitably or very likely lead us to this undeniably bad outcome, then surely we have a good reason not to do it. But it is important to be clear about what is required for a convincing slippery slope argument, and where it can go astray, or where it can seem more convincing than it really should be. Basically, we must be very careful to clarify exactly what the bad outcome is supposed to be, and to clarify what is bad about it. Further, we must give reasons to believe it would really occur. Unfortunately, it is too easy to construct seemingly convincing scenarios without giving serious thought to each of these matters.

The image of biotech applied to the wholesale design of human beings to more and more exacting standards is indeed a scary one. Now, one might argue that there is an element of a "yuck factor" even here, and it may be worth pondering what exactly would be morally wrong with these human applications. But let us assume here that such an outcome would indeed be a very bad one, to be avoided at all costs. Still, is there reason to believe that the use of genetic engineering to the hilt in agricultural contexts (or the production of Football Birds in particular) will increase the likelihood of the above *human* genetic engineering practices?

We can tell various stories: At one point we will put a human gene in a pig. At another point we will put genes from other species into chimps. Finally, we will put genes from other species into humans. But it's not enough to trace possible intermediate steps. The slippery slope argument requires a causal claim, and in this case it's a causal claim that is very hard to assess.

So, how much evidence should be required? This is a difficult question. Suppose someone said: Since we don't at present have any specific evidence that this sort of thing would happen, and we don't have any good way to test such speculative claims about very subtle effects on difficult to predict human actions, we should therefore not give any credence to this slippery slope objection. This is surely too strong; while we should not tolerate blind speculation, such blithe dismissal does not appear to be the right policy. After all, we're talking about events which have never before taken place, and we really don't have very clear evidence *one way or another*. Ignorance is not bliss. But clearly the proponent of the slippery slope argument needs to be able to say *something* about why we should take the outcome seriously.

So there remain unresolved questions about what will count as sufficient evidence to be a serious worry, and where the burden of proof shall lie. But we can say the following: The slippery slope argument's prediction of inevitable slide is especially weak if it doesn't address the following question. Could we not we have *safeguards* (perhaps regulations, perhaps public discussions) so that each further step *won't* be easier, and *won't* be less noticeable? If we had some such safeguards, then we really *could* stop before we got to the bottom of the slope. Thus the claim that the bottom of the slope is unacceptable might not be a strong enough argument for not taking the first step.

One reply would be to insist that the steps really will be very small and not easily noticeable, and there won't be sharp lines to draw, and there will always be strong economic forces driving us to move ahead. It also might be pointed out that there is a long distance between "completely inevitable" and being confident that it *won't* happen, so showing that it isn't completely inevitable is not enough. Another response would be to declare victory: Egg Machines raise serious moral questions in that they jar us into taking seriously that we must have these discussions and these safeguards.[3]

[3] Others might use the slippery slope argument to argue for stopping much sooner – on the grounds that we might end up making Egg Machines! Would *this* be reasonable?

The Rub

Another sort of "subtle consequence" of Egg Machines might be their psychological effect on us.

> Emily might ask, for instance, 'Might "how we treat" these Football Birds "rub off" on how we treat either other animals, or even other humans?'

On this view, again, it is not as though the non-conscious Football Birds themselves *matter*; it is not as though there is some way they ought to be treated, so that we should not treat them as machines. But if we do so, we increase the likelihood that we will treat in analogous ways entities that *do* matter, persons and sentient creatures.

Various thinkers (for example, Aquinas) have given an analogous argument for why it is wrong to be cruel to animals (Rachels 1990). Aquinas worked within a framework whereby only beings with souls mattered intrinsically and non-human animals didn't have souls. Hence there was nothing wrong *per se* with harming or being cruel to animals. But the person who did so might be made more likely to mistreat other human beings.

Now, we might not think Aquinas' use of this argument adequate to ground the degree of obligations to sentient animals that we have (or intuitively think we have). Nevertheless, this is a legitimate *kind* of argument. It is, again, a consequentialist one, but one in terms of subtle consequences. So we have no trouble understanding its moral force – there is no worry that it is "merely" a psychological feeling, a "carry over" that counts as a confusion of reasoning. And this would also explain why it is hard to pinpoint what is wrong with the Egg Machine practice.

But is there any reason to believe that its factual premise will turn out to be true? That those engaged in this activity will come to act towards animals and persons in new and detrimental ways? This is another very complicated empirical matter, and so it forces again the questions of burden of proof. But there also are some more specific reasons for skepticism, reasons for thinking that this sort of argument works *less* well in the Egg Machine case than in Aquinas' case concerning the treatment of animals.

First, note a certain lack of precision in the story: Not only is there the question of how this would take place, but who is it claimed is going to be affected in this way? Just who is it that is "engaged in this activity"? The scientists involved in the research and development? Those (like the Bird-tender) who "interact" with them daily? Unless the effect is rather severe, it might be pointed out that this is not that many people, really. Is the idea in fact that *all* of us would be affected, for taking part as consumers? How is this supposed to take place, especially given our rather distant relationship to the sources of our food? Second, note that in the Aquinas case, it was a matter of being *cruel* to the animals; the present case would seem to be a much more subtle action and hence less likely to "spill over" in the way suggested.

And again, we would need to ask why safeguards or countermeasures could not be effective in counteracting these effects.

Effect on World View

> Emily recalls something she has seen recently on TV announcing that "Biotechnology will transform our very lives! We will live in a different world." She remembers it having really cool graphics and a lot of emotional appeal. She is thinking big.
>
> "Perhaps we should look more broadly", she says. "Perhaps what strikes us about the Egg Machine case is that its general world view is corrupt, especially in its general attitude toward nature."

Emily's idea here is that the creation of Egg Machines reflects or arises from a certain mind set, a mind set about how we see ourselves in relation to nature. We might note that "intrinsic" considerations are sometimes understood in terms of "*symbolic* significance" (Wachbroit, 1992, p. 66). Such concerns may be hard to pinpoint, and yet they remain, potentially, of great import.

There are a number of different things that can count as a "world view", or that may get cited in this kind of suggestion. For example, the stewardship idea discussed above can be seen in this way. But so can: having respect for nature, the tendency to believe that certain things (e.g., life, living things, ecosystems) have "intrinsic value", what counts as "natural", or on the other hand, a reductionistic or mechanical view of the world, perhaps even just the general tendency to use high tech solutions to problems.

Perhaps the main point – what makes these "world views" – is that they are not *principles* which say: "Always carry out actions or this sort", or "Never do X". Rather, we are talking about a general way of looking at the world, a view about the relationship of humankind to nature. So it's much more general than a particular principle.

Reductionism

One sort of world view often warned against is that of reductionism (Rifkin 1983). Like the other isms, it is not easy to say just what this is, but one might start by noting that it includes understanding everything in terms of its physical chemical parts, and paying little attention to the organic wholes, or higher levels of organization, such as species, ecosystems, or even organisms.

So, the claim might go, genetic engineering in general – and the Egg Machine practice in particular – fits with the reductionist view in some way, and this is to be avoided.

But in order to use this as a tool for evaluating our present issue, we would have to spend a good deal of time teasing apart a number of issues. First, reductionism can mean several different things, from the metaphysical view that all that really exists in the world are certain kinds of entities (describable in terms of our theories of physics and chemistry), to the methodological view that we should try to do

science in terms of such entities, to views (usually attributed by others) that don't fully respect life. Unfortunately, these are often thrown together without clarification of which is central and how they are related.

Second, we would need to specify what we mean by some practice "fitting with" reductionism. Is this going to be understood as "is consistent with", "arises out of or is an expression of", or "will (or could) lead to"? Further, the last of these could be anything from "will increase the likelihood of" to "will inevitably lead to". We need to be clear about exactly what claim is being made, keeping in mind that a claim which is plausible may not be the claim which is morally significant.

And then we need to clarify what is *wrong* with those things. One difficulty is illustrated by the following: One sort of reductionistic view would involve not paying sufficient attention to the ecological relations between different variables in the course of such things as environmental safety analysis. Presumably we can understand why this would be a bad thing. But this is very different from being a reductionist in the sense of limiting one's attention to problem-solutions that focus on changing one or a few genes in a given crop. For one could do this and yet be ecologically sophisticated in one's handling of environmental impact assessment. One might expect "genetic engineers" to be reductionists in the one sense, but they wouldn't need to be in the other.

"A Vast, Organic Lego Kit"

It might be more fruitful to consider another world-view idea: Sagoff (1992) utilizes a contrast between positions of Barry Commoner and Hans Bethe to describe a difference between two ways of viewing the natural world, ones that may be at play in different views of biotechnology, and that might underlie why different people have different reactions to the Egg Machine case. The contrast is that between viewing the natural world as *raw materials* (to be used for manufacture) or viewing it as *natural resources* (to be managed or conserved). The "natural resources" side gets described as asserting that: "the history of evolution has made natural species and ecosystems what they are and has given them forms or essences we ought to respect. We engage in manipulation at our own peril." The other side tends to view "nature as a collection of materials that humankind manipulates to serve its interests and ends."

There is some of the language here from our earlier discussions, and there are a number of components all combined. We might therefore worry that it may end up being unclear, metaphorical, unable to give helpful guidance, and difficult to evaluate. And, like any world view analysis, it will have some vagueness due to the fact that we are attributing a certain mind set or general outlook to the person, rather than a set of specific beliefs or rules. It is crucial that we bear this in mind, that this is speculative.

Still, perhaps it will be useful to say that the Egg Machines arise from (and therefore indicate) a tendency to treat the entire natural world as raw material for commercial manufacture, things to be owned and built with. Sagoff cites Yoxen putting this as viewing nature as "a vast, organic Lego kit inviting combination, hybridization, and continual rebuilding" (Sagoff 1992).

This is quite suggestive. Note, for one thing, that it might make sense of the connection between our problem and the environmentalist's conundrum, yet it will avoid the difficulty we saw in the discussion above concerning preservation and creation of species.

What else can we say about exactly what it is to view the natural world as raw material for manufacture? Well, it's always to be at the ready to make things out of bits of living nature, or to view nature always and only in terms of *commercial* potential. It's to view this in the same way that timber, coal and copper are viewed. Insofar as it's a matter of having in mind constructing things out of bits of nature, it might be said to be reductionist in spirit. We might say that the Raw Materials view also indicates a tendency to choose to modify the organism rather than the environment; we would change the organism so that it can deal with increased pollution, rather than clean up the pollution. Relatedly, when confronted with animal suffering in agricultural contexts, we would change the animals so that they don't feel the suffering, rather than change the conditions so that the animals aren't under stress (Rollin 1996).

Note the following important advantage of this way of understanding what underlies our moral intuitions here. Recall that when we considered such things as "treating animals as factories" as moral *principles*, they seemed unacceptable on grounds that there were cases of such treatment of animals could not plausibly be ruled out completely as always morally wrong. Are we in any better shape here? Maybe. For consider: Perhaps the moral principle should not have been seen as "Never treat an animal as a factory" (analogous to Kant's dictum that we never treat persons as means only, and not at the same time ends in themselves), or "Never treat nature as raw material for manufacture". After all, how could we possibly follow these principles?

Rather, we should imagine dicta such as "Don't *always* treat nature as raw material for manufacture" or "Be careful about the extent to which you treat nature as raw material". It is at most a requirement that we *tend* not to do it – that we put limits on the degree to which we do this. It is worth emphasizing that these things *come in degrees*. It's acceptable to treat animals as machines to an extent, but not to *this* extent.

If we understand the Raw Materials view in this way, then the fact that certain perfectly legitimate activities are cases of acting on a bit of nature as if it is "raw material for manufacture" does not require us to reject the legitimacy of the rationale. Of course, we also cannot use this rationale to say that the Egg Machine practice is necessarily wrong. Our treating animals as machines or as raw material in this case (and to this degree) does not entail that we always do so. The moral assessment depends on what else we do, what we do in other cases, how far we push this way of looking at things. So if we were looking for a way to say that the

Egg Machine case was simply morally wrong, that it ought to be forbidden straight out, then this will not do it. But this is probably as it should be.

The idea here is not so much that the Egg Machine practice will *cause* certain bad things, even long term, or even as part of a slippery slope argument. Rather, it's seen as a *symptom* of the Raw Materials view, and it *triggers* our reflection on the world view. The scenario pushes in our face an idea of how we are treating these other creatures as machines rather than as fellow residents sharing the planet, and this is cause for moral reflection: Should we take this attitude – to this degree? Such reflection may show us an image of ourselves that we don't like, or that, if taken as a deep and extensive foundation of how we view the world, would be of some concern.

Our discussion began with one particular application of ag biotech (the Egg Machines) and broadened at various points to biotechnology generally. What have we learned? One kind of learning involves getting clear about what questions to ask. Perhaps the most useful question is not "Should we engage in agricultural biotechnology or not?", but rather "Are there *ways* of doing biotechnology (what degree? which products or kinds of projects? under whose control?) which fit more than others with appropriate world views – e.g., the Natural Resource rather than the Raw Material view? In other words, supposing we think there is something to this idea of the superiority of the Natural Resources world view, are there ways to use this to *shape* the biotechnological revolution?

Patenting and Ownership and Developing Nations

> "OK, my head hurts, but there's another thing I've been wondering about all this time" says Emily finally. "The idea that somebody *patented* these things. I guess it's related to the idea that they somehow *own* them."
>
> "Wait", Doug interjects, "people have been owning animals for a long time."
>
> "Sure. But they own individual animals: this brown cow or that white pig. No, what I mean is that now the courts have said that companies can own the very *type* of thing, all the animals of a certain kind – they own the idea of it. They have a patent on this form of life. So I'm thinking that there's another issue here on top of the matter of our creating and modifying living things in this way. And, now that I think about it, it seems like this might relate to the question we've been discussing of the attitude we take toward the living world."

Of course, there is nothing "extreme" or "futuristic" about this aspect of the case; patenting is a normal practice with genetically altered animals and crops. But this practice (and the attendant issues of ownership and commercialization) is disturbing to some, and it can be seen to raise various moral questions. In the remainder of this chapter, I will explore briefly a few of these.

Patenting is a mechanism which protects intellectual property. It allows an inventor to guard against others freely using her work; patents give one the right to license to others for a fee. This encourages useful innovation as well as investment in the industry (Krimsky 1991).

The system of patenting that we have is in fact has its source in several different things: Supreme Court decisions, legislation, analogous practices in other nations, and agreements between nations. This system of patenting might be seen to have various moral rationales. Primary is the *utilitarian* one that the encouragement of innovation brings useful products to society and promotes economic activity. But it also might simply be judged to be *fair*, because those who have put labor into an invention *deserve* to be able to profit from it.

The rules for what counts as patentable include that it be novel, non-obvious, and useful (Office of Technology Assessment 1989). But up until 1980 it was unclear that living things would be considered patentable. In that year, the U.S. Supreme Court determined that a microorganism, an E. coli bacterium modified so as to be able to degrade oil, could be patented. Patents have since been given for multi-cellular organisms, for both plants and animals, including mammals, and for genes.

Emily brought up the issue in terms of owning types of animals, but concerns about patenting range over a number of questions, from whether there is something worrisome or inappropriate about any patenting concerning life, to what *kinds* of things ought to be allowed to be patented (an organism or only a process of manufacture? a mammal? a human gene?), to what sorts of impacts this will have on commercialization or the direction of research.

Note that these various questions about patenting can be understood at different levels: they can be evaluated in terms of what the law says (as in Supreme Court decisions), but they can also be evaluated in moral terms. And the moral considerations raised are often usefully categorized along lines we have already discussed, some fitting the consequentialist mode, but others involving more intrinsic considerations (Wachbroit 1992).

For instance, on the one hand, it's said that patenting in the realm of plants and animals will lead to the same in the human area – a sort of slippery slope argument. On the other hand, it's argued that patenting seems to involve treating the item patented as a mechanical object and an item of manufacture. For these are the sorts of things that have traditionally been patented; we are assimilating living things to that model. It may be threatening or offensive to some to act in ways which ignore the difference between living beings and mechanical objects or machines, and it may be thought unwise to treat animals in this way. We've come back to the idea of treating animals as machines, though it's in a somewhat different way.

Sometimes the concern is not so much patenting *per se*, but commercialization, which patenting may be seen as intertwined with and may be said to encourage. Perhaps Emily's concerns are tied to this. Some argue that there is something intrinsically wrong with commercialization of life or living beings (especially as that life is closer to humans). Of course, it may be hard to square this with the fact of commercial agricultural practices which have gone on for a long time before biotechnology.

But concerns about commercialization more often have to do with the distorting effects of the profit motive. These can concern how economic forces affect, in disturbing ways, *which products* get created; those products which promise the greatest profit won't necessarily promise the greatest social benefit. But they can also

concern the impact on basic science, which might suffer if people are drawn instead to commercial endeavors. This broadens the moral questions to be asked to: Who should own the products of genetic engineering? Who should have a say in the direction of research? And might it be unfair and unwise to allow some people to own and have control over the biological or genetic resources of the world?

In this context, it will be useful to examine an important debate concerning genetic intellectual property – in particular, the debate over ownership of germplasm (the world's plant genetic resources that form the basis for the crops grown all over the world). This discussion will illustrate certain consequentialist sorts of concerns, but there are also some other issues that don't reduce to these. But these are not really the "in principle" types of concerns that we dealt with earlier. Rather, they are concerns involving distributive justice and other rights claims, and questions about the nature of property.

Such issues as the ownership of parts of nature might suggest questions about our relationship to nature, thus raising certain "world view" issues discussed earlier. Of course, viewing *plants* as mechanical objects or raw materials will have less emotional valence than this same thing concerning *animals*. What is most significant about the issue, however, is the way it connects the issues of ownership to a conflict of interests between the developed and developing nations and raises questions of global justice. At stake are both who should own the products of genetic engineering, and who should own the world's germplasm which constitutes the raw materials for the former. This question will also allow us to address Krista's claim that her high tech solution is a solution to world hunger.[4]

The basic dilemmas over patenting and the world's plant genetic resources arise as follows (Juma 1989; Kloppenberg and Kleinman 1987). Traditionally, seeds found in the "centers of diversity", mostly in the developing nations, have been freely collected by scientists from developed nations. These seeds have then been used to develop sophisticated, high-yielding cultivars (in part by use of genetic engineering). These products, viewed as the property of seed companies, have been available to others (including those in the developing nations from which the initial seeds were taken) only for commercial purchase, allowing the seed companies to make substantial profits. The seed companies hold that they should be able to patent and profit from the products that they develop in this way, but that the original germplasm should be viewed instead as "common heritage". Critics of this position can take one of two stances. They can say that *both* sorts of plant genetic resources – original germplasm from developing nations and the cultivars developed from them – should be viewed as "common heritage". Or else they can say that the original germplasm should be viewed as the property of the developing nations, and so those who utilize it in any form should have to pay a fee for it.

[4] I will discuss this in relation to plant genetic resources from developing nations, but analogous things could be said concerning animals such as chickens, or any of the animals of which the Egg Machines are "descendants".

You might think it unfair to have it "both ways". But there is a rationale for the seed companies' position, that the original germplasm from developing nations should be viewed as no one's property in particular, while the lines developed by entrepreneurs should in fact be viewed as their private property. First, it will be said that viewing the initial germplasm as the property of developing nations is completely impractical. The usefulness of germplasm is not clear till some time down the road, and at that point a given cultivar may have its source in several nations. There is no effective mechanism for *pricing* the raw genetic material; at least, the market doesn't generate that price for us.

Secondly, some further points about the nature of the basis of ownership and patenting can be brought to bear: The germplasm only becomes *valuable* after time and money have been invested in its improvement and it is incorporated into a commercial cultivar. So there's really no rationale for viewing the raw germplasm as patentable.

One response to this is to argue that the germplasm is not actually "raw", but is instead a product of accumulated labor of indigenous farmers over generations, and it is unfair that this goes uncompensated. Besides, raw resources aren't typically viewed as common heritage (consider oil and coal). In response to this, it will be said that when one collects seed, the resource isn't "taken away" in the same way as these other resources; the first country still has the resource. Hence it doesn't deprive them of anything, or leave them worse off.

Still, there is a further response: Those in the developing nations do indeed lose something – namely, earning power – and thus they are not as well off. After all, in what other way is an oil-rich nation made worse off if, say, one-tenth of its oil resources are taken away? This debate is not easily resolved. These questions about the kind of thing that can be owned as intellectual property are complicated.

Finally, one can also argue for the seed company position via a consequentialist argument: It's important to encourage the development of new products, and this requires that patents be given to those companies that develop the elite lines of seed. Indeed, the world's people – including, it might be argued, those in the developing world – are better off having the development of all these biotechnological products. But this consequentialist rationale doesn't hold for the developing nations case. Even keeping in mind the labor that went into the development of the germplasm over generations, the motivation that the lure of patent-protection provides was not needed in order to get this work done. Hence, the argument goes, there really is an asymmetry.

We cannot resolve this debate here. But I want to step back and ask a broader question: We have some different possible starting points for moral arguments here. On the one hand are some general arguments about what constitutes property. On the other are some specific moral intuitions about the plight of the poor. Which of these is more important, or a more appropriate starting point? Should we start from a view of what constitutes property (and what the rules and rationale for patenting have been), and then let the distribution of welfare fall where it may? Or should we start with the facts about global inequality, or about the uncompensated work that went into the gradual development of the "raw" germplasm in developing nations?

Some might argue that it is important not to violate reasonable or established rules concerning ownership and patenting. But others might argue that we should start with some intuitive moral judgments about the justice of the situation, and then mold our rules or conventions about ownership and patenting to bring about a more fair distribution of welfare.

Someone who chose the latter route might say: developed nations and their seed companies ought to pay such and such a sum to the developing nations from which they obtain raw germplasm, but not because that follows from our present rules of ownership and patenting – it may not. Rather, this should be done because it will lead to a more just distribution of food and welfare. Indeed, some might challenge the view that patentable property is the right way to conceptualize these materials and resources.

Of course, on the other side it will be said that we cannot be all that confident about (or may not agree about) our intuitions about what counts as a fair distribution of welfare in the world. Better to follow rules of property seen independently as reasonable.

All this requires that we be able to reason about what counts as a fair or just distribution. So let us return briefly to some general positions about this question. Recall that on a utilitarian theory of justice, we should do whatever maximizes the welfare of the whole community: here, let us say, of the human community. The distribution *per se* does not matter. If an unequal (even very unequal) distribution maximizes overall utility, then so be it. On the other hand, there might well be utilitarian reasons for opting for a more equal distribution. First, since there are *so many* people in the developing nations; their welfare has a great impact on the calculation of *overall* welfare. Second, it can be argued on utilitarian grounds that we should focus on the welfare of the less well-off people due to diminishing marginal utilities of an increase in welfare to those already well-off. It might be argued further that great inequality is to be avoided on the grounds that it threatens global stability.

Other theories of justice require more directly that we close the gap between rich and poor as much as we can. As stated earlier, this could be accomplished either by having a principle of equality, or by saying, as Rawls' social contract theory does, that the most just society is the one which treats its least well-off members as well as possible. Keep in mind, however, that the world is not a single society, and thus it is less clear how all these theories of social justice should apply to justice between nations.

As Paul Thompson's chapter indicates, a libertarian view of justice does not stress welfare; it stresses freedom and rights, including property rights. It urges us to consider only questions of procedure, not to look directly at what the pattern of distribution is. We should apply appropriate views of what counts as legitimate acquisition of property and "legitimate transactions", such as voluntary market transactions. One would probably expect this to be used to argue for positions favoring the seed companies of the developed world. But one could also argue for a different position, taking more seriously the above point that the original germplasm is actually the result of the accumulated labor of indigenous peoples. Those in the developing world are

responsible for a large part of the value of many of the products, and these have been taken from them unfairly. So they should be compensated for it.

Of course, in order to fully address these issues, we would also need to resolve a number of factual issues, such as what economic impacts various policies would have. Further, it should be pointed out that there are in fact a number of policy options besides the two basic opposing positions outlined here. For instance, other ways can be created for compensating the developing nations. Thus a full analysis of what to do would have to take account of this wider range of options, as well as geopolitical forces of a variety of sorts. But my goal here is simply to show that we need to make a judgment about the appropriate conception of distributive justice. And it is also to show how conceptual issues concerning the nature of property and the role of patenting become part of the debate.

This brief discussion of the "germplasm problem" indicates another way in which biotechnological innovations have profound effects on our world – ones that force us to ask questions about whether biotechnology will benefit members of developing nations, and what our obligations to them are. It also provides a different sort of challenge to the view that we should be utilitarians and simply add up the consequences. This challenge does not pose questions about the relevance of various "in principle" considerations, such as naturalness, but rather about rights and distributive justice. And it looks from another angle at the issues concerning our general view of the world and our relation to it, for it concerns ownership or property relations applied the living world.

Conclusion

Let us take stock. Emily might take a lesson from the first part of our discussion above to be that we have to broaden our ways of thinking about the ethical evaluation of a technology. She might, for example, say that some moral objections to biotech need to be seen as intrinsic ones, ones that go beyond concerns about consequences. She may continue to hold that even if all of the consequences of the Egg Machine system of agriculture are positive, there might still be something intrinsically wrong with it. Others might disagree with her, holding that such a view is based *merely* on emotional reaction, indicating a soft, "unscientific" way of thinking. These people will call for us to discount our initial reactions and take a more hard-nosed consequentialist approach. On the other hand, our last topic, concerning germplasm, requires Emily to think about yet a different set of issues, from property to global justice. Overall, she sees that the Egg Machine thought experiment not only jars her mind into thinking hard about what role emotions and intuitions play in one's reasoning, and whether morality is solely a matter of consequences, but also how there are connections to such things as people's relationship to the natural world, and the developed nations' relationship to the developing nations.

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Chapter 10
Genetically Modified Foods*

Gary L. Comstock

Abstract An overview of, and response to, ethical objections to the genetic engineering of foods, crops, and animals.

Keywords Ethics • Genetic engineering • Foods • Crops • Animals

Case: Dr. Ghee, Theologian

Dr. Drew Ghee, a professor of theology from a local denominational college has begun lecturing as Emily takes her seat.

"I would like to put a few more issues on the table about Frankenfoods," he begins. "I understand from Dr. Wright that you have already considered some of these objections, but I invite you to think about them more carefully. And I'm here to suggest that we are not yet wise enough to control this technology, and that it does not befit us as stewards of God's land to think that we can manage these powerful tools. Moreover, GM foods will not help us feed the poor and hungry in the developing world."

The class, to Emily, seems only mildly interested. She finds herself a bit skeptical about the speaker, too, but thinks they at least should give him a chance.

"GM foods are subject to several theological objections," Dr. Gee continues. "First, it is a form of playing God that threatens to change the world dramatically,

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if not destroy it. Second, it is a form of crossing species boundaries that may lead to disastrous consequences. And it encourages us to treat each form of life – plant, animal, and even human – as a thing, a product, a tool to be bought and sold to the highest bidder."

Dr. Gee looks around the room. "Imagine yourself fifty years from now standing in front of your grandchildren who have nothing to eat. Biodiversity has been wiped out, crop rotations have not been sustained, water has been poisoned by more and more agricultural chemicals, and no one remembers how to grow crops the old-fashioned way. Your grandchildren are starving."

"You forgot to add that eggs are being produced by football chickens," Rich adds in a stage whisper. Dr. Wright wags his finger at him.

"This is the future we risk creating for our offspring if we continue down this path of constant tinkering and thinking – thinking – we are improving ourselves," concludes Dr. Gee.

Case: Discussion Questions

1. Assess each of Dr. Gee's claims:
   (a) GM foods are playing God.
   (b) GM foods unethically cross species boundaries.
   (c) GM foods are too risky; we should take precautions.
2. If you were a member of a county commission that had to decide whether to allow GM crops to be planted, how would you vote?
3. What arguments would you give to your opponents to try to persuade them to take your point of view?

Discussion

As Fred Gifford made clear in the previous chapter, some consumer advocates object to GM foods on ethical grounds. In this chapter, I build on Gifford's analysis, exploring further some of the reasons given for opposing the technology.

Is it ethically justifiable to pursue GM crops and foods? There may be an objective answer to this question, and we will try here to figure out what it is. But we must begin with a proper, heavy dose of epistemic humility, acknowledging that few ethicists at the moment seem to think they know the final answer.

Should the law allow GM foods to be grown and marketed? The answer to this, and every public policy question rests ultimately with us, citizens who will in the voting booth and shopping market decide the answer. To make up our minds, we will use feelings, intuitions, conscience, and reason. However, as we citizens are, by and large, not scientists, we must, to one degree or other, rest our factual

understanding of the matter on the opinions of scientific experts. Therefore, ethical responsibility in the decision devolves heavily on scientists engaged in the new GM technology.

Ethical Responsibilities of Scientists

Science is a communal process devoted to the discovery of knowledge and to open and honest communication of knowledge. Its success, therefore, rests on two different kinds of values.

Epistemological values are values by which scientists determine which knowledge claims are better than others. The values include clarity, objectivity, capacity to explain a range of observations, and ability to generate accurate predictions. Claims that are internally inconsistent are jettisoned in favor of claims that are consistent and fit with established theories. (At times, anomalous claims turn out to be justifiable, and an established theory is overthrown, but these occasions are rare in the history of science.) Epistemological values in science also include fecundity, the ability to generate useful new hypotheses; simplicity, the ability to explain observations with the fewest number of additional assumptions or qualifications; and elegance.

Personal values, including honesty and responsibility, are a second class of values – values that allow scientists to trust their peers' knowledge claims. If scientists are dishonest, untruthful, fraudulent, or excessively self-interested, the free flow of accurate information so essential to science will be thwarted. If a scientist plagiarizes the work of others or uses fabricated data, that scientist's work will become shrouded in suspicion and otherwise reliable data will not be trusted. If scientists exploit those who work under them or discriminate on the basis of gender, race, class, or age, then the mechanisms of trust and collegiality undergirding science will be eroded.

The very institution of scientific discovery is supported – indeed, permeated – with values. Scientists have a variety of goals and functions in society, so it should be no surprise that they face different challenges.

University scientists must be scrupulous in giving credit for their research to all who deserve credit; careful not to divulge proprietary information; and painstaking in maintaining objectivity, especially when funded by industry. Industry scientists must also maintain the highest standards of scientific objectivity, a particular challenge because their work may not be subject to peer-review procedures as strict as those faced by university scientists. Industry scientists must also be willing to defend results of their research that are not favorable to their employers' interests. Scientists employed by nongovernmental organizations face challenges as well. Their objectivity must be maintained in the face of an organization's explicit advocacy agenda and in spite of the fact that their research might provide results that could seriously undermine the organization's fund-raising attempts. All scientists face the challenges of communicating complex issues to a public that receives them

through media channels that often are not equipped to communicate the qualifications and uncertainties attaching to much scientific information.

At its core, science is an expression of some of our most cherished values. The public largely trusts scientists, and scientists must in turn act as good stewards of this trust.

A Method for Addressing Ethical Issues[1]

Ethical objections to GM foods typically center on the possibility of harm to persons or other living things. Harm may or may not be justified by outweighing benefits. Whether harms are justified is a question that ethicists try to answer by working methodically through a series of questions:

(i) What is the harm envisaged? To provide an adequate answer to this question, we must pay attention to how significant the harm or potential harm may be (will it be severe or trivial?); who the "stakeholders" are (that is, who are the persons, animals, even ecosystems, who may be harmed?); the extent to which various stakeholders might be harmed; and the distribution of harms. The last question directs attention to a critical issue, the issue of justice and fairness. Are those who are at risk of being harmed by the action in question different from those who may benefit from the action in question?

(ii) What information do we have? Sound ethical judgments go hand in hand with a thorough understanding of the scientific facts. In a given case, we may need to ask two questions. Is the scientific information about harm being presented reliable, or is it fact, hearsay, or opinion? What information do we not know that we should know before we make the decision?

(iii) What are the options? In assessing the various courses of action, we emphasize creative problem-solving, seeking to find win-win alternatives in which everyone's interests are protected. Here we must identify what objectives each stakeholder wants to obtain; how many methods are available by which to achieve those objectives; and what advantages and disadvantages attach to each alternative.

(iv) What ethical principles should guide us? There are at least three secular ethical traditions:

- Rights theory holds that we ought always to act so that we treat human beings as autonomous individuals and not as mere means to an end.
- Utilitarian theory holds that we ought always to act so that we maximize good consequences and minimize harmful consequences.

[1] In describing this method, I have drawn on an ethics assessment tool devised by Courtney Campbell, Department of Philosophy, Oregon State University, and presented at the Oregon State University Bioethics Institute in Corvallis, OR, summer 1998.

- Virtue theory holds that we ought always to act so that we act the way a just, fair, good person would act.

Ethical theorists are divided about which of these three theories is best. We manage this uncertainty through the following procedure. Pick one of the three principles. Using it as a basis, determine its implications for the decision at hand. Then, adopt a second principle. Determine what it implies for the decision at hand. Repeat the procedure with the third principle. Should all three principles converge on the same conclusion, then we have good reasons for thinking our conclusion is morally justifiable.

(v) How do we reach moral closure? Does the decision we have reached allow all stakeholders either to participate in the decision or to have their views represented? If a compromise solution is deemed necessary in order to manage otherwise intractable differences, has the compromise been reached in a way that has allowed all interested parties to have their interests articulated, understood, and considered? If so, then the decision may be justifiable on ethical grounds.

There is a difference between consensus and compromise. Consensus means that the vast majority of people agree about the right answer to a question. If the group cannot reach a consensus but must, nevertheless, make some decision, then a compromise position may be necessary. But neither consensus nor compromise should be confused with the right answer to an ethical question. It is possible that a society might reach a consensus position that is unjust. For example, some societies have held that women should not be allowed to own property. That may be a consensus position or even a compromise position, but it should not be confused with the truth of the matter. Moral closure is a sad fact of life; we sometimes must decide to undertake some course of action even though we know that it may not be, ethically, the right decision, all things considered.

Ethical Issues Involved in the Use of Genetic Technology in Agriculture

Discussions of the ethical dimensions of agricultural biotechnology are sometimes confused by a conflation of two quite different sorts of objections to GM technology: extrinsic and intrinsic. It is critical not only that we distinguish these two classes but that we keep them distinct throughout the ensuing discussion of ethics.

Extrinsic objections focus on the potential harms consequent upon the adoption of GM organisms (GMOs). Extrinsic objections hold that GM technology should not be pursued because of its anticipated results. Briefly stated, the extrinsic objections go as follows. GMOs may have disastrous effects on animals, ecosystems, and humans. Possible harms to humans include perpetuation of social inequities in modern agriculture, decreased food security for women and children on subsistence farms in developing countries, a growing gap between well-capitalized economies in the northern hemisphere and less capitalized peasant

economies in the south, risks to the food security of future generations, and the promotion of reductionistic and exploitative science. Potential harms to ecosystems include possible environmental catastrophe; inevitable narrowing of germplasm diversity; and irreversible loss or degradation of air, soils, and waters. Potential harms to animals include unjustified pain to individual animals used in research and production.

These are valid concerns, and nation-states must have in place testing mechanisms and regulatory agencies to assess the likelihood, scope, and distribution of potential harms through a rigorous and well-funded risk assessment procedure. It is for this reason that I said above that GM technology must be developed responsibly and with appropriate caution. However, these extrinsic objections cannot by themselves justify a moratorium, much less a permanent ban, on GM technology, because they admit the possibility that the harms may be minimal and outweighed by the benefits. How can one decide whether the potential harms outweigh potential benefits unless one conducts the research, field tests, and data analysis necessary to make a scientifically informed assessment?

In sum, extrinsic objections to GMOs raise important questions about GMOs, and each country using GMOs ought to have in place the organizations and research structures necessary to ensure their safe use.

There is, however, an entirely different sort of objection to GM technology, a sort of objection that, if it is sound, would justify a permanent ban.

Intrinsic objections allege that the process of making GMOs is objectionable *in itself*. This belief is defended in several ways, but almost all the formulations are related to one central claim, the unnaturalness objection:

It is unnatural to genetically engineer plants, animals, and foods (UE).

If UE is true, then we ought not to engage in bioengineering, however unfortunate the consequences of halting the technology may be. Were a nation to accept UE as the conclusion of a sound argument, then much agricultural research would have to be terminated and potentially significant benefits from the technology sacrificed. A great deal is at stake.

In Comstock, *Vexing Nature? On the Ethical Case Against Agricultural Biotechnology*, I discuss 14 ways in which UE has been defended (Comstock 2000). For present purposes, those objections can be summarized as follows:

(i) To engage in ag biotech is to *play God*.
(ii) To engage in ag biotech is to *invent world-changing technology*.
(iii) To engage in ag biotech is to *illegitimately cross species boundaries*.
(iv) To engage in ag biotech is to *commodify life*.

Let us consider each claim in turn.

(i) To engage in ag biotech is to *play God*.

In a Western theological framework, humans are creatures, subjects of the Lord of the Universe, and it would be impious for them to arrogate to themselves roles and powers appropriate only for the Creator. Shifting genes around between individuals

and species is taking on a task not appropriate for us, subordinate beings. Therefore, to engage in bioengineering is to play God.

There are several problems with this argument. First, there are different interpretations of God. Absent the guidance of any specific religious tradition, it is logically possible that God could be a Being who wants to turn over to us all divine prerogatives, or explicitly wants to turn over to us at least the prerogative of engineering plants, or who doesn't care what we do. If God is any of these beings, then the argument fails because playing God in this instance is not a bad thing.

The argument seems to assume, however, that God is not like any of the gods just described. Assume that the orthodox Jewish and Christian view of God is correct, that God is the only personal, perfect, necessarily existing, all-loving, all-knowing, and all-powerful being. On this traditional Western theistic view, finite humans should not aspire to infinite knowledge and power. To the extent that bioengineering is an attempt to control nature itself, the argument would go, bioengineering would be an unacceptable attempt to usurp God's dominion.

The problem with this argument is that not all traditional Jews and Christians think this God would rule out genetic engineering. I am a practicing evangelical Christian and the chair of my local church's council. In my tradition, God is thought to endorse creativity and scientific and technological development, including genetic improvement. Other traditions have similar views. In the mystical writings of the Jewish Kabbalah, God is understood as One who expects humans to be co-creators, technicians working with God to improve the world. At least one Jewish philosopher, Baruch Brody, has suggested that biotechnology may be a vehicle ordained by God for the perfection of nature.[2]

I personally hesitate to think that humans can perfect nature. However, I have become convinced that GM might help humans to rectify some of the damage we have already done to nature. And I believe God may endorse such an aim. For humans are made in the divine image. God desires that we exercise the spark of divinity within us. Inquisitiveness in science is part of our nature. Creative impulses are not found only in the literary, musical, and plastic arts. They are part of molecular biology, cellular theory, ecology, and evolutionary genetics, too. It is unclear why the desire to investigate and manipulate the chemical bases of life should not be considered as much a manifestation of our godlike nature as the writing of poetry and the composition of sonatas. As a way of providing theological content for UE, then, argument (i) is unsatisfactory because it is ambiguous and contentious.

(ii) To engage in ag biotech is to *invent world-changing technology*, an activity that should be reserved to God alone.

Let us consider (ii) in conjunction with a similar objection (iia).

(iia) To engage in ag biotech is to *arrogate historically unprecedented power* to ourselves.

[2] B. Brody, private communication.

The argument here is not the strong one, that biotech gives us divine power, but the more modest one, that it gives us a power we have not had previously. But it would be counterintuitive to judge an action to be wrong simply because it has never been performed. On this view, it would have been wrong to prescribe a new herbal remedy for menstrual cramps or to administer a new anesthetic. But that seems absurd. More argumentation is needed to call historically unprecedented actions morally wrong. What is needed is to know *to what extent* our new powers will transform society, whether we have witnessed prior transformations of this sort, and whether those transitions are morally acceptable.

We do not know how extensive the ag biotech revolution will be, but let us assume that it will be as dramatic as its greatest proponents assert. Have we ever witnessed comparable transitions? The change from hunting and gathering to agriculture was an astonishing transformation. With agriculture came not only an increase in the number of humans on the globe but the first appearance of complex cultural activities: writing, philosophy, government, music, the arts, and architecture. What sort of power did people arrogate to themselves when they moved from hunting and gathering to agriculture? The power of civilization itself (McNeill 1989).

Ag biotech is often oversold by its proponents. But suppose they are right, that ag biotech brings us historically unprecedented powers. Is this a reason to oppose it? Not if we accept agriculture and its accompanying advances, for when we accepted agriculture we arrogated to ourselves historically unprecedented powers.

In sum, the objections stated in (ii) and (iia) are not convincing.

(iii) To engage in ag biotech is to *illegitimately cross species boundaries*.

The problems with this argument are both theological and scientific. I will leave it to others to argue the scientific case that nature gives ample evidence of generally fluid boundaries between species. The argument assumes that species boundaries are distinct, rigid, and unchanging, but, in fact, species now appear to be messy, plastic, and mutable. To proscribe the crossing of species borders on the grounds that it is unnatural seems scientifically indefensible.

It is also difficult to see how (iii) could be defended on theological grounds. None of the scriptural writings of the Western religions proscribes genetic engineering, of course, because genetic engineering was undreamt of when the holy books were written. Now, one might argue that such a proscription may be derived from Jewish or Christian traditions of scriptural interpretation. Talmudic laws against mixing "kinds," for example, might be taken to ground a general prohibition against inserting genes from "unclean" species into clean species. Here's one way the argument might go: For an observant Jew to do what scripture proscribes is morally wrong; Jewish oral and written laws proscribe the mixing of kinds (eating milk and meat from the same plate; yoking donkeys and oxen together); bioengineering is the mixing of kinds; therefore, for a Jew to engage in bioengineering is morally wrong.

But this argument fails to show that bioengineering is intrinsically objectionable in all its forms for everyone. The argument might prohibit *Jews* from engaging in certain *kinds* of biotechnical activity but not all; it would not prohibit, for example,

the transferring of genes *within* a species, nor, apparently, the transfer of genes from one clean species to another clean species. Incidentally, it is worth noting that the Orthodox community has accepted transgenesis in its food supply. Seventy percent of the cheese produced in the United States is made with a GM product, chymosin. This cheese has been accepted as kosher by Orthodox rabbis.[3]

In conclusion, it is difficult to find a persuasive defense of (iii) on either scientific or religious grounds.

(vi) To engage in ag biotech is to *commodify life*.

The argument here is that genetic engineering treats life in a reductionistic manner, reducing living organisms to little more than machines. Life is sacred and not to be treated as a good of commercial value only to be bought and sold to the highest bidder.

Could we apply this principle uniformly? Would not objecting to the products of GM technology on these grounds also require that we object to the products of ordinary agriculture on the same grounds? Is not the very act of bartering or exchanging crops and animals for cash vivid testimony to the fact that every culture on earth has engaged in the commodification of life for centuries? If one accepts commercial trafficking in non-GM wheat and pigs, then why object to commercial trafficking in GM wheat and GM pigs? Why should it be wrong to treat DNA the way we have previously treated animals, plants, and viruses? (Nelkin & Lindee 1995).

Although (iv) may be true, it is not a sufficient reason to object to GM technology because our values and economic institutions have long accepted the commodification of life. Now, one might object that various religious traditions have never accepted commodification and that genetic engineering presents us with an opportunity to resist, to reverse course. Kass, for example, has argued that we have gone too far down the road of dehumanizing ourselves and treating nature as a machine and that we should pay attention to our emotional reactions against practices such as human cloning. Even if we cannot defend these feelings in rational terms, our revulsion at the very idea of cloning humans should carry great weight (Kass 1988a, b). Midgley has argued that moving genes across species boundaries is not only "yukky" but, perhaps, a monstrous idea, a form of playing God (Midgley 2000).

Kass and Midgley have eloquently defended the relevance of our emotional reactions to genetic engineering but, as both admit, we cannot simply allow our emotions to carry the day. As Midgley writes, "Attention to … sympathetic feelings [can stir] up reasoning that [alters] people's whole world view" (10). But as much hinges on the reasoning as on the emotions.

Are the intrinsic objections sound? Are they clear, consistent, and logical? Do they rely on principles we are willing to apply uniformly to other parts of our lives? Might they lead to counterintuitive results?

[3] J. Gressel, observation at the Annual Meeting of the Weed Science Society of America, Chicago, 10 February 1998.

Counterintuitive results are results we strongly hesitate to accept because they run counter to widely shared considered moral intuitions. If a moral rule or principle leads to counterintuitive results, then we have a strong reason to reject it. For example, consider the following moral principle, which we might call the doctrine of naive consequentialism (NC):

Always improve the welfare of the most people (NC).

Were we to adopt NC, then we would not only be permitted but required to sacrifice one healthy person if by doing so we could save many others. If six people need organ transplants (two need kidneys, one needs a liver, one needs a heart, and two need lungs) then NC instructs us to sacrifice the life of the healthy person to transplant six organs to the other six. But this result, that we are *obliged* to sacrifice innocent people to save strangers, is wildly counterintuitive. This result gives us a strong reason to reject NC.

I have argued that the four formulations of the unnaturalness objection considered above are unsound insofar as they lead to counterintuitive results. I do not take this position lightly. Twelve years ago, I wrote "The Case Against bGH," an article, I have been told, that "was one of the first papers by a philosopher to object to ag biotech on explicitly ethical grounds." I then wrote a series of other articles objecting to GM herbicide-resistant crops, transgenic animals, and, indeed, all of ag biotech (Comstock 1988).[4] I am acquainted with worries about GM foods. But, for reasons that include the weakness of the intrinsic objections, I have changed my mind. The sympathetic feelings on which my anti-GMO worldview was based did not survive the stirring up of reasoning.

Why Are We Careful with GM Foods?

I do not pretend to know anything like the full answer to this question, but I would like to be permitted the luxury of a brief speculation about it. The reason may have to do with a natural, completely understandable, and wholly rational tendency to take precautions with what goes into our mouths. When we are in good health and happy with the foods available to us, we have little to gain from experimenting with new food and no reason to take a chance on a potentially unsafe food. We may think of this disposition as the precautionary response.

When faced with two contrasting opinions about issues related to food safety, consumers place great emphasis on negative information. The precautionary response is particularly strong when a consumer sees little to gain from a new food technology. When a given food is plentiful, it is rational to place extra weight on negative information about any particular piece of that food. It is rational to do so,

[4] The other essays are reprinted in *Vexing Nature?* (Chapters 1–4).

as my colleague Dermot Hayes points out, even when the source of the negative information is known to be biased.

There are several reasons for us to take a precautionary approach to new foods. First, under conditions in which nutritious tasty food is plentiful, we have nothing to gain from trying a new food if, from our perspective, it is in other respects identical to our current foods. Suppose on a rack in front of me there are eighteen dozen maple-frosted Krispy Kreme doughnuts, all baked to a golden brown, all weighing three ounces. If I am invited to take one of them, I have no reason to favor one over the other.

Suppose, however, that a naked man runs into the room with wild hair flying behind him yelling that the sky is falling. He approaches the rack and points at the third doughnut from the left on the fourth shelf from the bottom. He exclaims, "This doughnut will cause cancer! Avoid it at all costs, or die!" There is no reason to believe this man's claim and yet, because there are so many doughnuts freely available, why should we take any chances? It is rational to select other doughnuts, because all are alike. Now, perhaps one of us is a mountain climber who loves taking risks and might be tempted to say, "Heck, I'll try that doughnut." In order to focus on the right question here, the risk takers should ask themselves whether they would select the tainted doughnut to take home to feed to their 2-year-old daughter. Why impose any risk on your loved ones when there is no reason to do so?

The Krispy Kreme example is meant to suggest that food tainting is both a powerful and an extraordinarily easy social act. It is powerful because it virtually determines consumer behavior. It is easy, because the tainter does not have to offer any evidence of the food's danger. Under conditions of food plenty, rational consumers should and do take precautions, avoiding tainted food no matter how untrustworthy the tainter.

Our tendency to take precautions with our food suggests that a single person with a negative view about GM foods will be much more influential than many people with a positive view. The following experiment lends credibility to this hypothesis. In a willingness-to-pay experiment, Hayes and colleagues paid 87 primary food shoppers $40 each (Fox et al. 2002). Each participant was assigned to a group ranging in size from a half dozen to a dozen members. Each group was then seated at a table at lunchtime and given one pork sandwich. In the middle of each table was one additional food item, an irradiated pork sandwich. Each group of participants was given one of three different treatments: (i) the *pro-irradiation* treatment; (ii) the *anti-irradiation* treatment; and (iii) the *balanced* treatment.

Each treatment began with all the participants at a table receiving the same, so-called "neutral" description of an irradiated pork sandwich. The description read, in part:

> The U.S. FDA has recently approved the use of ionizing radiation to control Trichinella in pork products. This process results in a 10,000-fold reduction in Trichinella organisms in meat. The process does not induce measurable radioactivity in food.

After the participants read this description, they conducted a silent bid to purchase the right to exchange their nonirradiated sandwich for the irradiated sandwich.

Whoever bid the highest would be able to buy the sandwich for the price bid by the second-highest bidder. To provide participants with information about the opinions of the others at their table so that they could factor this information into their future bids, the lowest and highest bids of each round were announced before the next round of bidding began. At the end of the experiment, one of the ten bidding rounds was selected at random, and the person bidding the highest amount in that round had to pay the second-highest price bid during that round for the sandwich.

After five rounds of bidding, the second-highest bids in all three groups settled rather quickly at an equilibrium point, roughly 20 cents. That is, someone at every table was willing to pay 20 cents for the irradiated pork sandwich, but no one in any group would pay more than 20 cents. The bidding was repeated five times in order to give participants the opportunity to respond to information they were getting from others at the table and to ensure the robustness of the price.

After five rounds of bidding, each group was given additional information. Group a, the so-called *pro* group, was provided with a description of the sandwich that read, in part:

> Each year, 9,000 people die in the United States from food-borne illness. Some die from Trichinella in pork. Millions of others suffer short-term illness. Irradiated pork is a safe and reliable way to eliminate this pathogen. The process has been used successfully in 20 countries since 1950.

The *pro*-group participants were informed that the author of this positive description was a pro-irradiation food industry group. After the description was read, five more rounds of bidding began. The price of the irradiated sandwich quickly shot upward, reaching 60 cents by the end of round 10. A ceiling price was not reached, however, as the bids in every round, including the last, were significantly higher than in the preceding round. The price, that is, was still going up when the experiment was stopped (see Fig. 10.1).

After its first five rounds of bidding, group b was provided with a different description. It read, in part:

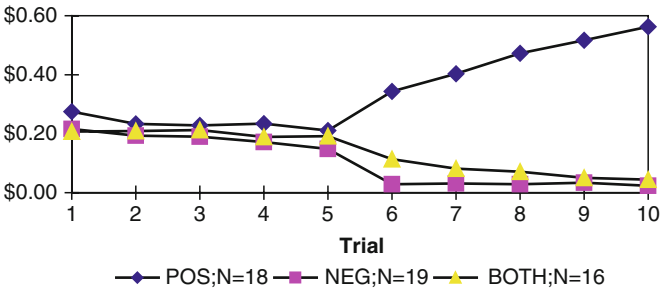

Fig. 10.1 Effect of information on average bid for irradiated pork: POS = positive; NEG = negative (Reprinted from (Fox et al. 2002). With kind permission from Springer Science + Business Media)

> In food irradiation, pork is exposed to radioactive materials. It receives 300,000 rads of radiation – the equivalent of 30 million chest x-rays. This process results in radiolytic products in food. Some radiolytic products are carcinogens and linked to birth defects. The process was developed in the 1950s by the Atomic Energy Commission.

The source of this description was identified to the bidders as "Food and Water," an anti-irradiation activist group in England. After group b read this description, it began five more rounds of bidding. The bid went down, quickly reaching zero. After the first five rounds produced a value of 20 cents in group b for the pork sandwich described in a "neutral" way, *no one* in this group would pay a penny for the irradiated sandwich described in a "negative" way. This result obtained even though the description was clearly identified as coming from an activist, nonscientific group.

After five rounds of bidding on the neutral description, the third group, group c, received *both* the positive and negative descriptions. One might expect this group's response to be highly variable, with some participants scared off by the negative description and others discounting it for its unscientific source. Some participants might be expected to bid nothing while others would continue to bid highly.

However, the price of the sandwich in the third, so-called *balanced* group, also fell quickly. Indeed, the price reached zero almost as quickly as it did in group b, the negative group. That is, even though the third group had both the neutral and the positive description in front of them, no one exposed to the negative description would pay 2 cents for the irradiated sandwich.

Hayes's study illuminates the precautionary response and carries implications for the GM debate. These implications are that, given neutral or positive descriptions of GM foods, consumers initially will *pay more* for them. Given negative descriptions of GM foods, consumers initially will *not* pay more for them. Finally, and this is the surprising result, given *both* positive and negative descriptions of GM foods, consumers initially will *not* pay more for them. Both sides in the GM food debate should be scrupulous in providing reasons for all their claims. But especially for their negative claims.

In a worldwide context, the precautionary response of those facing food abundance in developed countries may lead us to be insensitive to the conditions of those in less fortunate situations. Indeed, we may find ourselves in the following ethical dilemma.

For purposes of argument, make the following three assumptions. (I do not believe any of the assumptions is implausible.) First, assume that GM food is safe. Second, assume that some GM "orphan" foods – such as rice enhanced with iron or vitamin A, or virus-resistant cassava, or aluminum-tolerant sweet potato – may be of great potential benefit to millions of poor children. Third, assume that widespread anti-GM information and sentiment, no matter how unreliable on scientific grounds, could shut down the GM infrastructure in the developed world.

Under these assumptions, consider the possibility that, by tainting GM foods in the countries best suited to conduct GM research safely, anti-GM activists could bring to a halt the range of money-making GM foods marketed by multinational corporations. This result might be a good or a bad thing. However, an unintended

side effect of this consequence would be that the new GM orphan crops mentioned above might not be forthcoming, assuming that the development and commercialization of these orphan crops depends on the answering of fundamental questions in plant science and molecular biology that will be answered only if the research agendas of private industry are allowed to go forward along with the research agendas of public research institutions.

Our precautionary response to new food may put us in an uncomfortable position. On the one hand, we want to tell "both sides" of the GM story, letting people know about the benefits and the risks of the technology. On the other hand, some of the people touting the benefits of the technology make outlandish claims that it will feed the world and some of the people decrying the technology make unsupported claims that it will ruin the world. In that situation, however, those with unsupported negative stories to tell carry greater weight than those with unsupported positive stories. Our precautionary response, then, may well lead, in the short term at least, to the rejection of GM technology. Yet, the rejection of GM technology could indirectly harm those children most in need, those who need what I have called the orphan crops.

Are we being forced to choose between two fundamental values, the value of free speech versus the value of children's lives?

On the one hand, open conversation and transparent decision-making processes are critical to the foundations of a liberal democratic society. We must reach out to include everyone in the debate and allow people to state their opinions about GM foods, whatever their opinion happens to be, whatever their level of acquaintance with the science and technology happens to be. Free speech is a value not to be compromised lightly.

On the other hand, stating some opinions about GM foods can clearly have a tainting effect, a powerful and extraordinarily easy consequence of free speech. Tainting the technology might result in the loss of this potentially useful tool. Should we, then, draw some boundaries around the conversation, insisting that each contributor bring some measure of scientific data to the table, especially when negative claims are being made? Or are we collectively prepared to leave the conversation wide open? That is, in the name of protecting free speech, are we prepared to risk losing an opportunity to help some of the world's most vulnerable people?

The Precautionary Principle

As a 13 year-old, I won my dream job, wrangling horses at Honey Rock Camp in northern Wisconsin. The image I cultivated for myself was the weathered cowboy astride Chief or Big Red, dispensing nuggets to awestruck young rider-wannabes. But I was, as they say in Texas, all hat.

"Be careful!" was the best advice I could muster.

Only after years of experience in a western saddle would I have the skills to size up various riders and advise them properly on a case-by-case basis. You should

slouch more against the cantle and get the balls of your feet onto the stirrups. You need to thrust your heels in front of your knees and down toward the animal's front hooves. You! Roll your hips in rhythm with the animal, and stay away from the horn. You, stay alert for sudden changes of direction.

Only after years of experience with hundreds of different riders would I realize that my earlier generic advice, well-intentioned though it was, had been of absolutely no use to anyone. As an older cowboy once remarked, I might as well have been saying, "Go crazy!" Both pieces of advice were equally useless in making good decisions about how to behave on a horse.

Now, as mad cow disease grips the European imagination, concerned observers transfer fears to genetically modified foods, advising: "Take precaution!" Is this a valuable observation that can guide specific public policy decisions, or well-intentioned but ultimately unhelpful advice?

As formulated in the 1992 Rio Declaration on Environment and Development, the precautionary principle states that "lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." The precautionary approach has led many countries to declare a moratorium on GM crops on the supposition that developing GM crops might lead to environmental degradation. The countries are correct that this is an implication of the principle. But is it the only implication?

Suppose global warming intensifies and comes, as some now darkly predict, to interfere dramatically with food production and distribution. Massive dislocations in international trade and corresponding political power follow global food shortages, affecting all regions and nations. In desperate attempts to feed themselves, billions begin to pillage game animals, clear-cut forests to plant crops, cultivate previously nonproductive lands, apply fertilizers and pesticides at higher than recommended rates, kill and eat endangered and previously nonendangered species.

Perhaps not a likely scenario, but not entirely implausible, either. GM crops could help to prevent it, by providing hardier versions of traditional lines capable of growing in drought conditions, or in saline soils, or under unusual climactic stresses in previously temperate zones, or in zones in which we have no prior agronomic experience.

On the supposition that we might need the tools of genetic engineering to avert future episodes of crushing human attacks on what Aldo Leopold called "the land," the precautionary principle requires that we develop GM crops. Yes, we lack full scientific certainty that developing GM crops will prevent environmental degradation. True, we do not know what the final financial price of GM research and development will be. But if GM technology were to help save the land, few would not deem that price cost-effective. So, according to the precautionary principle, lack of full scientific certainty that GM crops will prevent environmental degradation shall not be used as a reason for postponing this potentially cost-effective measure.

The precautionary principle commits us to each of the following propositions:

1. We must not develop GM crops.
2. We must develop GM crops.

As (1) and (2) are plainly contradictory, however, defenders of the principle should explain why its implications are not incoherent.

Much more helpful than the precautionary principle would be detailed case-by-case recommendations crafted upon the basis of a wide review of nonindustry-sponsored field tests conducted by objective scientists expert in the construction and interpretation of ecological and medical data. Without such a basis for judging this use acceptable and that use unacceptable, we may as well advise people in the GM area to go crazy. It would be just as helpful as "Take precaution!"

Religion and Ethics

Religious traditions provide an answer to the question, "How, overall, should I live my life?" Secular ethical traditions provide an answer to the question, "What is the right thing to do?" When in a pluralistic society a particular religion's answers come into genuine conflict with the answers arrived at through secular ethical deliberation, we must ask how deep is the conflict. If the conflict is so deep that honoring the religion's views would entail dishonoring another religion's views, then we have a difficult decision to make. In such cases, the conclusions of secular ethical deliberation must override the answers of the religion in question.

The reason is that granting privileged status to one religion will inevitably discriminate against another religion. Individuals must be allowed to follow their conscience in matters theological. But if one religion is allowed to enforce its values on others in a way that restricts the others' ability to pursue their values, then individual religious freedom has not been protected.

Moral theorists refer to this feature of nonreligious ethical deliberation as the *overridingness* of ethics. If a parent refuses a life-saving medical procedure for a minor child on religious grounds, the state is justified in overriding the parent's religious beliefs in order to protect what secular ethics regards as a value higher than religious freedom: the life of a child.

The overridingness of ethics applies to our discussion only if a religious group claims the right to halt GM technology on purely religious grounds. The problem here is the confessional problem of one group attempting to enforce its beliefs on others. I mean no disrespect to religion; as I have noted, I am a religious person, and I value religious traditions other than my own. Religious traditions have been the repositories and incubators of virtuous behavior. Yet each of our traditions must in a global society learn to coexist peacefully with competing religions and with nonreligious traditions and institutions.

If someone objects to GM technology on purely religious grounds, we must ask on what authority they speak for their tradition, whether there are other, conflicting views within their tradition and whether acting on their views will entail disrespecting the views of people from other religions. It is, of course, the right of each tradition to decide its attitude about genetic engineering. But in the absence of other good reasons, we must not allow someone to ban GM technology for narrowly

sectarian reasons alone. To allow such an action would be to disrespect the views of people who believe, on equally sincere religious grounds, that GM technology is not necessarily inconsistent with God's desires for us.

Minority Views

When in a pluralistic society the views of a particular minority come into genuine conflict with the views of the majority, we must ask a number of questions: How deep is the conflict? How has the minority been treated in the past? If the minority has been exploited, have reparations been made? If the conflict is so deep that honoring the minority's views would entail overriding the majority's views, then we have a difficult decision to make. In such cases, the conclusions of the state must be just, taking into account the question of past exploitation and subsequent reparations or lack thereof. This is a question of justice.

The question of justice would arise in the discussion of GM technology if the majority favored GM technology, and the minority claimed the right to halt GM technology. If the minority cites religious arguments to halt GMOs and the majority believes that halting GMOs will result in loss of human life, then the state faces a decision very similar to the one discussed in the prior section. In this case, secular policy decisions may be justified in overriding the minority's religious arguments insofar as society deems the value of human life higher than the value of religious freedom.

However, should the minority cite past oppression as the reason their values ought to predominate over the majority's, then a different question must be addressed. Here, the relevant issues have to do with the nature of past exploitation, its scope and depth, and the sufficiency of efforts, have there been any, to rectify the injustice and compensate victims. If the problem is long-standing and has not been addressed, then imposing the will of the majority would seem to be a sign of an unjust society insensitive to its past misdeeds. If, on the other hand, the problem has been carefully addressed by both sides and, for example, just treaties arrived at through fair procedures have been put in place, are being enforced, are rectifying past wrongs, and are preventing new forms of exploitation, then the minority's arguments would seem to be far weaker. This conclusion would be especially compelling if it could be shown that the lives of *other* disadvantaged peoples might be put at risk by honoring a particular minority's wish to ban GMOs.

Conclusion

Earlier I described a method for reaching ethically sound judgments. It was on the basis of that method that I personally came to change my mind about the moral acceptability of GM crops. My opinion changed as I took full account of three

considerations: (1) the rights of people in various countries to choose to adopt GM technology (a consideration falling under the human rights principle); (2) the balance of likely benefits over harms to consumers and the environment from GM technology (a utilitarian consideration); and (3) the wisdom of encouraging discovery, innovation, and careful regulation of GM technology (a consideration related to virtue theory).

Is it ethically justifiable to pursue GM crops and foods? I have come to believe that three of our most influential ethical traditions converge on a common answer. Assuming we proceed responsibly and with appropriate caution, the answer is yes.

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Chapter 11
Animals in Agriculture

Gary Varner

Abstract This chapter discusses the philosophical views underlying the animal welfare/animal rights distinction, and how these philosophies would apply to various forms of animal agriculture.

Keywords Animal welfare • Animal rights • Neo-Cartesianism • Consequentialism • Non-consequentialism • Food • Animal agriculture

Case: Misha the Cow

Dr. Wright asks the class to read Tom Regan's book, *The Case for Animal Rights*. While they are working through it, Doug invites Dawn out to his farm and, on a Saturday morning, she is helping him with the milking. She notices that he calls each one by name, so she asks him what he thinks about the early chapters of the book, where Regan discusses the mental abilities of animals.

"Well you know what?" Doug says, "I think Regan is right about one thing: each of these cows is 'a subject of a life.' Holsteins have been a part of my life for as long as I can remember, and I think I know them pretty well. A lot of people think cattle look stupid, I guess, but when you watch them carefully you see that they have their own ways of solving problems – when they're confronted with something new, you can almost see them thinking about it: what they want, and how to get it. And each one has its own personality, like Misha, who's shy and gentle but likes to hang around the rambunctious and ornery Daisy. I'm certainly not an animal rightist, but I think Regan is right that animals like cows are at least conscious and have preferences about their futures. What do you think?"

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"I think he's right that many animals are conscious 'subjects of a life'," Dawn replied, "but I wonder about the conclusions he claims follow from that. I can see why animal rights activists would object to things like cramming five hens into a small cage, and maybe even to slaughter, even if it's painless. Because like Regan says, if you believe that animals have rights, then you can't justify slaughtering them, even painlessly, just because humans like the taste of meat. But Misha seems to live a very nice life, and she sure doesn't seem to mind being milked."

Doug thinks a moment. "The objectionable part is probably not the milking, or how they spend their days. You're right about that. Our cows spend most of their time on that ten acres we have fenced in for them. And if we go to a rotational grazing system, then they'll even be getting almost all of their food by grazing rather than us bringing them forage. We never mistreat them and would not allow any of the people we hire to help with milking to mistreat them either."

"So then what's wrong with dairy farms according to someone like Regan?"

"Well," Doug continues, "the whole point of breeding dairy cows is to maximize the amount of milk they will produce over their lifetimes. We breed our cows so that they will first give birth when they are about two years old, and we continue to breed them so that they calve about once a year after that. Then, when they're no longer producing milk at an efficient rate, we cull them."

"Cull them?"

"Send them to slaughter. Years ago we'd cull cows when they were seven or eight years old; now we cull them at about three or four years. So each year, we ship about a quarter of our 200 milkers to market. We have to keep 50 heifers to replace them, but only one out of every two cows born is female. The rest are male – they become veal calves, which are slaughtered after a few months."

"I see," Dawn replies. "If every cow gives birth each year and only 50 of those calves can be used to replace retiring dairy cows, then you're producing 150 unneeded calves each year."

Doug looks at the ceiling, thinking. "Well, that's not quite right," he says. "Since the 50 milkers who are being retired aren't bred, we only have 150 calves at most, and since 50 of them end up replacing the retiring cows, that leaves only 100."

By this time everyone working in the milking barn is cleaning up and putting equipment away.

"OK," Dawn continues, "so one problem an animal rights activist might have with dairy farms is that they end up depending on a lot of slaughter, like maybe a number equal to half of the milking herd every year. But just how bad is it, being slaughtered?"

"Well, actually, when my dad and I have gone to that slaughterhouse out in the county, it hasn't seemed so bad. The cows go through a walled pathway – called a 'race' – just like we have here on the farm for getting them into the device that restrains them during veterinary care. The races at the slaughterhouse are curved so that they can't see far ahead and that helps keep them calm. And my dad and I can get them to move forward through the races without using cattle prods or anything. You just have to get into the right place in their field of vision and they'll move on down the races trying to stay away from you."

"But don't people say that animals know when they're about to be killed?"

"The ones we watched sure didn't seem to. The slaughterhouse is ventilated so that air is drawn in through the kill chute, so you can't smell anything, and like I said, they can't see ahead. So if you don't get them excited, they don't get scared."

"So how are they actually killed? In my junior high English course we read a book called *The Jungle* by Upton Sinclair, and it described guys beating cows to death with big hammers."

Dough laughs. "It's nothing like that anymore. They use a pneumatic gun that fires out a bolt about the size of your pinkey finger, and when it's placed correctly, the cow just slumps unconscious immediately. You can even see a grey mist that's the brain being obliterated, so the cows must lose consciousness instantly and permanently."

"Well that's not a pretty sight, but you're right, it doesn't sound like they suffer."

"Yeah, but my dad's seen chickens slaughtered, and he said it was different. The chickens get hung from their feet, fully conscious, on a conveyer belt. They are killed by having their heads sliced off, but if things work right, they are stunned electrically first."

"But remember that expression, 'running around like a chicken with its head cut off'?" Dawn asks. "Maybe chickens are not subjects of a life, and maybe they don't have rights because they can't think in even the simple ways Misha can. I mean, how far do 'animal rights' go? If chickens have rights, then do fish? What about cockroaches?"

Before Doug can respond, his mother rings the dinner bell on the back porch. "We better hurry and get cleaned up for lunch," he says, and they head for the house.

Case: Discussion Questions

1. Do you think that animals like cattle and chickens are capable of feeling pain? Do you think that they have a sense of their own future and preferences about what happens to them? What sorts of evidence leads you to answer "yes" or "no" to each of these questions, regarding cattle and regarding chickens? What animals, are *not* capable of each of these things? What makes you think they aren't?
2. How much merit is there in the idea that a kind of farm that takes animal interests into account and satisfies them more fully is better than a farm that does not? Explicitly distinguish the normative premises that support your conclusion from the empirical ones.
3. A majority of Americans are not vegetarians and do not accept animal rights arguments. How important, from a moral point of view, is this fact to Doug's family's decisions about the place of cows in their future farm operation?
4. It would be difficult, economically and socially, for dairy farmers to not slaughter cows. Given the state in which veal calves live out their short lives, do you

think we need scientific research to make it possible that only heifers would be born on dairy farms? And if so, who should pay for this?
5. Should we shape public policy so that cows are put under as little stress as possible on dairy farms? Why or why not? Should we outlaw veal production? Why or why not?

Discussion of Issues

Introduction

Do non-human animals have rights? The answer to that question depends not only on whom you ask, but on how you ask them.

Philosopher Bernard Rollin of Colorado State University in Fort Collins has extensive experience talking to cattle ranchers about the well-being of their animals and about the animal rights movement. The ranchers are understandably suspicious of the animal rights movement. After all, they are in the business of raising beef, and a well-known slogan of the animal rights movement is that "Animals are not ours to eat, wear, or experiment on." So if an animal rights activist were to ask them if their animals "have rights," the ranchers might well answer "no." But philosopher Rollin finds that if you ask ranchers whether or not animals "have rights," and you make it clear that a "yes" answer to that question does not entail that ranching is wrong, they will often say "of course," citing what they take to be an obvious duty they have to treat their animals well.

Clearly, then, to understand what is at issue in debates over various uses of animals, it is critical that we get more clear about what it means to "have rights." This chapter begins with an overview of various ways rights claims are used. Subsequent sections survey the ways the main contributors to the contemporary debate over animal rights have interpreted rights claims and the implications those differing interpretations have for a range of human uses of animals.

The Logic of Rights Claims

If it sounds odd for cattle ranchers to acknowledge that their animals "have rights" while denying that it is wrong to kill them for food, it is only because "having rights" means a number of different things in different contexts.

When a rancher says that cattle "have rights" she or he might mean only that there are right and wrong ways of treating cattle, that cattle are not mere objects that you can use any way you please without concern for their well-being. A cow, the rancher might say, is a sensitive being who can suffer if mistreated and who therefore deserves to be treated well; but the rancher might maintain that humane

slaughter, in which cows do not suffer, is OK. For an animal rights activist, however, to say that a cow "has rights" probably means something much stronger – it might mean that we would be wrong to use the cow as a means to our ends, even if we treat it very well in the process. For this reason, an animal rights activist might oppose dairy farming, even if all the animals were allowed to live out their natural lives rather than being sent to slaughter eventually.

These dramatically different views of "animal rights" reflect one of the most basic divisions in modern ethical theory: between consequentialist and utilitarian thinking in ethics on the one hand, and non-consequentialist and rights-based thinking on the other.

Consequentialism and Utilitarianism

"Consequentialism" is the view that the morality of actions or institutions is a function of their consequences. By "actions" is meant particular actions of individuals, whereas by "institutions" is meant social practices, laws, customs, etc. On a consequentialist approach, you evaluate an action or institution in terms of the effects that flow from it. To the extent that the consequences are good on the whole, the action or institution is good.

The best-known version of consequentialism is utilitarianism. As a general school of thought, utilitarianism is often described as advocating "the greatest good for the greatest number," but a more precise definition would be this: To think in utilitarian terms is to think that the right thing to do is maximize aggregate happiness. It is important to note that utilitarianism is defined in terms of "*aggregate* happiness." To speak of "aggregate" happiness is to speak of the total or average happiness of the affected group, rather than the agent's own happiness individually. So utilitarianism is not to be confused with egoism – whereas an egoist would hold that each individual is obligated to maximize his or her own happiness, the utilitarian holds that each individual is obligated to maximize the total or average happiness of the group. That might well call for individual sacrifice, as when a parent foregoes something that would make him or her happy, because the family as a whole would benefit from another use of available money.

Since utilitarianism is defined in terms of maximizing aggregate happiness, any utilitarian obviously owes us an analysis of this key term. Most utilitarians have fallen into one of two camps on this issue: *hedonistic* utilitarians define happiness in terms of feeling pleasure and avoiding pain; *preference* utilitarians define happiness in terms of some kind of integrated satisfaction of one's preferences – that is, of one's projects, plans, desires, hopes, dreams, and so on. Although most contemporary utilitarians endorse the latter, the classical utilitarians, Jeremy Bentham, John Stuart, and Henry Sidgwick, all endorsed the former.

It is Mill who wrote that "It is better to be a human being dissatisfied than a pig satisfied; better to be Socrates dissatisfied than a fool satisfied." But Mill explicitly endorsed a purely hedonistic conception of happiness, writing that "By happiness is intended pleasure, and the absence of pain; by unhappiness, pain, and the privation

of pleasure." He noted that such a definition of happiness "excites in many minds … inveterate dislike. To suppose that life has (as they express it) no higher end than pleasure – no better and nobler object of desire and pursuit – they designate as utterly mean and groveling; as a doctrine worthy only of swine." Mill replied to this "doctrine of swine objection" by arguing that the pleasures associated with various intellectual endeavors are qualitatively superior to pleasures associated with bodily functions, and that because only human beings are capable of the more intellectual endeavors (like doing science, philosophy, art, etc.), a happy life for a human being will involve the exercise of those capacities.

Commentators sometimes argue that in responding this way, Mill was implicitly abandoning his professed hedonism, because Mill defends the qualitative superiority of intellectual pleasures by arguing that humans strongly *prefer* a life that includes some of them. Whether or not that is the best way to interpret Mill, we can understand why many philosophers are dubious that a purely hedonistic view of happiness is adequate, at least in regard to humans, and why, therefore, most contemporary utilitarians endorse a preference-based conception of human happiness.

Many people think that happiness for an animal consists in merely avoiding pains and enjoying pleasures, and that only when it comes to humans is premature death really "tragic." Suppose, for instance, that tonight you die painlessly in your sleep. How are we to describe the harm you have suffered? We are assuming that you did not suffer consciously while being killed, so how shall we describe the harm? To many people, it seems inadequate to describe it in terms of missed opportunities for pleasure in the future. When talking about animals, many people think that is an adequate way of describing what has been lost when they die young, but when a human dies young, people commonly think that the death is tragic in a way that no animal's death is. The tragic nature of a person's premature death might be explained in terms of its precluding the fulfillment of various long-term projects – hopes, dreams, or plans – that she or he had (e.g. to raise a family, to succeed professionally, etc.) or, in the case of the very young, that she or he would eventually have developed.

This is why most contemporary utilitarians define happiness in terms of some kind of integrated fulfillment of one's preferences. For when one's happiness is conceived in these terms, it is easy to see how death could be tragic even when one passes away painlessly in one's sleep. However painless, death forecloses all possibilities for accomplishing all the things one hopes to do, for achieving one's goals, prosecuting one's projects, chasing one's dreams, etc. Describing premature death this way seems to capture more adequately the "tragedy" that such a death is.

Obviously there is much more for a preference utilitarian to say about happiness. In particular, what does it mean to achieve an "integrated fulfillment of one's preferences"? Are all preferences on a par, or do individuals have hierarchies of preferences, some of them more important and fundamental to one's happiness than others? If so, how do we decide which are the more and less fundamental ones? And can the satisfaction of many less fundamental ones outweigh, in the aggregate, the frustration of a more fundamental one?

However, enough has been said to make the basic outlines of utilitarian thinking clear. Utilitarians are consequentialists; they evaluate actions and institutions in terms of their effects or consequences. Specifically, utilitarians look at effects on the aggregate happiness of the affected individuals. And while some utilitarians define happiness in terms of individuals simply feeling pleasure while avoiding pain, others say that individuals are happy to the extent that they achieve an integrated satisfaction of their preferences.

Non-consequentialism and Rights-Based Thinking

The non-consequentialist alternatives to utilitarianism are best introduced by identifying what is widely thought to be the central problem for utilitarian thinking in ethics, and this takes us back to our over-arching topic in this section of the chapter. A succinct way of expressing the fundamental problem many philosophers have seen in utilitarianism would be: Because it evaluates actions and institutions in terms of aggregate happiness, utilitarianism fails to respect individual *rights*.

To see why someone would think this, consider the institution of slavery. Presumably slavery makes each slave dramatically less happy than she or he could be, but if each slave serves several free people, then perhaps the total added happiness for the slave holders more than outweighs the aggregate unhappiness of the slaves. If so, then wouldn't slavery be justified on utilitarian grounds? Some utilitarians have responded that it is unrealistic to think that the dramatic sufferings of the slave class would really be outweighed by the increased leisure time and other benefits enjoyed by the slave holders. But critics of utilitarianism argue that even if no real world cases of slavery can be justified on utilitarian grounds, there is still something wrong with a theory that evaluates institutions like slavery in terms of aggregate happiness. That utilitarianism would endorse human slavery, even just in principle, is a critical objection in many thinkers' eyes. And this objection is commonly expressed in terms of rights claims: If slavery violates fundamental human rights, then even if the slaves' unhappiness were outweighed by the slave holders' happiness, slavery would still be wrong.

To criticize utilitarianism for neglecting individual rights in this way is to invoke the kind of stronger notion of "having rights" that we earlier attributed to animal rights activists and contrasted with "rights" of the kind ranchers are willing to acknowledge that animals have. A utilitarian certainly thinks that individuals "have rights" in a sense. After all, since utilitarians believe that we ought always to maximize aggregate happiness, they ought to take into account effects on all individuals whose happiness is affected by an institution like slavery, and they do just that in taking the slaves' unhappiness into consideration. But the rights that critics of utilitarianism have faulted it for neglecting are rights in some stronger sense. Just as we imagined an animal rights activist objecting to various uses of animals – even perfectly humane ones – on the grounds that animals ought not to be treated as means to our ends, some philosophers have criticized utilitarians for treating individual humans as means to others' ends.

One of the most famous opponents of utilitarian thinking in ethics was the eighteenth century Prussian philosopher Immanuel Kant. Kant formulated a very different way of thinking about right and wrong, which he called "the categorical imperative." Although Kant claims repeatedly that there is only one categorical imperative, he gives several different formulations which are not obviously equivalent. One of them invokes the distinction between treating people "as ends rather than means": "Act in such a way that you treat humanity, whether in your own person or the person of any other, never simply as a means but always at the same time as an end." Kant claims that precisely the same conclusions follow from this version of the categorical imperative as would follow from this very different formulation of it: "Act only on that maxim through which you can at the same time will that it should become a universal law." It is not obvious how to apply either of these criteria, nor is it obvious that they would imply exactly the same things as Kant claimed.[1]

Without going into any further detail about Kant's specific way of opposing utilitarianism, we can sum up what we have learned about the logic of rights claims in this section. Utilitarianism is the consequentialist view that right actions and institutions maximize aggregate happiness. Utilitarians recognize that individuals "have rights" in the limited sense that every individual's happiness ought to be taken into account in deciding what to do. Critics of utilitarianism charge that it ignores a stronger sense of "having rights." If an individual "has rights" in this stronger sense, then that individual deserves to be treated as more than a utility receptacle. That is, if an individual "has rights" in the stronger sense, then it would be wrong to harm that individual on purely utilitarian grounds.

This of course leaves open many questions. First and foremost, how do we decide which individuals "have rights" in this stronger sense? Kant believed that only human beings are due this kind of respect, but obviously animal rights advocates who oppose even the most humane uses of animals think that the animals do too. And even once the question of who has rights is settled, it remains to be said how we should decide whose rights to violate when rights come into conflict. Both of these important questions will be discussed in more detail in the next section.

The Contemporary Debate Over "Animal Rights"

The battle lines in the current debate over "animal rights" can be drawn pretty clearly in terms of utilitarianism versus rights views, with hedonistic utilitarian thinking about "animal rights" corresponding to animal welfare. (Note: from here

[1] Quotations from Immanuel Kant, *The Moral Law: Kant's Groundwork of the Metaphysics of Morals* (Kant 1948), pp. 96 and 88. Readers desiring a more detailed treatment of Kantian thinking in ethics should see chapters eight and nine of Marcus Singer's *Generalization in Ethics* (Singer 1971). Singer makes it very clear how to apply the second formulation of the categorical imperative given above and why the "treat humanity as an end" formulation is not equivalent. (By the way, Marcus Singer is no relation to Peter Singer, the animal rights philosopher.)

on, we will put "animal rights" in quotation marks when we intend for the term to include both animal welfare philosophies and true animal *rights* philosophies.) The above discussion of rights claims makes it clear how such an animal welfare position might lead to dramatically different conclusions than a true animal *rights* view. Before looking at such views in greater detail, however, it is important to contrast both with what is often called the neo-Cartesian position.

Neo-Cartesianism

René Descartes, commonly designated "the father of modern philosophy," held that animals lack all consciousness because they lack language and they lack reason. Descartes and his followers held that, because they are not conscious, animal experimentation raises no ethical issues at all. Modern study of animal cognition makes it implausible to hold that animals entirely lack reason, and some studies suggest they can master at least the rudiments of language. Moreover, Descartes never clearly explained why an organism which lacks language and reason must necessarily lack all consciousness whatsoever, including consciousness of pain, which is generally regarded as a less cognitive phenomenon. After all, newborn babies can neither reason nor use language, yet we believe that they can feel pain – otherwise, why would circumcising infants without using anesthetics be controversial?

Still, some contemporary philosophers hold that animals may entirely lack consciousness. The best-known example is Peter Carruthers of the University of Sheffield, England. In a widely-discussed article called "Brute Experience," Carruthers argued that although animals clearly experience their environment, their experiences might all be non-conscious, the same way a driver distracted by conversation experiences and unconsciously avoids traffic on the road but can't recall anything about it later. Carruthers proposed that an experience is only conscious if it is available for reflection. That would explain why the preoccupied driver would claim not to remember anything about miles and miles of road she has just traversed, even though she was clearly conscious of other things during the same period. With that criterion for consciousness in mind, Carruthers questioned whether animals are ever conscious. In Carruthers' view, unless we can show that they think about at least some of their own experiences, we have no evidence that animals are conscious at all.

"Blind sight" is the term for a well studied phenomenon in humans which can help us understand Carruthers' claim about animals. "Cortical blindness" results when part of the primary visual cortex in the brain is damaged. If the damage is limited, the blindness will be limited to part of the subject's visual field. In the damaged area, the patient has no conscious vision; these patients claim not to see anything at all, they steadfastly maintain that they are not conscious of, and do not think about, anything in the affected area of their visual field. Nevertheless, when forced to guess what is being presented there, they answer correctly with far higher than chance accuracy (in some situations approaching 100%), proving that visual information is still being processed, that they really do see, but without that vision being available to consciousness.

Carruthers' suggestion about animals is that they may be, in effect, blind sighted in all respects; that all of their experiences – including their experiences of pain – may be non-conscious experiences. And just as it would not seem to matter to a blind sighted patient whether she is presented with a beautiful scene or a gory scene in the area of her visual field which she has no conscious awareness of, it may not matter to an animal whether it feels pleasure or pain. Non-conscious pains don't have any conscious "feel" at all, so they can't feel *bad*, and it would seem to be the fact that our pains feel bad to us that makes us think pain is a bad thing.[2]

Although a few contemporary philosophers are neo-Cartesians like Carruthers, most hold that at least some non-human animals are conscious, at least in certain ways, and this is certainly a feature of our common-sense world view. But if at least some animals are conscious, then the question of their moral status arises, for if animals can feel pain, suffer, etc., then it would appear that they can be harmed in morally significant ways. Contemporary proponents of animal welfare and of animal rights argue for two different ways of taking the conscious suffering of animals into consideration, ways which map roughly onto the hedonistic utilitarian perspective and some kind of stronger claim about animal rights.

The Animal Welfare Position

In response to the emergence of the contemporary animal rights movement (roughly following the release of Peter Singer's book *Animal Liberation* in 1975), agriculturalists, medical researchers and others targeted by the movement began using the term "animal welfare" to describe their position on the moral status of animals. They used the term to emphasize that while they took seriously the moral standing of animals, they did not reach the abolitionist conclusions of self-styled animal rights activists. To be an animal welfarist came to mean roughly that one takes animal suffering into account, but in roughly the way a hedonistic utilitarian would. Although the implications of applying utilitarian thinking to our treatment of other humans had long been a source of objections to the view, the analogous implications for our treatment of non-human animals allowed animal welfarists to endorse things like medical research on animals, which promised to save countless humans (and animals) from preventable suffering and death, while distancing themselves from the neo-Cartesians who would deny that animals are conscious at all.

In the philosophical literatures on animal rights and environmental ethics, the term "animal welfare" has become synonymous with the hedonistic utilitarian approach to thinking about "animal rights." However, in popular discussions of the

[2] For more on Carruthers' view, see his initial article "Brute Experience" (Carruthers 1989), and his later, book-length overview of related issues, *The Animals Issue: Moral Theory in Practice* (Carruthers 1992). In more recent work, Carruthers has entertained the hypothesis that pains which are non-conscious may nevertheless be morally significant (Carruthers 1999).

issue, the "animal welfare/rights" distinction is commonly employed in a less philosophical and more political sense, in terms of the goals various activists have in mind and the tactics they employ in trying to reach those goals. For instance, in media coverage of the "animal rights" issue, animal welfarists are usually portrayed as people who work within the system to revise certain problematic practices, without advocating a total end to those practices. Animal rightists, by contrast, are portrayed as extremists bent on abolishing various practices and willing to use illegal means to accomplish their goals. It is also common for animal welfarists to be portrayed as calm, well-informed and rational critics, with animal rightists portrayed as emotional, unreasoning, and poorly informed.

However, this more popular, political version of the animal rights v. animal welfare distinction obscures the agreement which exists at the level of philosophical principle between self-described animal welfarists and the best-known "animal rights" philosopher, Australian ethicist Peter Singer. Singer is a thorough-going utilitarian, and although he actually employs a complex mix of hedonistic and preference utilitarianism, Singer thinks, as do most animal welfarists, that a hedonistic conception adequately captures the concept of happiness as it applies to many non-human animals. In principle, Singer acknowledges, his utilitarianism implies that some medical research and some forms of slaughter-based animal agriculture would be justifiable, but in practice, he argues, even a hedonistic utilitarian stance implies that these practices should be abolished, or all but abolished. So Singer is popularly characterized as an animal rightist, because he argues for abolitionist conclusions, even though much of his philosophical stance corresponds to that of self-professed animal welfarists.

In this section, we will look at a few important details of Singer's philosophical position, noting more carefully where and how his views correspond to those of self-professed animal welfarists, and noting certain general implications of Singer's views. We will wait until the final section to look in detail at specific uses of animals, so that we can first look at the very different, and explicitly rights-based view of the other best-known animal rights philosopher, Tom Regan. We will then be able to carefully compare and contrast the implications of thinking about animals in hedonistic utilitarian terms and in terms of rights more strongly construed.

Any thorough summary of Singer's utilitarian approach to "animal rights" must discuss at least four things:

1. His principle of equal consideration of interests.
2. His claim that sentience is a sufficient condition for having interests.
3. The related notion of speciesism.
4. His distinction between animals which are morally "replaceable" and those which are not.

Singer discusses the first three of these points in the first chapter of his book *Animal Liberation*, which is one of the most widely reprinted pieces on the subject of "animal rights."

Singer titles the chapter "All Animals are Equal: or why the ethical principle on which human equality rests requires us to extend equal consideration to

animals too."[3] In it, he first argues that "Equality is a moral idea, not an assertion of fact" (p. 4). That is, when we say that "all humans are equal," we do not assert that they are in fact equal in intelligence, capabilities, size, etc. Rather, we assert that every human, regardless of these variations, deserves equal consideration of his or her interests. For instance, the interests of white males should not be counted while those of black females are not, the interests of less intelligent people should not be discounted, etc. The moral equality we insist on for all humans, Singer concludes, comes to this: "the interests of every [individual] affected by an action are to be taken into account and given the same weight as the like interests of any other" (p. 5).

But, Singer then argues, if some non-human animals have interests which are similar to some human interests, then it would be arbitrary to limit equal consideration of interests to humans. In particular, he argues, all animals which are capable of feeling pain have a basic interest in common with humans, namely an interest in avoiding pain. Although the term "sentient" can be used to refer to any kind of consciousness whatsoever, the term has come to be associated with consciousness of pain, specifically, because Singer chose to use it that way. We can summarize Singer's argument so far, then, as follows:

1. The principle of equal consideration of interests is the basis of our recognition of human moral equality.
2. According to that principle, the similar interests of all individuals affected by actions and institutions ought to be given equal weight in evaluating those actions and institutions.
3. Sentience (conceived of as the capacity to feel pain) is a sufficient condition for having interests.
4. So we ought to treat the similar interests of all sentient animals equally in evaluating actions and institutions.

In this sense, all (sentient) animals are equal.

One of the most basic misunderstandings people get from a superficial acquaintance with Singer's argument for animal equality comes from not noticing that, to the extent that different individuals have different interests, equal consideration of similar interests does not require equal treatment of different individuals. Singer himself emphasizes this with the following example:

> Precisely what our concern or consideration requires us to do may vary according to the characteristics of those affected by what we do: concern for the well-being of children growing up in America would require that we teach them to read; concern for the well-being of pigs may require no more than that we leave them with other pigs in a place where there is adequate food and room to run freely. (p. 5)

So recognizing (sentient) animals' moral equality with humans in the way Singer advocates would not entail providing horses with libraries or giving

[3] Page references to Singer's *Animal Liberation* are to the second, minimally revised edition (Singer 1990).

monkeys the vote. Exactly what it might entail is considered further in the final section of this chapter, but Singer thinks the implications are sweeping, as his discussion of "speciesism" in the first chapter of *Animal Liberation* makes clear.

The term "speciesism" was coined by Richard Ryder, a British author of several popular books on our treatment of animals. Singer describes speciesism as "a prejudice or attitude of bias toward the interests of members of one's own species and against those of members of other species" (p. 6). Speciesism thus has the same logic as racism or sexism: each involves either ignoring or differentially weighting the similar interests of members of different groups. Racists ignore or differentially weight the similar interests of different racial groups and sexists ignore or differentially weight the similar interests of the two sexes. A speciesist would be anyone who ignores or differentially weights the similar interests of different species.

In Animal Liberation, Singer rests his case against animal research, agriculture, hunting, etc. on two kinds of arguments, both of which rely on the concept of speciesism. The first strategy we can call the argument from marginal cases. By "marginal cases" are meant human beings who lack many, most, or all of the intellectual traits distinctive of normal adult humans, e.g. profoundly retarded persons, very young children, fetuses and newborns, the enfeebled elderly, and the irreversibly comatose. (The label for this form of argument may be unfortunate, but the label is widely used in the contemporary literature on animal rights.) An argument from marginal cases proceeds thus:

1. Identify a reason which most people think would suffice to make it wrong to treat such "marginal humans" a certain way.
2. Show how that same reason applies to animals who are commonly treated the same way.
3. Conclude that we are being speciesist when we treat the animals differently than the "marginal" humans.

Here is an example in Singer's own words:

> [I]f we consider it wrong to inflict pain on a baby for no good reason then we must, unless we are speciesists, consider it equally wrong to inflict the same amount of pain on a horse for no good reason. (p. 15)

Singer's other argument strategy, which we can call the generalization argument, works the other way around:

1. The advocate of a practice cites some reason for using certain non-human animals.
2. The reason given is that the animals lack some characteristic.
3. For any characteristic the advocate cites, some human beings can be found who lack this same characteristic.
4. Therefore the advocate should feel justified in dong the same thing to those humans for the same reason.
5. But the advocate does not, and this shows that he is a speciesist.

Here is an example of this type of argument from Singer:

> [I]f we use [the argument that certain experiments would cause less pain if performed on non-human animals than if performed on normal human beings] to justify experiments on nonhuman animals we have to ask ourselves whether we are also prepared to allow experiments on human infants and retarded adults. (p. 16)

Singer argues that "Most humans are speciesists," because most humans "take an active part in, acquiesce in, and allow their taxes to pay for practices that require the sacrifice of the most important interests of members of other species in order to promote the most trivial interests of our own species" (p. 9); because we would never sacrifice similarly important interests of human beings for the sake of trivial benefits, our acceptance of various agricultural, scientific, educational and recreational practices is speciesist.

In *Animal Liberation* Singer relied on such arguments rather than explicitly endorsing utilitarianism, in order to avoid embroiling himself in philosophical controversies which he thought it was unnecessary to settle. He thought that our acceptance of various uses of animals is so clearly speciesist that one needn't even take sides on the utilitarianism versus rights issue in order to oppose those practices, and he thought that a popular, less philosophical book would be more effective in generating opposition to them. However, throughout his professional philosophical work Singer endorses utilitarianism, and in concluding our overview of Singer, we should note that Singer defends a complex mix of hedonistic and preference utilitarianism.

In our general discussion of utilitarianism we noted that different utilitarians employ different conceptions of happiness. On the hedonistic conception, one is happy to the extent that one feels pleasure and avoids pain, while the other conception identifies happiness with the "integrated fulfillment of one's preferences." The latter, we saw, has seemed to many to capture better the way premature death is tragic for a human being. In *Practical Ethics*[4] Singer agrees that the death of an individual who (like any normal adult human being in decent circumstances) has a robust sense of her future, who has projects, plans, desires, hopes, dreams, and so on – which he identifies with being "self-conscious" – is a greater harm than is the death of an individual who lacks such a robust sense of self and future.

However, Singer denies that only human beings are self-conscious. He cites research which, he claims, clearly shows that some other primates are self-conscious (specifically chimpanzees, gorillas, and orangutans, pp. 111–116, 118, and 132). He admits than many animals may not be, including fish and chickens (pp. 95, 133), but he claims that

> a case can be made, though with varying degrees of confidence, on behalf of whales, dolphins, monkeys, dogs, cats, pigs, seals, bears, cattle, sheep and so on, perhaps even to the point at which it may include all mammals. (p. 132)

[4] Page references to Singer's *Practical Ethics* are to the second, minimally revised edition (Singer 1993).

This is an important qualification on Singer's view, because he concludes that the morality of killing is very different in the case of animals who are self-conscious and those who are not.

Specifically, Singer claims that what he calls "the replaceability argument" applies to the latter but not to the former.

> When we come to animals who, as far as we can tell, are not rational and self-conscious beings, the case against killing is weaker…. Even when the animal killed would have lived pleasantly, it is at least arguable that no wrong is done if the animal killed will, as a result of the killing, be replaced by another animal living an equally pleasant life. (pp. 132–133)

Singer argues that this reasoning applies to individuals who are self-conscious in his sense, but not to those who are not. Table 11.1 illustrates Singer's reasoning. Suppose a farmer has three happy chickens, kills one without causing it to suffer in the process, and replaces it with an equally happy chicken. Singer's claim is that in this case, there is the same total happiness in the world before and after, as illustrated in situation A. But this assumes that the opportunities for future pleasure foregone by the terminated individual (#1) do not count as negatives in the moral ledger after that individual is replaced by an equally happy individual (#4). By comparison, if the unfulfilled preferences of a self-conscious individual *do* count as negatives in the moral ledger after its death, then things are as represented in situation B, where aggregate happiness is not maintained by replacing the terminated individual (#1) with an equally happy individual (#4). According to Singer, this explains why killing an individual who is self-conscious is a more serious affair, morally speaking.

Singer's replaceability thesis is controversial, but for our purposes it is interesting primarily because it shows where his philosophical views coincide most closely with those of self-professed animal welfarists. The animal welfarists think like hedonistic utilitarians in regard to all animals. Singer does so only in regard to animals who are not self-conscious. This is not to say that for Singer we are never justified in harming a being which is self-conscious; as a utilitarian, he must admit that at some point the aggregate utility of doing so justifies the harm to that individual. However, on Singer's view, the painless death of a non-self-conscious individual is easier to justify than is the painless death of a self-conscious one, and Singer believes that many of the animals involved in agriculture and scientific research, including birds and fish, may not be self-conscious. As noted above, he explicitly gives chickens and fish as examples, but we may surmise that he intends to include other birds, as well as all reptiles and amphibians.

Table 11.1 Illustrating the replaceability thesis

Situation A	Before	After	Situation B	Before	After
Individual #1	+1		Individual #1	+1	−1
Individual #2	+1	+1	Individual #2	+1	+1
Individual #3	+1	+1	Individual #3	+1	+1
Individual #4		+1	Individual #4		+1
Aggregate happiness	+3	+3	Aggregate happiness	+3	+2

The Animal Rights View

We just saw how the views of the best-known "animal rights" philosopher, Peter Singer, correspond in significant ways to those of self-professed animal welfarists. In this subsection we examine the views of the other best-known "animal rights" philosopher, Tom Regan of North Carolina State University. Regan defends what he calls "the rights view" and claims that it, rather than Singer's utilitarianism, is the philosophical foundation of the more abolitionist conclusions which self-professed animal rights activists reach. To adequately summarize Regan's view, we need to discuss three things:

1. His rights-based opposition to utilitarianism.
2. His use of an argument from marginal cases.
3. His "miniride" and "worse-off" principles.

All of these features of his view are developed in his book *The Case for Animal Rights* (Regan 1983).

As the label he chooses for his view – "the rights view" – suggests, Regan rejects utilitarian justifications for harming individuals who have moral rights; that is, Regan agrees with the standard criticisms of utilitarian views, e.g. the slavery objection. While Singer responds to this objection the way we described earlier – he argues that realistically, slavery would never actually maximize aggregate happiness (see *Practical Ethics*, p. 23) – Regan objects to the fact that a utilitarian could admit that something like slavery would ever be justified, even in principle. To do so, he argues, is to treat human beings as if they were mere "utility receptacles" (pp. 205–206, 236). Regan reasons that the respect we normally think is due our fellow humans, and that makes slavery wrong even in principle, is the kind of respect described earlier as "having rights" in the stronger sense. So Regan concludes that if an individual "has rights" in this sense, then it is wrong to harm him or her on the grounds that doing so maximizes aggregate utility – to do so would be to treat him or her as a mere "utility receptacle."

Thus far, Regan's view is a very traditional response to utilitarianism. It is the next step in Regan's argument that leads him toward a very untraditional attitude toward nonhuman animals: Regan uses an argument from marginal cases to defend extending such basic respect, or rights in the strong sense, from humans to include many animals. Specifically, Regan argues that the most plausible basis for attributing rights to humans, what he calls "the subject of a life criterion," implies that many animals, and at the very least all "normal adult mammals of a year or more," have similar rights.

Regan describes a "subject of a life" as any individual who has

> beliefs and desires; perception, memory, and a sense of the future, including [one's] own future; an emotional life together with feelings of pleasure and pain; … the ability to initiate action in pursuit of their desires and goals; a psychological identity over time; and an individual welfare in the sense that their experiential life fares well or ill for them, logically independently of their utility for others and logically independently of their being the object of anyone else's interests. (p. 243)

Notice how similar Regan's notion of being a "subject of a life" is to Singer's notion of "self-consciousness." In both cases, what is meant, basically, is that the individual in question has a fairly robust sense of his or her (or its) own future and preferences (desires, goals, plans, etc.) about that future.

Regan argues that the subject of a life criterion best explains the judgments we make about respect being due our fellow human beings, because not only normal adults but many "marginal" humans (including the quite profoundly retarded, very young children, and the very enfeebled elderly) are subjects of a life. But if their having the capacities listed above is what qualifies all of these humans for the special kind of respect which moral rights in the stronger sense carry, then we ought to recognize that many animals have rights in this sense too. For in the early chapters of *The Case for Animal Rights* Regan presents empirical evidence which he thinks proves that at least "all mentally normal mammals of a year or more" (p. 78) are subjects of a life.

Some commentators have misinterpreted this claim to mean that "mammals and no other forms of life" have rights on Regan's view.[5] But Regan makes it very clear that he is only restricting the reference of "animals" in this way to avoid the controversy over "line drawing" by making his arguments in the book "refer [to] individuals *well beyond* the point where anyone could reasonably 'draw the line' separating those who have the mental abilities in question from those who lack them" (p. 78). And at various places in the book Regan reminds us that this does not mean that birds, for instance, do not have rights, only that the case for saying that they are subjects of a life is not incontrovertible the way he believes it is for mammals (see, e.g. p. 349).

So to summarize Regan's use of the argument from marginal cases: He argues that if most humans' being subjects of a life qualifies them for moral rights in the strong sense, then so too does it qualify many non-human animals, including at least all mammals, probably also birds, and maybe even some other animals. In the final section of this chapter, a bit more will be said about which animals are subjects of a life, and also about which ones feel pain (the two categories might not be co-extensive). To finish up this summary treatment of Regan's view, however, we must first say something about his "mini-ride" and "worse-off" principles.

These principles are Regan's way of answering the question "How can we decide whose rights to violate when rights come into conflict?" Regan recognizes that such conflicts will arise, but realizes that to decide on utilitarian grounds in such cases would be to take back the basic respect for individuals which recognizing their moral rights requires. So he proposes two non-utilitarian principles. The principles apply in two different kinds of cases and require very different things.

[5] Eugene C. Hargrove, "Preface" to *The Animal Rights/Environmental Ethics Debate: The Environmenal Perspective* (Hargrove 1992). Similarly, in his review of Regan's book, J. Baird Callicott ridicules Regan for titling it *The Case for Animal Rights*: "Regan insists on using the word *animal* throughout his discussion, even though what he really means, as he himself notes, is 'mammal', on the grounds of 'economy of expression'. This is puzzling since both words contain six letters. Why wasn't the book called *The Case for Mammal Rights*?" (Callicott 1985).

Here are convenient summaries of the two principles (based on what Regan says about them in Section 8.10 of *The Case for Animal Rights*):

> *The miniride principle* applies where comparable harms are involved and requires that we override the rights of the few rather than the many.
>
> *The worse-off principle* applies where the harms involved are not comparable, and requires us to avoid harming the "worse-off individual."

Before we can apply these principles to various situations, we need to clarify two key concepts.

One is the concept of a "non-comparable" harm. To understand how Regan conceives of harm, remember that what qualifies individuals for rights is their being what he calls "subjects of a life," and what he means by this is roughly that they have conscious preferences, desires, etc. about their own futures. So harm to a subject of a life consists in either thwarting actual preferences, desires, etc., or in diminishing the individual's capacity to form and/or satisfy such preferences, desires, etc. in the future. What would be an example of "non-comparable harms" so construed? An obvious example would be losing a finger or a leg versus losing one's life. The former would diminish one's capacity to form and satisfy desires at least temporarily as one adjusted to the loss of the digit or limb. It might even make it impossible to ever pursue certain previously valued goals. But in contrast, losing one's life completely destroys the capacity to form and satisfy desires. As we shall see, Regan does not think that his critique of animal agriculture and other uses of animals requires us to make any more fine-grained distinctions than this. He thinks that the harms animals suffer in these practices are just as obviously not comparable to the harms humans would suffer by eliminating the practices.[6]

The other concept crucial to applying Regan's two principles is that of "the worse-off individual." The best way to explain this concept is by considering an abstract example. In Table 11.2, assume that each row represents a choice between two options in a given situation, that each negative number under an option represents the harm that would befall one individual if that option were chosen in that situation, and that a −10 harm is "noncomparably worse" than a −1 harm.

By "avoid harming the worse-off individual" Regan means, avoid harming whoever would suffer a harm that is non-comparably worse than the harm anyone would suffer under the alternative option. In situation A this is the individual who, under option #1, would suffer a harm that is non-comparably worse than the harm any individual would suffer if option #2 were chosen. In situation B, each of the individuals under option #1 is "the worse-off individual" in relation to the individuals under option #2.

Regarding the implications of Regan's principles, note that in some cases, his principles will imply the same conclusions as the principle of utility, for instance in situation B (where the aggregate harm under option #1 is −50, versus −5 under option #2).

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[6] Actually, there are two complications, which will be considered later: first, in medical research the harms some human beings will suffer if disease cures are not found might actually be non-comparably worse, on Regan's view, than the harms experimental animals suffer; and second, Regan invokes "special considerations" both regarding medical research and in response to certain objections to his abolitionist conclusions regarding animal agriculture.

Here the worse-off principle applies, because non-comparable harms are again involved, and it requires us to avoid harming "the worse-off individual" who is, we have just seen, any of the individuals under option #1 in relation to those individuals under option #2. But sometimes, as in situation A, the implications will be radically different. In situation A, the utilitarian would choose option #1, because less aggregate harm would occur (−10) in comparison to option #2 (−25). However, Regan's worse-off principle implies that we should forego maximizing aggregate utility in this case in order to respect the rights of the worse-off individual. This illustrates how, according to Regan, the rights view rules out slavery even in principle. The relatively trivial harms each beneficiary of the institution would suffer via its abolition (the −1s under option #2 in situation A) do not justify, even in the aggregate, causing non-comparable harm to even one slave (the −10 under option #1).

In situation C, however, notice that everyone who would be harmed by either option #1 or option #2 would be harmed to the same degree (−10). So "comparable" harms are involved and the miniride principle applies, requiring us to override the rights of the few rather than the many. Thus in situation #3 we are required to choose option #2. Notice that this is the same option a preference utilitarian would choose, since the aggregate harm under option #2 (−50) is less than under option #1 (−250). Regan insists, however, that the miniride principle is not utilitarian, because its application does not turn on minimizing aggregate harm, but rather on minimizing the overriding of rights (pp. 305–306). Where *comparable* harms are involved, Regan claims, respecting individuals equally means counting each rights violation equally and minimizing the total number of individual rights violations. His reasoning is, roughly, that where comparable harms are involved, the rights violations are equally serious, whereas when non-comparable harms are involved, they are not; so in the former case, but not in the latter, it is the number of rights violations that is crucial.

Table 11.2 Applying Regan's two principles

	Option #1	Option #2
Situation A	−10	−1 −1 −1 −1 −1
		−1 −1 −1 −1 −1
		−1 −1 −1 −1 −1
		−1 −1 −1 −1 −1
		−1 −1 −1 −1 −1
Situation B	−10 −10 −10 −10 −10	−1
	−10 −10 −10 −10 −10	−1
	−10 −10 −10 −10 −10	−1
	−10 −10 −10 −10 −10	−1
	−10 −10 −10 −10 −10	−1
Situation C	−10 −10 −10 −10 −10	−10
	−10 −10 −10 −10 −10	−10
	−10 −10 −10 −10 −10	−10
	−10 −10 −10 −10 −10	−10
	−10 −10 −10 −10 −10	−10

Animal Rights and Agriculture

We are now in a position to compare and contrast the animal welfare position, which employs hedonistic utilitarian thinking about our treatment of animals, with a view which, like Regan's, attributes rights in a stronger sense to many non-human animals. A wide range of practices, both traditional and new, have come under the moral microscope since animal rights views achieved new prominence in the last quarter of the twentieth century. One of the most prominent targets of animal rights groups has been animal agriculture, but even within this area a range of practices have come under fire, raising a variety of issues. Here we can only discuss a few general practices: beef, dairy, and poultry/egg production; but the differences among these three practices give us an occasion for critically comparing and contrasting the implications of Singer's and Regan's views.

One difference is that, as we saw in the preceding section, Singer's and Regan's views might imply different things about the two types of animals involved. Singer, for instance, holds that the replaceability argument applies to animals who are not self-conscious, and he gives chickens as an example of animals which might be sentient without being self-conscious. And for Regan, it is only animals who are subjects of a life who "have rights" in his strong sense. So the questions, "Which animals are self-conscious?" and "Which animals are subjects of a life?" are crucially important for understanding the implications of their views.

But how do we answer such questions? All attributions and denials of mental states or consciousness[7] to other animals, including our fellow human beings, involve arguments by analogy. For even when it comes to a fellow human being, you can never directly observe his or her conscious states (pains, desires, beliefs, etc.). You are always reasoning by analogy.

Formally, arguments by analogy have the following structure:

1. *a*, *b*, and *c* are all known to have properties *P* and *Q*.
2. *a* and *b* are known to have property *R* as well.
3. So probably *c* has property *R* as well.

Suppose, for instance, that you see a stranger accidentally place his hand on a hot stove. When he screams and jumps away, nursing his hand, you are certain that he is in pain, even though you do not see or feel his pain. How can you be so certain? In the case of a fellow human being, you know that he has precisely similar neurophysiology and behaviors to yours (think of these as *P* and *Q* in the argument form above). And since you know that you would feel pain in his situation (*R*), you think it likely (indeed *extremely* likely) that he does too. When it comes to non-human animals, the situation is no different, except that the analogies will usually not be

[7] Although here I use these two terms interchangeably, sometimes there is a distinction to be made. An obvious example would be Freud's use of unconscious mental states in the explanation of behavior. However, as was mentioned in our earlier discussion of Carruthers' views, it is only *conscious* mental states that seem to matter morally. For as Carruthers argues, if animals' mental states are all unconscious, then our treatment of them seems to raise no moral issues at all.

as strong. With regard to our fellow humans, there are innumerable analogies we could cite under the general categories of behavior and neurophysiology. However, depending on the animal and the type of conscious state in question, the case for saying that the animal has the conscious state in question may be stronger or weaker, depending on the number and type of analogies scientific research and/or simple observation provide.

Bear in mind, however, that the strength of an argument by analogy is not simply a matter of *how many* analogies one can find. To see why, consider this obviously weak argument by analogy:

1. Chickens, turkeys, pheasants, and cattle are all animals and they are all eaten by humans.
2. Chickens, turkeys and pheasants are all born from eggs.
3. So probably cattle are born from eggs.

Obviously, one could come up with more and more analogies to list off (e.g., chickens, turkeys, pheasants, and cattle all have hearts, they all have lungs, they all have bones, etc., etc.). The above argument is weak because it ignores a crucial *disanalogy*: that cattle are mammals, whereas the others are all birds, and we have very different theories about how the two are conceived, gestated and born. So in assessing an argument by analogy, we do not look just at the raw number of analogies cited, but at both how significant are the analogies cited and whether there are any relevant disanalogies.

Regarding consciousness of pain, specifically, the authors of the four most detailed examinations of the available analogies all reach the conclusion that while all vertebrates probably can feel pain, most invertebrates probably cannot (the notable exception being the cephalopods, which are octopi, squid, and cuttlefish). They consider behaviors like avoidance of previously harmful stimuli and situations and favoring of injured limbs, and neurophysiological considerations like whether or not various animals respond to known analgesics and have natural pain blockers (endogenous opiods) in their systems. The four studies note that while vertebrates uniformly score high on such comparisons, invertebrates (with the exception of cephalopods) score low.[8]

When it comes to being "self-conscious" and/or a "subject of a life," however, there is much more disagreement, both about what analogies are relevant and which animals fit those analogies. When scientists have studied the concept of "self-consciousness," their focus has usually been animals' use of either mirrors or

[8] The four studies are *Lives in the Balance: The Ethics or Using Animals in Biomedical Research* (Smith and Boyd 1991); (2) David DeGrazia and Andrew Rowan, "Pain, Suffering and Anxiety in Animals and Humans" (DeGrazia and Rowan 1991); Patrick Bateson, "Assessment of Pain in Animals" (Bateson 1991); and (4) Margaret Rose and David Adams, "Evidence for Pain and Suffering in Other Animals" (Rose and Adams 1989). For a table summarizing the evidence, see Gary Varner, *In Nature's Interests? Interests, Animal Rights and Environmental Ethics* (Varner 1998), p. 53. A version of that table is available via the world wide web at: http://www-phil.tamu.edu/~gary/awvar/lecture/pain.html.

language. Regarding both, studies have usually shown that only a few of the great apes behave in the ways the scientists have assumed that a "self-conscious" being would. For instance, chimpanzees and gorillas have been taught crude versions of human language, and their uses of these languages have suggested to some scientists that these animals might be self-conscious. Other scientists have thought that a self-conscious organism would be one that recognizes that it is seeing itself in a mirror, as evidenced by it not treating its mirror image as an unknown conspecific (member of its own species) and, instead, investigating parts of its body that it would otherwise never be able to look at (e.g. its teeth and forehead). But by this criterion, only chimpanzees, orangutans, and (possibly) gorillas would appear to be self-conscious, since only these animals have been shown to recognize changes in their own bodies (e.g. a paint spot applied to the forehead during anesthesia) after acclimation to mirrors, and many animals (e.g. baboons) can live with mirrors for years and never stop acting aggressively (as if to an unknown conspecific) toward their own mirror image.[9]

As we saw above, however, Singer seems to think that all mammals might be self-conscious in his sense. But all he means by the term "self-conscious," and all Regan means by the term "subject of a life," is (roughly) having conscious preferences about one's own future, which might not require the kind of capacities discussed in the preceding paragraph. So what scientific work would be relevant to determining which animals have this more limited capacity? Elsewhere I have discussed certain research on basic learning strategies which suggests that although mammals, birds, and herpetofauna (reptiles and amphibians) probably have such forward-looking desires, fish may not and invertebrates (with the exception of cephalopods) probably do not. The studies in question involve very simple learning strategies which would seem to be indicative of thinking consciously about the environment and how to respond to it in ways that will get you what you want, rather than "mindlessly" repeating behavior patterns you have been habituated into. Insofar as most invertebrates and even fish lack these basic learning strategies, the case for thinking that they have conscious preferences is weak relative to mammals, birds, and herpetofauna, which employ these strategies (see Gary Varner, "Localizing Desire," in (Varner 1998)).

It is much more difficult to say what counts as clear evidence for conscious preferences, so in light of the much less controversial evidence for consciousness of pain in all vertebrates, we can see how the answers to the questions, "Which animals are self-conscious in Singer's sense?" and "Which animals are subjects of a life in Regan's sense?" are controversial and the best answers may not be the same as to the question "Which animals can feel pain?"

For present purposes, then, let us suppose, as Singer at least seems willing to do, that although all mammals are in his sense "self conscious," birds are not. A crucial difference in his analysis of the beef and poultry/egg industries would follow, since

[9] For a recent overview of relevant research, see James R. Anderson and Gordon G. Gallup, "Self-Recognition in Nonhuman Primates: Past and Future Challenges" (Anderson and Gallup 1999).

the replaceability argument would apply to chickens but not cattle. A sufficiently humane form of poultry and egg production, in which animals lived happy lives, died humane deaths, and were replaced by similarly happy animals, would be justified, especially in light of the nutritional and culinary benefits of having eggs and chicken to eat. Singer acknowledges precisely this in *Practical Ethics* (pp. 132–33). Above, we noted that self-professed animal welfarists differ from Singer in denying the assumption we just made, namely that cattle are self-conscious animals whose well-being cannot be adequately captured in purely hedonistic terms, so that the replaceability argument does not apply to them. So it is also clear why an animal welfarist might conclude that a sufficiently humane form of cattle production is also morally acceptable.

However, right after admitting that the replaceability argument might justify a sufficiently humane form of slaughter-based agriculture for those animals to whom it applies, Singer argues that even if it applies to birds, the argument doesn't justify the contemporary poultry industry, which is based on "factory farming, where animals do not have pleasant lives" (p. 133). It is easy to see why someone thinking from an animal welfare perspective would be critical of the contemporary U.S. poultry industry. Today most laying hens live in small, crowded cages, and most broilers (chickens raised for meat) are raised in very large numbers in large barns where crowding becomes extreme as the birds mature to slaughter weight. Economies of scale and other factors drove the egg industry towards confinement early: by 1990, 90% of all laying hens in the United States were caged. One of the main reasons is that intensive confinement systems require far less labor to maintain. For instance, although it might cost $2.5 million to build a single facility in which 300,000 hens live while laying eggs, only three laborers might be needed to run such a facility (Parkhurst and Mountney 1988). Little labor is needed because feeding, watering and sanitation are mechanized, and farmers can afford to forego monitoring for underproductive hens and simply replace the entire flock when average production falls below a certain level (which usually occurs every 12–15 months) (Austic and Neshem 1990). Confined several to a small wire cage, today's laying hens cannot forage, fly, dust-bathe, or nest. Poultry are still exempt from U.S. federal humane slaughter and poultry slaughter is a relatively indelicate affair, with fully conscious birds hung from their legs on conveyor belts before being electrically stunned and then mechanically beheaded, and poultry slaughter is on the rise. As beef consumption fell during the late 1980s and early 1990s, chicken slaughter grew at a rate of almost 300 million animals a year, reaching a yearly rate of almost 6 *billion* chickens in the United States alone.

By contrast, relatively few cattle, approximately 30 million per year, are slaughtered).[10] Of these, many have lived a portion of their lives loose on Western ranges, and when it comes to the slaughter procedure itself, conditions have

[10] This statistic, and those in the foregoing paragraph are based on the U.S. Department of Agriculture's publications *Livestock Slaughter* (United States Department of Agriculture Livestock Slaughter, various dates) and *Poultry Slaughter* (United States Department of Agriculture Poultry Slaughter, various dates).

improved dramatically since the scenes described in the early 1900s in Upton Sinclair's novel *The Jungle*. Large-scale, state-of-the-art facilities today are capable of slaughtering as many as 400–600 cattle per hour, but (probably contrary to popular belief) systems of this kind, when well designed and operated, can be the most humane. The "races" or walled paths approaching the stunning chute can be designed to look just like those through which cattle have traveled previously for routine veterinary care, and experienced handlers can move animals along without prodding. Although inexperienced or poorly trained handlers may prod every animals who passes by, this is unnecessary. By simply shaking a pom-pom on a stick in their "flight zone," an experienced handler can use cows' natural herding instinct to move them forward without ever touching them in most cases. Also contrary to popular belief, cattle do not "smell blood in the chutes." Any unfamiliar or unusual object or fluid will arouse the animals, but a well-designed slaughterhouse will be ventilated so that air flows into the building through the kill chute, thus making it impossible to smell anything from outside the building. The kill chute itself in state-of-the-art facilities today allows cattle to see nothing but the buttocks of the animal immediately in front of them as they are supported on either side of their briskets by a double track conveyor system just prior to being hit with the "stun gun." Finally, "stunning" is a misnomer for what happens in the chute, since a properly placed shot with a "stun gun" obliterates the animal's brain, making it impossible for it to remain or ever regain consciousness. I have myself watched cattle being killed for over an hour at a time at a slaughterhouse on the Colorado plains. While I watched, very few animals struggled at all while entering the double track conveyor system, and almost always the first shot of the stun gun sent a mist of gray matter into the air.[11]

While not all self-professed animal welfarists are critics of the U.S. poultry industry, we can see how, thinking from a hedonistic utilitarian perspective, the beef and poultry industries could look very different, and why the poultry industry in Scandinavian countries has been a special target of legislative reform and welfare-oriented animal science. It is also understandable that, from a viewpoint like Regan's, which holds that animals "have rights" in a stronger sense, the beef and poultry industries would fare equally badly.

For even if the animals involved live perfectly happy lives and die completely painless deaths, Regan argues that animal slaughter violates the worse-off principle, at least in developed nations like the United States and the Scandinavian countries. Regan admits that the worse-off principle would justify humans in killing animals for food, if this were the only way to survive. For, he argues, "the harm that death is, is a function of the opportunities for [preference formation and] satisfaction it forecloses" (p. 324), so since the range of preference formation and satisfaction open to a human being is dramatically greater than that open to any of the animals commonly consumed for food, the harm that death is to a human being is

[11] I am indebted to Colorado State University animal scientist Temple Grandin for showing me the facility and for other details of cattle slaughter described in this paragraph.

non-comparably worse than the harm that death is to any animal. However, he argues, in developed Western nations, people cannot plausibly claim that they have to kill animals to survive; vegetarian diets can suffice, and even be superior in terms of nutrition and taste.

The foregoing argument also shows us why an animal rights advocate like Regan might oppose the dairy industry, at least as it exists today in a country like the United States. For today's dairy industry is heavily dependent on slaughter. Today milking cows spend only about 3–4 years in production, after which they are slaughtered for relatively low-grade beef. Also, dairy farmers maintain high milk production by breeding their milkers to calve about once per year (Bath et al. 1985). The resulting calves are removed from their mothers immediately or within days, and although as many as one half to two thirds of the female calves become replacement milk cows, the remaining heiffers and all the males become beef or veal. Altogether, the dairy industry produces around one seventh of the cattle slaughtered in the United States.[12]

So someone who, like Regan, objects to animal slaughter, might also object to the dairy industry. It would be economically infeasible in today's market for dairy farmers not to slaughter older cows who give relatively little milk, to cease breeding their milkers yearly, or not to send unused animals into the beef trade. So assuming that a strict vegetarian diet can be nutritionally adequate, humans can live without dairy products as well. That assumption is controversial, as some nutritionists doubt that a vegan diet, which excludes all animal by-products like milk and eggs, can be nutritionally adequate, at least for people with high metabolic needs like growing children and pregnant and lactating women. Others believe a vegan diet can be perfectly healthy for these individuals, and some have even claimed that heavy reliance on dairy products actually increases the incidence of osteoporosis or brittle bones in the elderly. These nutritional issues are complex,[13] but the tie between the dairy and beef industries at least makes it clear why animal rights advocates might be seriously concerned with the dairy industry even if the animals involved are treated very well on a day to day basis.

Regan concludes that if we recognize that the animals involved have rights in the strong sense, then we ought to be committed to "the dissolution of commercial animal farming as we know it" (p. 353). You may know people who are dependent on the beef, dairy, or poultry industries and wonder how even an animal rights philosopher like Regan could call for this. Millions of families are economically dependent on animal agriculture, either as farmers, processors or retailers, so even if consumers could be convinced to give up meat, dairy, and eggs, wouldn't it be better to preserve these industries because so many families are dependent on them? After all, wouldn't the harms be very serious, especially if you take into consideration lost opportunities for education and other important things, so that

[12] Based on the USDA's *Livestock Slaughter* (United States Department of Agriculture Livestock Slaughter, various dates).

[13] For an overview of the scientific and philosophical issues, see (Comstock 1994).

Regan's own worse-off principle would imply that we should preserve these industries in order to avoid these harms, some of which might be non-comparably worse than what an animal suffers through humane slaughter?

Regan considers this objection and responds by arguing that the miniride and worse-off principles do not protect individuals who voluntarily participate in competitive, risky enterprises (p. 339). He acknowledges that we have a duty to prevent their dependents from being made worse-off (since they did not choose to be dependent on animal agriculture). But, he argues, "it is not the consumers, in their capacity as consumers, who have this responsibility" (p. 341). At most, we as a society have an obligation to protect these innocent victims of economic forces just as we have obligations to the dependents of people unemployed for other reasons; we have no duty to buy animal products.

In conclusion, you may know people who are dependent on animal agriculture and you may disagree with Regan's response to this objection. However, our discussion of Regan's strong, abolitionist stance on animal rights at least demonstrates that the popular, political characterization of animal rights people as uninformed and unreasoning is a caricature. Regan's work on animal rights shows that an abolitionist stance can follow from a carefully argued application of a traditional ethical theory, the theory that individuals are due a kind of respect which utilitarianism denies them.

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Chapter 12
Animals in Research

Richard Haynes

Abstract A short review of the history of US animal welfare legislation and discussion of the views of animal liberationists, who want to abolish (most) biomedical research using animals, and reformist animal welfarists, who hold that a suitably reformed use of animals would make the use of animals in research ethically acceptable.

Keywords Biomedical research • Animal welfare • Federal regulations • Professional authority • Ethical issues

Case: Nonhuman Primates and Biomedical Research

Dr. Wright asks the class to read Peter Singer's *Animal Liberation*, and while they are reading it, Doug and Emily find themselves in a heated discussion about whether biomedical research on animals is justified, especially given the description that Singer gives of how these animals are treated. Doug is skeptical of the ethical rightness of this treatment because the researchers do not have the close relationship with their animal subjects that farmers have with their cows.

Emily is not so sure, since she has a friend who works as a student helping with a research project aiming at finding a cancer cure using mice bred to develop cancer. This friend argues that helping to find a cure for cancer is worth any costs that the animals being used have to suffer. Emily notes that Singer is a utilitarian, a position that says that activities are right in so far as they promote the general well-being of all involved, both humans and animals. If using animals yields a net benefit to all sentient beings, then it is justified, even if some have to suffer for it. Doug says that he has a friend who is a student member of the University's Institutional Animal Care and Use Committee, a committee required by Federal law to give

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approval of any animal use. Doug says that his friend went on an inspection tour of some of the animal facilities, and was pretty put out when he saw a room in which about fifty macaque monkeys were housed in individual cages in a dark room. When they came into the room, the lights were turned on and the monkeys began to scream at each other and the visitors. Doug said that his friend later asked the Committee whether this was acceptable housing, since the law requires that nonhuman primates be housed in a way that promotes their psychological well-being. The University veterinarian, who was a consulting member of the committee, replied that in his professional judgment, this was the best way of housing these animals, since all of them were males and if any of them were housed in the same cage, they would kill each other. The lights were out in the room because when the lights were on, the males saw each other and started engaging in fight behavior.

Doug's friend thought that the veterinarian, who was in charge of caring for the University's research animals, was not giving them proper care in spite of the veterinarian's appeal to his professional judgment.

Doug and Emily then talked about whether utilitarianism was a correct ethical theory, particularly in light of the position that Tom Regan took in his book about animal rights. Neither were sure about this, and even if Singer's position was right, whether housing the macques in this way produced results that utilitarians would approve of.

Case: Discussion Questions

1. Do you think that biomedical research using animals as models is justified when we consider the negative effects of this research on the animal models? If Federal law requires that such research be approved of by an Institutional Animal Care and Use Committee, what criteria and standards should these committees use in judging whether a particular use of animals is justified? What standards of care should be provided these animals in their housing? What qualifications should members of these committees have? Should it be required that at least one animal rights advocate be on each committee?
2. How can nonhuman primates be housed in a way that "promotes their psychological well-being," as the law requires? What does the law mean by "psychological well-being" and how can we tell when it is being promoted? Do you think that veterinarians are uniquely qualified to make this judgment? If so, what is it about their training that gives them this qualification?
3. Do you think that it is morally justified to breed mice so that they will naturally, or easily, develop cancer (these are called "onco-mice")? What ethical theory would you appeal to in making your decision?
4. What is the difference between the ethical theory of Regan and the ethical theory of Singer? Singer is a utilitarian. What does this mean and why is utilitarianism called a consequentialist theory? How would these two theories be used to answer question 3 above? Who do you think is right?

Discussion of Issues

I have restricted the topic of this chapter to using animals in *biomedical* research for several reasons, the most important of which is that their use here can be paradigmatic of humans using nonhuman animals exploitatively. Nonhuman animals can be used as research subjects in many ways that do not restrict their freedom or otherwise jeopardize their welfare, as when, for example, wildlife scientists tag an animal and release it as part of a study of habitat range, but typically in biomedical research, the life of the animal is controlled by the researcher or the institution supporting the research, and this control commonly is in the form of the research animal being caged for its entire life, however long or short that may be. In the US, and in some other countries, institutions using animals in biomedical research are required to have proposed uses (as well as the care given animals while not being used) evaluated and approved by an institutional committee.

In the US, the required committees are called Institutional Animal care and Use Committees (IACUCs), and are, to some extent, modeled on Institutional Review Boards (IRBs).[1] IRBs at every institution doing research on humans must obtain permission from their IRB to assure that the human subjects are fully informed of the possible effects of the research on them and that they give their "informed consent" to be subjects. We will explore below the extent to which the analogy between IRBs and IACUCs can hold up.

Prior to the federal legislation requiring IACUCs, nongovernmental organizations, like the American College of Veterinary Medicine (ICLAM) and the American Association of Laboratory Animal Scientists (AALAS)[2] monitored membership institutions primarily on the care given animal models in their housing when they were not actually being used in a protocol, and there was no significant monitoring of the actual uses of the animals in the protocols. The 1985 Animal Welfare Act required that animals be monitored during use as well. IACUCs must see to it that animals receive adequate care and also that the proposed use meets certain criteria. What these criteria are is somewhat unclear, but they seem to include (1) that the research has the promise of leading to important results, (2) that it is not unnecessarily duplicative of other research, and that where painful procedures are involved, an animal be administered anesthesia and/or analgesics, unless doing so would interfere with the research.[3] There has also evolved an appeal to what are called "The Three Rs"[4] – replacing animals models with other models where possible, reducing the number of animals used, and refining the protocol so that it uses the animal models as effectively as possible. The criteria for both care and use can be a good starting point for raising some questions about important issues.

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[1] This is required by the 1985 animal welfare act and also by OLAW. For an account of the mandated IACUCs (see Haynes 2008).

[2] AALAS was formerly known as the Animal Care Panel.

[3] Rollin (2006) notes that prior to the 1986 amendment, scientists using animal in research tended to think that animals did not feel pain.

[4] The three Rs came out of Russell and Burch (1992).

We can use the framework of the legislatively mandated IACUCs to raise a number of *ethical* issues. Keeping the distinction between care and use, we can ask (1) what level of care is ethically acceptable. Those who are identified as "animal welfarists"[5] argue that only care that promotes or allows for the welfare of the animals being cared for is ethically acceptable. Others, who do not see animals as having any moral standing, appear to think any level of care is ethically acceptable as long as it is consistent with the reliability of the animal models.[6] We can also ask (2) What *uses* of animals in research are ethically acceptable? With both questions (1) and (2), we need to reach some agreement about what ethical criteria are relevant for making judgments about ethical acceptability, and there is clearly some controversy, at least among philosophers, about this question. Also, in regard to (1), we need to be clear about how to conceptualize "welfare," especially in regard to the idea of animal welfare. Surprisingly, there has been considerable disagreement here as well.

In practice, IACUCs tend to use some version of utilitarianism as their ethical criterion to decide which research protocols are acceptable, though there is no official position about this. Based on my 10 years experience as an IACUC member at the University of Florida and my attendance at several national workshops, I would judge that the maxim recommended is that if the benefits of the research outweigh the costs to the animal used, then it is justified.[7] The practice of using this maxim raises two questions. (2a) Should IACUCs use other ethical criteria, and (2b) If we use this utilitarian criterion, how much approved research is actually warranted? If we count as benefits the increase in happiness and reduction of suffering brought about by improved health care and the costs the reduced welfare of the animals used[8] (we might also throw in the monetary gains by research professionals, etc.), it is controversial whether much approved research yields any net benefit, given the number of animals used each year[9] and the skepticism about whether using animals models for human health is productive.[10]

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[5]The distinction between "animal welfarists," who argue that a suitably reformed use of animal in science would be acceptable, and "animal liberationists," who argue against any use, is explored by (Jasper and Nelkin 1992). I would argue that if animal welfare is properly conceptualized, then there is no significant difference between these two positions.

[6]There is a long history of scientists claiming that only animals with high levels of welfare make good models.

[7]There is some literature on the effective use of IACUCs (see, for example, Canadian Federation of Humane Societies 1986; Dresser 1990: OPRR/ARENA 1992; Rowan 1990; Laboratory Animal Science 1987).

[8]The costs to these animals varies with the care given them, the reduced levels of welfare they experience, the shortness of their lives, and the limitations imposed on those animals that are bred with specific defects to be used as models for certain diseases. Most animals are terminated after their use.

[9]It is estimated that between 100 and 200 million animals are used in research worldwide (Sandoe and Christiansen 2008).

[10]Greek (2000) and Greek and Greek (2002), for example, argue that it is actually counterproductive to use animals as models for humans (penicillin was originally rejected because of its negative effects on the animal models used to test it) (see Greek 2000; Greek and Greek 2002; Sharpe 1988). Greek (2000) devotes Chapter 8 to discussing more productive alternatives to using animal models. For a different view, see (Sandoe and Christiansen 2008), where the authors list what they consider to be the benefits of using animal models.

In regard to (2a), it is controversial as to whether an increase in utility is the only or even the main goal of our ethical practices. Some have argued that other goals include fairness (protecting the weak against the strong), and promoting compassion (e.g., Sapontzis 1987). If we include these other goals, then our ethical criteria for assessing which protocols are ethically acceptable would change. For example, is it fair to make animals pay the costs for the gains that others make, and does our indifference to these costs make us less compassionate for their suffering?

To be in a better position to consider (1), the level of care that is ethically acceptable as well as (2), what uses are ethically acceptable, we need first of all to explore the relationship between IACUCs and IRBs to see whether IRBs can be used as a model for determining the responsibilities of IACUCs toward the animals they monitor.

Institutional Review Boards as a Model for Institutional Animal Care and Use Committees

It has been argued that IRBs do not offer a productive ethical model for IACUCs, since IACUCs face more difficulty in making principled judgments than do IRBs because, among other reasons, IRBs have more resources to draw on from moral theory about what we owe humans because there is less disagreement about this than about what we owe animals (see, e.g., Prentice et al. 1988). But I think some of these difficulties can be resolved if we think about the role of consent in deciding which risks to research subjects are acceptable. IRBs want to ensure that human research subjects are fully informed about the risks they are accepting as research subjects and that they freely consent to assuming these risks. While IACUCs cannot expect the research subjects that they monitor to become aware of the risks and signal or withhold consent, they can "construct consent" if they think that the benefits to the research subject clearly outweigh the costs or risks. The notion of constructing consent is used where parent, custodians, or medical ethical committees have to make decisions about whether to withhold or accept certain treatments to subjects who are not in a position to give their own consent. Those who must make these decisions have to ask themselves whether it is in the best interests of their wards to receive or not receive the treatments. IACUCs, I would argue, are in an analogous position in regard to the research subjects they must decide for. But in making the assessments about costs and benefits, IACUCs would need some baseline to measure costs and benefits, and here the notion of the research subject's welfare would have to play a crucial role. If we think of this type of consent decision as analogous to our evaluation of whether work animals are receiving fair deals in exchange for their work, then we would be looking to see whether the contributions to their welfare given by those "paying" for their services were worth the work efforts that the animals had to put forth. The analogy to fair deals for human workers, however, breaks down, since with work animals, those receiving the work benefits and paying for the services also control the entire life of the work animal, so the animal has no freedom to live the life that it would choose to live if it had the

freedom to make those choices. Presumably, human workers have their own conception of what sort of life they would like to live, and work to enable themselves to better live that life. Most research animals are bred for their use as models and would not have existed without that intended purpose. So the constructed consent model would only work if we assume that the *care* provided research animals when they are not being used is consistent with their having a high quality of life. With that background assumption, the use would be warranted if it earned the animal an improvement in that quality of care that was worth the extra effort that the use required of the animal. In reality, the assumption that animals used in research have a high quality of life when they are not being used is unwarranted. Perhaps the thesis that "animal welfarist" are holding is that if the care is consistent with the welfare of the animal, and the use a further benefit, then it is ethically acceptable to use the animal in research. However, what is controversial is the sort of life that care givers must give to assure the welfare of the animal. In fact, judgments about animal welfare and who is qualified to make them is a much debated issue. So let us turn to the question of what criteria we should use to judge the welfare of animals.

Competing Conceptions of Welfare

The conception of animal welfare (and human welfare as well) seems to be a hotly contested topic. Sandoe and Christiansen (2008) see three conceptions of welfare and no way to choose among them.[11] They then review various theories of animal welfare and reach the same conclusion. There is a long history of laboratory animal scientists and their affiliates claiming to have a more authoritative understanding of an animal's welfare than their critics (see Haynes 2008) and advocating the use of the judgment of professionals in making welfare decisions.[12] There is also an extensive literature by self-styled "animal welfare scientists" theorizing about how to conceptualize animal welfare and how to assess the degree of its presence in specific cases, especially in regard to farm animals (see Haynes 2008).

Sumner (1996) criticizes the three theories that Sandoe and Christiansen (2008) identify and offers a fourth conception, one that I think is more viable. Someone is well off to the extent that they are justifiedly satisfied (happy) with their life. The qualifier "justifiedly" is added to cover cases where someone is satisfied with their life because they have been oppressively socialized to expect no more because they think they deserve no more. While this account of welfare seems to work well for

[11] The theories that they identify are the objective theory, which identifies welfare with the possession of certain qualities or benefits, regardless of how the possessor assesses their merits, and two versions of subjective theories: hedonism and preference satisfaction. Each of these theories has its disadvantages (see Sumner 1996). For a persuasive objective theory of animal welfare (see Nussbaum 2004).

[12] In many cases, the professionals in question seems to be veterinarians, who tend to equate welfare with good health.

humans, how can we apply it to animals, who, no doubt, cannot really assess the quality of their lives and are in no position to determine whether whatever limits to the satisfactions they feel are justified? The solution to this problem is to place the burden on the animal custodian to see to it that the animals in their care lead a flourishing life. How they are to determine this would require a considerable amount of information about the kinds of lives animals of the type they are caring for would prefer if given the chance to lead it.[13] Current laboratory animal care-takers[14] lack this knowledge. But if they are to function as true custodians for the "wards" in their care, they are obligated to acquire and apply this knowledge.

The application of the above conception of welfare to laboratory animals would require major changes in current practices and would likely make research on animal models extremely expensive. Currently, animals models are bred for the purposes they are to serve, including health defects that might make them better models for research on certain human diseases. They also live comparatively short lives because of the expense of maintaining them, and even if a research protocol does not call for termination of the animals' lives, unless a further use can be found for them, they are in fact terminated because of the lack of funds to continue to support them. There are no prospects for a happy retirement for most animals used in research. Nevertheless, some have argued that a short but happy life is better than none at all and that death is not a harm except for animals that have a self-concept and an awareness of what death entails.[15] Most animals lack this, it is said. So this raises an important question, which I will leave the reader to wrestle with. Is death a harm and if so why. And is it better to have lived a life, however short it might be, than never to have lived at all?[16]

I have argued, in trying to apply Sumner's (1996) account of welfare to animals, that humans who control the lives of animals in their care have custodial obligations to their wards not unlike the obligations that parents have to their children. If they are not prepared to provide a high quality of life for their prospective wards (their children), then they should not have breed them. But the US legislative framework that we have introduced to raise these questions about the ethics of using animals in biomedical research falls far short of this ideal, as the brief account of the history of this legislation that we will conclude with shows.

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[13] Simple preference tests that some animal welfare scientist have appealed to to determine the best care conditions fail because they only give their subjects the opportunity to choose between two, or at most, a few conditions, and they do not allow for the fact that preferences may be based on oppressive socialization. For an account of these tests and some of their limitations when used for determining welfare for farm animals (see Haynes 2008).

[14] Note the difference between calling someone a care-taker and a care giver, As Kheel (2004) points out, care-taking implies taking care of someone's property for them.

[15] Singer maintains this position, as do many other (see Singer 1979; Appleby 1999). For a contrary position see Sapontzis (1987), who maintains that life is instrumentally good because it enables us to have future good experiences.

[16] I personally am unable to make sense of this question, since it can only be asked by those alive and not by those not alive, so any answer is prejudiced by the fact that one is alive.

A Brief History of US Legislation Governing the Use of Animals in Biomedical Research[17]

The 1985 US Animal Welfare Act represents a compromise between critics of the use of animals in scientific research and users and their institutions and associations. But even though there were some gains for the critics, the deferment to the judgment of user experts about what sorts of housing and use was most conducive to animal welfare kept significant control of the use of animal models in the hands of the users. In addition to the effects of this control in diluting the progress that the critics, in supporting the act, hoped to gain for the benefit of animal models, the regulatory agencies were generally lax in enforcing whatever improved standards the regulations seemed to impose. For a comparison between US and British legislation (see Garner 1998).[18] For an account of British and European animal welfare law (see Radford 2001).

The first regulation of animals used in research was the Laboratory Animal Welfare Act. H.R. 13881 became PL 89-544 in August, 1966. The act required licenses for dealers. Research facilities were required to register with the Secretary of Agriculture and comply with any rules and regulations s/he may impart. All dogs and cats transported or sold must be identified according to specifications of the Secretary. Humane standards must be employed. Violations are to be determined by inspections. Research facilities in violation must be subject to fines. Dealers will have their licenses revoked for a violation (Clingerman et al. 1988). While a large part of the public concern that lies behind the support of this bill was the use of stolen pets in research, with a major focus on cats and dogs, the law regulated laboratories conducting research on dogs, cats, hamsters, guinea pigs, rabbits, and nonhuman primates (Glosser 1990). Apparently the reason for choosing to protect these animals was that they were pets or were intelligent. Record keeping was required only for dogs and cats, and the Secretary of Agriculture was permitted to prescribe standards of treatment only for the protected animals while they were being housed in research facilities, but not when they were being used in research (OTA U.S. Congress 1986).

In 1970, Congress amended the animal welfare act by passing the Animal Welfare Act of 1970 [PL 91-579]. “Continued allegations of poor treatment of animals by unregulated parties and expressions of concern for experimental animals besides dogs and cats prompted Congress to pass … [this Act] … to cover a broader class of animals” (OTA U.S. Congress 1986). Now all “warm-blooded animals” used in research are covered. The Act gives the Secretary the authority to determine whether an animal is being used in research. If it is, then the animal is covered.

[17] What follows is a somewhat abbreviated version of Chapter 4 from Haynes (2008).

[18] For a critique of Garner’s position, see (Francione 1996). See also Francione (2004)’s analysis of animal rights.

In 1977, the Secretary promulgated regulations excluding rats, mice, birds, and horses and other farm animals from the definition of "animal." (9 CFR 1.1(n), (o) "The introductory comments published by the Secretary upon issuing the regulations did not discuss the basis for the exclusion [2 FR 31022]" (OTA U.S. Congress 1986).

> The amendments announced a commitment to the humane ethic that animals should be accorded the basic creature comforts of adequate housing, ample food and water, … reasonable handling, adequate veterinary care and the appropriate use of anesthetic, analgesic … (OTA U.S. Congress 1986).

The 1970 limitation to animals while housed rather than when actually being used in a research project remained and reports on the bills made it clear that there was no intention to extend authority to law enforcement officers or private citizens to harass research facilities.

> … the research scientist still holds the key to the laboratory door. This committee and Congress, however, expect that the work will be done with compassion and with care. (OTA U.S. Congress 1986; Report by the U.S. General Accounting Office 1985).

Amendments to the Animal Welfare Act in 1976 (PL 94-279), among other things, extended to Federal research facilities the existing requirement to demonstrate at least annually that professionally acceptable standards governing the care, treatment, and use of animals are being followed (OTA U.S. Congress 1986).

Congress amended the Animal Welfare Act for the third time by including provisions in the Food Security Act of 1985 (PL 99-198) for strengthening standards for laboratory animal care, increasing enforcement of the Animal Welfare Act, providing for the dissemination of information to reduce unintended duplication of animal experimentation, to reduce or replace animal use, to minimize animal pain or distress, and to aid in the training of personnel involved with animals (OTA U.S. Congress 1986). Among the new provisions affecting research facilities is the empowerment of local law enforcement agencies to gain access when searching for lost animals and the bestowal upon the Secretary of Agriculture a "latitude to exercise judgment in enforcing the law and the obligation to execute a number of distinct duties" (OTA U.S. Congress 1986). Animals include all animals used in research, except "birds, rats, mice, and horses and other farm animals 'intended for use as food or fiber, or livestock or … [for] improving animal nutrition, breeding, management, or production efficiency, or for improving the quality of food or fiber' " (OTA U.S. Congress 1986). Animal and Plant Inspection Service (APHIS) inspectors can act to confiscate suffering animals under certain conditions. Part 3 of the regulations details specific standards for humane care according to category of defined animals – dogs and cats, guinea pigs and hamsters, rabbits, and nonhuman primates (OTA U.S. Congress 1986).

The 1985 act "revises the standards, required to be promulgated by the Secretary of Agriculture, which govern the humane handling, care, treatment, and transportation of animals by dealers, research facilities, and exhibitors." Added to the House Bill by the Senate version, the "amendment provides that these standards would include minimum requirements ... for the exercise of dogs and for a physical environment

adequate to promote the psychological well-being of primates" (Report by the U.S. General Accounting Office 1985). The reason given for supporting this provision was to help meet the public concern for laboratory animal care in order to assure that research will continue to progress. The main purpose of the amendments to the Animal Welfare Act "is to improve the authority of the Secretary of Agriculture to insure the proper care and treatment of animals used in research..."

In 1987, the U.S. Department of Agriculture (USDA) charged APHIS to prepare animal welfare regulations and selected a Committee of primatologists, recommended by the National Institutes for Health (NIH), to work on primate housing standards for Part 3. Parts 1 and 2 of the regulations implementing the law were published in 1987, but Part 3, regulating standards, was delayed. In April, 1987 the APHIS Committee developed a comprehensive report on the regulations. In Review of U.S. Department of Agriculture's Animal and Plant Health Inspection Service (1988) conducted by Rep. Brown on July 7, 1988 (Serial No. 100-97), APHIS Administrator James Glosser, announced that Part 3 of the regulations would soon be issued as a proposal. In March, 1989 a final version of Parts 1 and 2 were published and a proposal for Part 3 (*Federal Register* 1989, March 15) refers to docket no. 87-004 published in the *Federal Register* (1989, March 15). A final version of Parts 1 and 2 of the rules were published in the Federal Register on August 31, 1989 and comments on the proposed version of Part 3 published in March were discussed and revisions announced together with a call for further comments. A revised version of subparts A (cats and dogs) and subpart D (nonhuman primates), the parts receiving the largest number of comments and generating the most controversy, were published in August, 1990 and in February, 1991, the final version of Part 3 was published in Federal Register (February 15 1991). In addition to specific "engineering standards" requiring minimum cage sizes and other standard operating procedures, it required research facilities and other users to "develop, document, and follow a plan for environmental enhancement adequate to promote the psychological well-being of nonhuman primates." The plan was to be available to APHIS inspectors at their request and appropriate. The plan to be developed by each research facility was to be in place by August, 1991.

In 1985, Congress also amended the Public Health Service Act (P.L. 78-184) by enacting the Health Research Extension Act of 1985 (P.L. 99-158). The act requires that each entity receiving PHS support for research with animals establish a committee to monitor care and treatment of animals. The act also requires applicants for NIH funds to file assurances and it contains provisions for the development of alternative research methods. For a discussion of these laws (see OTA U.S. Congress 1986).

The history of these attempts at the Federal level since 1965 to legislate standards for the humane treatment of laboratory animals and to regulate their treatment, handling, care, and transportation can be seen as a continuing effort to establish a line of discourse among several different groups. One group, often expressed as "the public concern for animal welfare" is an amorphous group of individual pet owners and others who are revolted or offended by insensitivity to animal suffering. Included among pet owners are those who have suffered from pet

thievery fostered by a growing market for experimental animals. This concern was clearly a major motivation behind the numerous bills filed in 1965 and 1966 that led to the passage of the 1966 Laboratory Animal Welfare Act. A second group consists of researchers who use animals in their research, together with the network that supports this research. The network consists of professional associations of researchers who use animals, the research input industry (including dealers who supply laboratory animals), other professionals and their organizations who are concerned with guarding the rights of professionals to police themselves, research managers and the administration of research facilities who profit from receipt of grants from funding agencies, research organizations, their lobbying associations, and their constituencies, private sector R&D who rely on public sector research for information basic to the technologies they develop and market, and, most remote from the actual research, the general public who view themselves as consumers and users of new technologies.

While early attempts at legislation seemed to aim primarily at dealers, including those who supplied animals to research facilities, increasing public concern about the use of animals in research led to the 1970 amendment, which covered all animals used in research. But the limitation that it applied to them only while they were being housed rather than when they were actually being used in a research project was a sign of the reluctance of Congress to interfere with scientific research and with the judgment of researchers about what sorts of uses were essential to that research.

The 1970 amendment can be seen as an uneasy effort on the part of Congress to mediate public concerns about the abuse of laboratory animals and the autonomy of researchers and their professional organizations to regulate their own research. But it does represent an incursion, however gently expressed, into the private domain of the research facility. The 1976 amendment extended to Federal research facilities the requirement that they demonstrate annually that professionally acceptable standards governing the care, treatment, and use of animals are being followed. But in both amendments, the intent of Congress was to control the discourse of the critics (the general public's perceptions of the standards followed by researchers as mediated by animal welfare groups) by locating the appropriate standards that critics in this discourse should use in the domain of science. "Professionally acceptable standards" clearly refers to (1) the rights of experts to judge what uses are required scientifically in research, (2) the rights of scientists to insist that criticism be based on scientifically valid data, (3) the rights of attending veterinarians to judge what is in the interest of animals used in research, and (4) finally, the notion that the professional ethics of researchers and veterinarians require a concern for the humane treatment of animals. These attempts to expropriate the standards of "outsider" critics, however, remained incomplete. One reason was the continued "expose" of laboratory abuse by welfare activists, and complaints that APHIS charged with the enforcement of the Welfare Act standards, was enforcing the standards in a less than enthusiastic manner. The Secretary of Agriculture at no time in the history of this legislation appeared to want its designated responsibilities of enforcing the Act and its amendments. And while APHIS clearly lacked the funding to support a strong inspection and enforcement program for animal welfare, the Department

refused to request the funding needed, and proposed in the 1986 administration budget to eliminate the program entirely. A General Accounting Office (GAO) study ordered by the Chairman of the Subcommittee on Agriculture, Rural Development and Related Agencies Committee of Appropriation of the U.S. Senate reported on the inadequacies of this program. The report was based on a study of the inspection patterns in a sample of six states. The study found that inspections were less than half of the frequencies considered desirable, the follow up on reported deficiencies was weak, there was little to no monitoring of the program, and the inspectors were poorly trained. While part of the fault for these deficiencies was under-funding for the program, USDA did not appear to ask for increased funding. At the same time, the question of the adequacy of training for inspectors came up, and, in that context, the vagueness of the standards that they were being asked to enforce. The problem of enforcement of the existing Act and its amendments became one of the major factors behind the 1985 amendment.

In the hearings on H.R. 5725 (Health Research Extension Act of 1985)[19] several witnesses, including the Committee Chairman Rep. George E. Brown, Jr., expressed concern about the poor enforcement of the 1976 Act by APHIS. This concern was expressed in the context of claims by a number of organizations, including the Secretary of Agriculture, that the objectives of the bill would be better achieved through regulations rather than new legislation. Bert Hawkins, testifying on behalf of APHIS, argued that the enforcement problem could be solved by better funding for APHIS. Rep. Brown and Rep. Staggers alluded to the as yet unpublished GAO report mentioned above as evidence of poor enforcement (Improved Standards for Laboratory Animal Act, Hearing on H R 5725) and a forthcoming Office of Technology Assessment (OTA) study with similar conclusions, and Brown continued to express some skepticism, given human nature and the nature of institutional frameworks, that the scientific community could be relied on exclusively to police itself on these matters. Similar points about self-enforcement were brought up in the hearings by Franklin M. Loew, Dean of the School of Veterinary Medicine at Tufts. Loew argued that it is in the interest of the scientific community to have properly enforced laws because such laws protect not only the animals used in research but the public interest in science, and Loew also alluded to a "scientific orthodoxy" that can be (by implication) as dogmatic as the orthodoxy of anti-science.[20] In the same hearings, Herbert Rackow, representing Scientists Group

[19]This was the House version of the bill enacted into law as part of PL 99-198 (The Food Security Act of 1985) that amended the previous Animal Welfare Act and its amendments. The hearings on this bill were the only hearings held. It was the Senate version [S.2100] that was reported out of conference as the recommended version and it added several features not included in the House version, including the requirement that dogs receive adequate exercise and nonhuman primates be housed in an environment adequate to promote their psychological well-being.

[20]Loew refers to hearings held in 1981 by Mr. Walgren and in 1982 by Mr. Waxman in which many other aspects of animal experimentation are discussed. See the Hearings before the Subcommittee on Science, Research, and Technology on October 13 and 14, 1981 conducted by Walgren, and another conducted by Waxman on the Walgren Bill – Lab Animals – before the Subcommittee on Health and Environment, December 9, 1982.

for the Reform of Animal Experimentation, refers to a study supported by The President's Commission for the Study of Ethical Problems in Medicine and Biological Research, by the American Association for the Advancement of Science, and by Medicine in the Public Interest on the use of human subjects in research.

It points out that scientists in a university setting are under pressure to produce results and justify more money for research. Promotion, tenure, salary, laboratory space and help, travel, and other professional requisites depend upon research productivity. There is a strong conflict of interest that may affect even the best persons. The University system of governance grants almost complete autonomy to departments and individual scientists. This may result in inadequate protection for human research subjects …. If these considerations concerning research on human subjects are valid, then the need for protection is even greater when the subjects are animals (Improved Standards for Laboratory Animal Act, Hearing on H R 5725).

The OTA study, reported in OTA U.S. Congress (1986), concurring with the findings of the GAO study, cite a number of enforcement problems, including the reluctance of the USDA to even request the additional funding needed to assure greater compliance. In its concluding section of Chapter 13 ("Federal Regulation of Animal Use") the OTA study identifies a number of criticisms of the present system of Federal regulation. Whether these criticisms can be met by strengthening existing statutes or regulations will require judgments about a number of important questions, the study concludes (OTA U.S. Congress 1986). One important issue is whether "strengthening existing laws will promote resolution of or enhance differences between the research and animal welfare communities." In spite of the several amendments to the 1966 Act, however, "A legislative reluctance to invade the actual conduct of research remains clear" (OTA U.S. Congress 1986). This reluctance continues to appear in subsequent policies by APHIS in adopting and enforcing regulations (see, for example, Review of U.S. Department of Agriculture's Animal and Plant Health Inspection Service (1988, July 7) where APHIS discloses that its enforcement policy focuses on education).[21]

To protect scientific research from further public concern about its use of animals, the 1985 amendment attempted to remove some of the obstacles to better enforcement, while still keeping a large amount of the control of the standards to be enforced under the control of the scientific community. The amendment required that the USDA formulate regulations that set standards for humane care, handling, use, and transportation of animals used in research. These standards were supposed to remove some of the vagueness from the existing standards that was cited as one of the sources of poor enforcement by inspectors (lack of training). In addition to a stronger role by the USDA in setting and enforcing animal welfare standards, research facilities were required to form animal care committees that would approve research protocols to ensure that they complied with these standards in the dimensions of avoiding unnecessary use of animals when alternatives were available, and that the research was conducted in a manner that was as humane as possible.

[21] See Francione (1996) for various criticisms of the 1985 act.

At the same time, neither the Secretary of Agriculture nor the animal care committees were entitled to interfere in the design of research. The former distinction between standards that applied when the animals were housed and standards that applied when they were used in research, was now slightly compromised by the authority of the institutional animal care committees and the requirement that assurances be given that research that was painful to animals was neither duplicative nor unnecessary. One important result of the amendment was to force users and IACUCs to take pain more seriously and to use analgesics to reduce or prevent it.[22]

A requirement was added to the original House version of the bill that the Secretary of Agriculture develop standards that included minimum requirements for research facilities to provide dogs with appropriate amounts of exercise and nonhuman primates a physical environment adequate to promote their psychological well-being. This requirement provided the background for the next round of struggles to find the acceptable balance between agency definition and enforcement of animal welfare standards and institutional self-enforcement. Outside critics complained about the slowness with which APHIS undertook the development of the new regulations mandated by the 1895 amendment. In the 1988 annual review of APHIS conducted by the House Subcommittee of Department Operations, Research, and Foreign Agriculture of the Committee on Agriculture, Rep. Brown urged APHIS Administrator James W. Glosser to hasten the review of the comments on the proposed regulations, especially those on dog exercise and primate psychological well-being, areas, according to Glosser, that posed some concern on issues that needed to be addressed. Brown indicated that continuous change in improving these conditions was necessary because Part 3 was "of a great deal of concern to those in the animal welfare community (Review of U.S. Department of Agriculture's Animal and Plant Health Inspection Service. July 7 1988) and further, that unless such change was forthcoming, APHIS might be "faced with a different set of actors and different results." By publishing a series of proposed rules and inviting comments from different groups, APHIS appeared to attempt a compromise between research facilities and outside critics. Nevertheless, APHIS appeared to try to manage the discourse by seeking expert opinion in every area in which controversy appeared. In one of the most controversial areas, that of defining the concept of nonhuman primate psychological well-being and in setting standards for promoting it through improvements in the physical environment of the housing of the primates, APHIS ran into unexpected resistance by the research community to accepting the standards articulated by a committee of NIH experts appointed by APHIS to study the problem.[23]

The final decision by APHIS to handle the problem of developing clear standards for primate welfare was to divide the issue into the establishment of

[22] Until this amendment, scientists using animals tended to discount the fact that pain even existed in animals. After the amendment, this practice ceased and pain was taken seriously, but "distress" was not given official recognition by APHIS until 2 years ago (see Rollin 2006).

[23] For a critical account of efforts by the research community to define psychological well-being (see Haynes 2008).

"engineering standards" that were minimum for (physical welfare) and performance standards for psychological well-being, even though the division between these two types of standards in their relation to the two types of welfare was not absolute. Engineering standards were adopted for minimum cage size, for sanitation, lighting, and temperature, and for other facilities to protect primates from inclement weather and from contamination and predation by other animals, including humans. Some recognition of the "psychological needs" of primates was evident in some aspects of these engineering standards, such as the removal of the previous requirement that all surfaces be impervious to water so that more "natural" materials might be used. The use of natural materials was thought justified because of the belief that primates in more "natural" settings would benefit psychologically. However, standards for conditions to promote the psychological well-being of primates were left vague, with only the stipulation that each research facility develop its own plan for environmental enhancement and for other means of promoting psychological welfare. The prescribed plans had to be "appropriate" and had to take into account the social needs of primates and house monkeys together when ever possible and whenever safe. Other than these requirements, the final regulations about the standards for promoting the psychological well-being of primates left it up to the respective research facilities to develop their own standards and have them available for APHIS inspectors to use as a guideline for inspections. Thus, APHIS chose to err on the side of caution in siding with the research community's complaints about the lack of scientifically validatable information regarding the psychological needs of primates, by leaving the judgments up to the body of experts in each institution to make use of the existing and acknowledged body of professional data – and the professional judgments of attending veterinarians – in developing their own plans. The rationale for this decision might appear somewhat contradictory. The reasons seem to be that (1) the psychological needs of primates were variable not only in terms of species differences but also in terms of the socialization history of the individual primates and in terms of the particular combination of animals that were housed at any one time in a particular institution. No universal "engineering" standards could do justice to this variability without running a serious risk of doing damage to the very animals the law sought to protect. The development of these standards were best left up to experts who were familiar with the local situation and who were also trained to recognize how each individual animal was faring (the professional judgment of the attending veterinarian). Furthermore, (2) if psychological needs are thought to be essentially different than physical needs and psychological well-being a different condition than physical well-being, there was a general lack of information about this new dimension of welfare.

A critical response to the decision by APHIS to handle this controversial task in this particular manner came from many animal welfare groups and other outside critics who had been complaining of the lack of enforcement of existing animal welfare regulations. Some of these groups were clearly impatient with the idea that researchers and research facilities could be trusted to self-regulate. The history of this complaint can be seen as part of the larger debate about the relative merits of external versus self-regulation not only of the use of animals in research, but in the

larger sphere of professional accountability and professional ethics. One of the major arguments used to justify professional self-regulation is based on a dualistic conception of insider communities and outsider communities. This dualism is endemic to the very conception of professional – one uniquely qualified by their expertise to make judgments about important areas of human concern. When these judgments must be based on relatively scarce information, it is the judgment of the expert who has access to this information that is to be preferred over the nonprofessional, who by definition lacks access. Professional codes of ethics normally require professionals to balance the needs of their clients with the larger social needs that provide the social environment in which the clients' needs are served. When a client's needs conflict with those of the professional and do not get adequately served, there exist clear procedures for the plaintiff to follow in filing a complaint either with the professional association that administers the code and the licensing, or with the courts. The argument for self-regulation, then, circumscribes major areas within the sphere of the professional activity to be regulated that require this sort of expert knowledge as a foundation for sound judgment about ethically required choices. When the knowledge is not applied, the expert is vulnerable to a charge of "malpractice." When the client's interests are not served because the professional places their own interests ahead of their clients, or other social requirements are not met, the professional is also vulnerable to reprimand. In either case there is a plaintiff who is thought to be qualified to recognize when the professional has failed to serve the required needs. But in the case of scientists using animals for research, the interests of the animals can only be protected if they are regarded not as clients but as objects of social concern. For a critique of claims for professional autonomy (see Bayles 1981).

The major argument from the other perspective is that there is clearly a conflict of interest between the experts' needs to be successful in their careers (and the institution's needs to reduce research expenses) and the needs of the animals used in research. Even when there are appointed guardians for the needs of the animals (e.g., the attending veterinarians), the veterinarians are so closely tied to the needs of the research community (and are typically animal users themselves) that the needs of the institutions provide a larger framework that colors their judgments. In general, in fact, the concept of client in veterinary medicine is less clear cut than in other professional practices, since clients are more likely to be thought of as animal users who hire veterinarians to keep their animals in "good health" rather than the animals themselves acting as clients. Thus it is the way in which the needs of the client determine how the benefit to the animals is to be defined that creates this confusion about clientele. This argument has been expanded to include a criticism of the biases represented by standards defined largely by various social classes that can be seen, historically, to dominate the various professions. These biases can interfere with the professional's capacity to serve the interest of clients whose interests differ from that of the dominant group, but are nevertheless defined in such a way as to covertly serve the interests of the dominant group. The use of "patriarchal" modes of consciousness in various medical professions to reinforce the social domination of women, or other historically oppressed groups is often cited as an

example of one sort of failure at self-regulation by professional groups. Another argument is that various disciplines are dominated by particular paradigms that exclude their alternatives and bias the professional to see problems and their solutions within that particular context. Problems not identified by the paradigm are not addressed nor are solutions.

Conclusion

I have raised several important issues in regard to assessing the ethical use of animals in biomedical research. One issue is a factual one: does this type of research actually produce more benefits than it costs in terms of the suffering of the animals involved and the money used to support this research. Other issues raised are ethical: even if the benefits do outweigh the costs, is it fair to those who have to pay them; and what levels of care must be provided animals asked to pay for these costs in order for their use to be ethically justified. A third set of issues are conceptual: what criteria should we use in making these ethical assessments; and how should we conceptualize animal welfare in those contexts in which we are called upon to measure the costs to the animals used.

My own responses to these issues should be evident from the analysis I have given of them. In regard to the general debate between animal liberationists, who want to abolish (most) biomedical research using animals and reformist animal welfarists, who hold the position that a suitably reformed use of these animals would make this use ethically acceptable, it is my position that if welfare is properly conceptualized, then most uses of animal in this type of research should be abolished on ethical grounds. So, in effect, the distinction mentioned above amounts to little.

I have concluded this chapter with a short history of US animal welfare legislation in order to identify some of the main obstacles to changing the practices that are ethically objectionable by the use of federal regulations. The main obstacle seems to be the power of those professionals involved in this animal use to give others the power to decide what their ethical-legal responsibilities are or should be. This is not an optimistic note to end on, unfortunately, but it does indicate the large gap between what is ethically acceptable and what is legally acceptable, and between what should be ethically acceptable in theory and what is accepted in practice.

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Chapter 13
Climate Change*

Stephen M. Gardiner

Abstract An introduction to ethical issues surrounding global climate change that discusses the difficulties of interpreting the complex empirical evidence and evaluates answers to the question, How should future carbon emissions be allocated?

Keywords Climate change • Environmental ethics • Virtue ethics • International law • Precautionary principle • Carbon emissions allocations

Case: Biofuels

At the beginning of a unit on global warming, Dr. Wright hands out a case study for discussion. Written by Susanna Flavia Boxall,[1] it reads as follows.

> In one of his State of the Union addresses, President George W. Bush called for a five-fold increase in biofuel production over 10 years.[2] As oil reached record-high prices, and the political landscape in the Middle East grew more violent, finding a sustainable, cheaper and cleaner alternative to fossil fuels seemed imperative.

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* The original, longer, version of this article appeared as "Ethics and Global Climate Change" in, and is reprinted with permission from, *Ethics* 114 (April 2004): 555-600. © 2004 by The University of Chicago. All rights reserved. The opening section of the chapter (''Case: Biofuels'') was written by G. Comstock, who edited Stephen Gardiner's essay for length. Readers are urged to consult the complete version in *Ethics*.

[1] Susannah Flavia Boxall, Case 8: Biofuels. (2008). Regional ethics bowl cases, Rhiannon Dodds Funke (Ed.). Retrieved May 8, 2009, at http://ethics.iit.edu/eb/Regional.html. Permission to reprint granted by the Association for Practical and Professional Ethics.

[2] Mouawad, Jad, "Oil Industry Says Biofuel Push May Hurt at Pump," *The New York Times*, May 24, 2007. http://www.nytimes.com/2007/05/24/business/24refinery.html?hp.

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Biofuels have been touted by some as a way to finally end U.S. dependence on foreign oil, and reduce our carbon foot-print.[3] However, this naive optimism about the future of biofuels was recently called into question as rising food prices caused riots across the globe.[4]

The production of corn-based ethanol in the U.S., an industry heavily subsidized by taxpayers' dollars,[5] has caused the global price of corn and other grain commodities to rise. The devastating effect of inflated food prices on the global poor has led experts to question the wisdom of using food for fuel. Professor McKnight from University of Minnesota illustrates this tension clearly when he says, "Filling the 25-gallon tank of an SUV with pure ethanol requires over 450 lb of corn – which contains enough calories to feed one person for a year."[6]

The environmental benefits of corn-based ethanol have also been called into question. Growing corn requires massive amounts of fuel, pesticides and fertilizers, and causes erosion and nitrate depletion of the soil – with the nitrates then contaminating coastal waters and decimating sea life[7] – only to produce a fuel that, compared to gasoline, reduces greenhouse gas emissions by (at most) 26%. Even more worrisome is the fact that as corn becomes a coveted commodity, tropical forests are being clear-cut for its cultivation.[8]

While the U.S. has focused on corn-based biofuels, the rest of the world has been exploring non-food-based alternatives to oil. Cellulose-based biofuels (e.g., waste sugar cane and switchgrass) seem to be the new energy crop, surpassing corn in environmental benefits. It has been estimated that "cellulosic ethanol could reduce greenhouse gas emissions up to 87 percent."[9] Yet, even if the production of cellulose-based fuels ever becomes commercially viable, it is unclear whether it will be able to satisfy the escalating world demand for fuel.[10]

After he is satisfied the class has understood the case, Dr. Wright asks everyone to discuss with those sitting next to them the following questions.

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[3]Walsh, Bryan, "Solving the Biofuels vs. Food Problem," *TIME*, January 7, 2008. http://www.time.com/time/health/article/0,8599,1701221,00.html.

[4]Martin, Andrew. "Food Report Criticizes Biofuel Policies," *The New York Times*, May 30, 2008. Sec. Business / World Business. http://www.nytimes.com/2008/05/30/business/worldbusiness/30food.html.

[5]Karetnikov, Daria, Elizabeth Skane, and Abdel Abellard. "How Far Can Corn Take Us? Evaluating the Impacts of Ethanol: Final Report," National Center for Smart Growth Research and Education, University of Maryland, 2007. http://www.efc.umd.edu/pdf/EthanolFinalReport010208.pdf.

[6]Runge, C. Ford and Benjamin Senauer, "How Biofuels Could Starve the Poor," *The New York Times*, May 7, 2007. http://www.nytimes.com/cfr/world/20070501faessay_v86n3_runge_senauer.html?pagewanted=print.

[7]Potera, Carol, "Corn Ethanol Goal Revives Dead Zone Concerns," *Environmental Health Perspectives*, Volume 116, Number 6, June 2008. http://www.ehponline.org/docs/2008/116-6/EHP116pa242PDF.PDF.

[8]Runge, supra n. 5.

[9]Clayton, Mark, "The Race for Nonfood Biofuel," *The Christian Science Monitor*, June 4, 2008. http://features.csmonitor.com/environment/2008/06/04/the-race-for-nonfood-biofuel/.

[10]Mouawad, Jad. "The Big Thirst," *The New York Times*, April 20, 2008. Sec. Week in Review. http://www.nytimes.com/2008/04/20/weekinreview/20mouawad.html?scp=10&sq=oil%20consumption%20more%20cars%20china&st=cse.

Case: Discussion Questions

1. Why do some question the idea that biofuels will help the US reduce its reliance on foreign oil and minimize its carbon foot-print?
2. Suppose no individual can do anything to make any difference to the future temperature of the planet. Can we then be held responsible for environmental harm?
3. Might we have collective duties to change our lifestyles even if individually we cannot affect the future?
4. What do you think the world's governments should be doing about climate change?
5. Why is the political landscape of the Middle East relevant to energy policy in the United States?
6. Is there merit in the claim that using food for fuel inflates food prices and harms the global poor? Is it fair for Professor McKnight to compare the use of ethanol in an SUV to the use of corn to provide calories for people?
7. On what grounds have the environmental benefits of corn-based ethanol been called into question?
8. In general, cellulose-based biofuels such as the waste from sugar cane production and switchgrass are more environmentally respectable ways to generate energy than using corn. The case author quotes a source to the effect that "cellulosic ethanol could reduce greenhouse gas emissions up to 87 percent." Do you agree with the author, however, that "even if the production of cellulose-based fuels ever becomes commercially viable, it is unclear whether it will be able to satisfy the escalating world demand for fuel?"
9. In the article to follow, Stephen M. Gardiner identifies skeptics about global warming who "claim to accept the reality of human-induced climate change but argue that there is a strong economic rationale for refusing to act. Prevention, they insist is more expensive than adaptation; hence, both present and future generations would be better off if we simply accepted that there will be climate change and tried to live with it" (Gardiner 581). Do you agree with the skeptics?

Discussion of Issues: "Ethics and Global Climate Change"

Stephen M. Gardiner

Very few moral philosophers have written on climate change.[11] This is puzzling, for several reasons. First, many politicians and policy makers claim that climate change is not only the most serious environmental problem currently facing the world, but

[11]Prominent exceptions include Broome (1992), Jamieson (1990, 1991, 1992, 1996, 1998, 2001, 2005), Shue (1992, 1993, 1994, 1995a, 1995b, 1996, 1999a, 1999b, in press), and an early anthology (Coward and Hurka 1993). Recently a few others have joined the fray. Gardiner (2004),

also one of the most important international problems per se.[12] Second, many of those working in other disciplines describe climate change as fundamentally an ethical issue.[13] Third, the problem is theoretically challenging, both in itself and in virtue of the wider issues it raises.[14] Indeed, some have even gone so far as to suggest that successfully addressing climate change will require a fundamental paradigm shift in ethics (Jamieson 1992, p. 292).

Arguably, then, there is a strong presumption that moral philosophers should be taking climate change seriously. So, why the neglect? In my view, the most plausible explanation is that study of climate change is necessarily interdisciplinary, crossing boundaries between (at least) science, economics, law, and international relations.

This fact not only creates an obstacle to philosophical work (since amassing the relevant information is both time-consuming and intellectually demanding) but also makes it tempting to assume that climate change is essentially an issue for others to resolve. Both factors contribute to the current malaise – and not just within philosophy, but in the wider community too.

My aims in this survey, then, will be twofold. First, I will try to overcome the interdisciplinary obstacle to some extent, by making the climate change issue more accessible to both philosophers and nonphilosophers alike. Second, by drawing attention to the ethical dimensions of the climate change problem, I will make the case that the temptation to defer to experts in other disciplines should be resisted. Climate change is fundamentally an ethical issue. As such, it should be of serious concern to both moral philosophers and humanity at large.

Singer (2002), and Traxler (2002) all write specifically about climate change; and Francis (2003), Gardiner (2001), and Green (2002) discuss issues in global ethics more generally but take climate change as their lead example. Moellendorf (2002) contains a short but substantive discussion. There are also brief overviews in two recent collections (Hood 2003; Shue 2001). There is rather more work by nonphilosophers. Grubb (1995) is something of a classic. Also worth reading are Athanasiou and Baer (2002), Baer (2002), Harris (2000a, 2001), Holden (1996, 2002), Intergovernmental Panel on Climate Change (IPCC 1995), Lomborg (2001), Paterson (1996, 2001), Pinguelli-Rosa and Munasinghe (2002), and Victor (2001). Brown (2002) provides a very readable introduction, aimed at a general audience.

[12]Such claims are made by both liberals (such as former U.S. President Bill Clinton and Britain's former Environment Minister, Michael Meacher) and conservatives (U.S. Senator Chuck Hagel and the Bush administration's first EPA director, Christine Todd Whitman) (see Johansen 2002, pp. 2, 93; Lomborg 2001, p. 258).

[13]For example, the most authoritative report on the subject begins by saying: "Natural, technical, and social sciences can provide essential information and evidence needed for decisions on what constitutes 'dangerous anthropogenic interference with the climate system.' At the same time, such decisions are value judgments determined through socio-political processes, taking into account considerations such as development, equity, and sustainability, as well as uncertainties and risk" (IPCC 2001c, p. 2, emphasis added). (see also Grubb 1995, p. 473).

[14]For example, I argue (Gardiner 2001) that climate change is an instance of a severe and underappreciated intergenerational problem.

The interdisciplinary nature of the climate change problem once prompted John Broome to imply that a truly comprehensive survey of the relevant literature would be impossible (Broome 1992, p. viii). I shall not attempt the impossible. Instead, I shall present an overview of the most major and recent work relevant to philosophical discussion. Inevitably, this overview will be to some extent selective and opinionated. Still, I hope that it will help to reduce the interdisciplinary obstacles to philosophical work on climate change, by giving both philosophers and the public more generally some sense of what has been said so far and what might be at stake. In my view, the ethics of global climate change is still very much in its infancy. Hopefully, this small contribution will encourage its development.

Terminology

> *While global warming has catastrophic communications attached to it, climate change sounds a more controllable and less emotional challenge. (Frank Luntz)*[15]

Potential confusion about the climate change problem begins even with the terms used to describe it: from 'greenhouse effect' to 'global warming' to the more recently favored 'climate change'.[16] To begin with, many people spoke of 'the greenhouse effect'. This refers to the basic physical mechanism behind projected changes in the climate system.[17] Some atmospheric gases (called 'greenhouse gases' [GHG]) have asymmetric interactions with radiation of different frequencies: just like glass in a conventional greenhouse, they allow shortwave incoming solar radiation through but reflect some of the Earth's outgoing long-wave radiation back to the surface. This creates "a partial blanketing effect," which causes the temperature at the surface to be higher than would otherwise be the case (Houghton 1997, pp. 11–12). Humans are increasing the atmospheric concentrations of these

[15]From a memo penned by strategist Frank Luntz recommending that Republicans adopt the new terminology. Cited by Lee (2003).

[16]Sometimes skeptics suggest that the terminological change is suspicious. Recently, however, most have embraced it. See previous note.

[17]It is perhaps worth pointing out that the global warming problem is distinct from the problem of stratospheric ozone depletion. Ozone depletion is principally caused by man-made chlorofluorocarbons (CFCs) and has as its main effect the ozone "hole" in the Southern hemisphere, which increases the intensity of radiation dangerous to human health through incidence of skin cancer. These compounds are currently regulated by the Montreal Protocol, apparently with some success. Since some of them are also potent greenhouse gases, their regulation is to be welcomed from the point of view of global warming. However, their main replacements, hydrochloro-fluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) are also greenhouse gases, though they are less potent and less long-lived than CFCs. There is an agreement to phase out HCFCs by 2030, but the concentration of such compounds remains a concern from the point of view of global warming (see Houghton 1997, pp. 35–38). Houghton's book provides an excellent overview of the science. Also worth reading is Alley (2000).

gases through industrialization. This would, other things being equal, be expected to result in an overall warming effect.

The basic greenhouse mechanism is both well understood and uncontroversial. Still, the term 'greenhouse effect' remains unsatisfactory to describe the problem at hand. There are two reasons. First, there is a purely natural greenhouse effect, without which the earth would be much colder than it is now.[18] Hence, it is not accurate to say that "the greenhouse effect" as such is a problem; in fact, the reverse is true: without some greenhouse effect, the Earth would be much less hospitable for life as we know it. The real problem is the enhanced, human-induced, greenhouse effect. Second, it is not the greenhouse effect in isolation which causes the climate problem. Whether an increase in the concentration of greenhouse gases does in fact cause the warming we would otherwise expect depends on how the immediate effects of an increase in low frequency radiation play out in the overall climate system. But that system is complex, and its details are not very well understood.

For a while, then, the term 'global warming' was favored. This term captures the point that it is the effects of increased levels of greenhouse gases which are of concern. However, it also has its limitations. In particular, it highlights a specific effect, higher temperatures, and thus suggests a one-dimensional problem. But while it is true that rising temperature has been a locus for concern about increasing human emissions of greenhouse gases, it is not true that temperature as such defines either the core problem or even (arguably) its most important aspects. Consider, for example, the following. First, a higher global temperature does not in itself constitute the most important impact of climate change. Indeed, considered in isolation, there might be no particular reason to prefer the world as it is now to one several degrees warmer.[19] However, second, this thought is liable to be misleading. For presumably if one is imagining a warmer world and thinking that it may be appealing, one is envisioning the planet as it might be in a stable, equilibrium state at the higher level, where humans, animals, and plants have harmoniously adapted to higher temperatures. But the problem posed by current human behavior is not of this kind. The primary concern of many scientists is that an enhanced greenhouse effect puts extra energy into the earth's climate system and so creates an imbalance. Hence, most of the concern about present climate change has been brought about because it seems that change is occurring at an unprecedented rate, that any equilibrium position is likely to be thousands, perhaps tens or hundreds of thousands, of years off, and that

[18]Houghton calculates that the average temperature at the Earth's surface without the natural greenhouse effect would be −6°C. With the natural effect, it is about 15°C (Houghton 1997, pp. 11–12).

[19]Hence, skeptics sometimes correctly point out that the Earth has been much warmer in previous periods of its history. They might also note, however, that we were not around during those times, that the climate has been extremely stable during the rise of civilization, and that we have never been subject to climate changes as swift, or of such a magnitude, as those projected by the IPCC.

existing species are unlikely to be able to adapt quickly and easily under such conditions. Third, though it is at present unlikely, it is still possible that temperature might go down as a result of the increase in atmospheric greenhouse gas concentrations. But this does not cast any doubt on the serious nature of the problem. This is partly because a rapid and unprecedented lowering of temperature would have similar kinds of adverse effects on human and nonhuman life and health as a rapid warming, and partly because the effects most likely to cause cooling (such as a shutdown of the thermohaline circulation [THC] which supports the Gulf Stream current to Northern Europe [discussed in the next section]) may well be catastrophic even in relation to the other projected effects of global warming.

For all these reasons, current discussion tends to be carried out under the heading 'climate change'. This term captures the fact that it is interference in the climate system itself which is the crucial issue, not what the particular effects of that interference turn out to be. The fundamental problem is that it is now possible for humans to alter the underlying dynamics of the planet's climate and so the basic life-support system both for themselves and all other forms of life on Earth. Whether the alteration of these dynamics is most conveniently tracked in terms of increasing, declining, or even stable temperatures is of subsidiary interest in comparison to the actual changes in the climate itself and their consequences for human, and nonhuman, life.[20]

Climate Science

Almost no one would deny that in principle our actions and policies should be informed by our best scientific judgments, and it is hard to deny that our best scientific judgments about climate change are expressed in the IPCC reports. (Jamieson 1998, p. 116)[21]

> Recent scientific evidence shows that major and widespread climate changes have occurred with startling speed.… Climate models typically underestimate the size, speed, and extent of those changes.… Climate surprises are to be expected. (U.S. National Research Council 2002, p. 1)

What do we know about climate change? In 1988, the Intergovernmental Panel on Climate Change (IPCC) was jointly established by the World Meteorological Association and the United Nations Environment Program to provide member governments with state of the art assessments of "the science, the impacts, and the

[20]It is perhaps worth noting that 'climate change' is not yet the perfect term. For one thing, it may turn out that there are other ways in which humans can profoundly alter global climate than through greenhouse gases; for another, much of our concern with climate change would remain even if it turned out to have a natural source.

[21]For a dissenting view, based on a Kuhnian view of public science (see Michaels and Balling 2000, Chap. 11).

economics of – and the options for mitigating and/or adapting to – climate change" (IPCC 2001c, p. vii).[22] The IPCC has, accordingly, submitted three comprehensive reports, in 1990, 1995, and 2001.[23] The results have remained fairly consistent across all three reports, though the level of confidence in those results has increased.[24] The main findings of the most recent are as follows.

The IPCC begins with an account of patterns of climate change observed so far. On temperature, they report: "The global average surface temperature has increased over the 20th century by about 0.6°C"; "Globally, it is very likely[25] that the 1990s was the warmest decade and 1998 the warmest year in the instrumental record, since 1861"; and "The increase in temperature in the 20th century is likely to have been the largest of any century during the past 1,000 years" (IPCC 2001c, p. 152). For other phenomena, they say that snow cover and ice extent have decreased, global average sea level has risen, and ocean heat content has increased. They also cite evidence for increases in the amount of precipitation in some regions; the frequency of heavy precipitation events; cloud cover in some latitudes; and the frequency, persistence, and intensity of El Nino phenomenon.[26]

The IPCC also surveys the literature on relevant human activities. They conclude that since preindustrial times (1750 is the usual benchmark), humans have altered "the atmosphere in ways that are expected to affect the climate" by markedly increasing the concentrations of greenhouse gases (IPCC 2001c, p. 154).

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[22]It should be noted that IPCC processes are politicized in several ways. For one thing, the scientific membership is decided by participant governments, who nominate their representatives. For another, the most important part of each report (the Summary for Policymakers [SPM]) is approved by member governments on a line-by-line, consensus basis (though this is not true of the scientific reports themselves). The latter procedure in particular is vigorously attacked both by skeptics (see, e.g., Lomborg (2001, p. 319), who complains that the IPCC toughened the language of the 2001 SPM for political reasons) and nonskeptics (many of whom believe that the consensus necessary for the SPMs substantially weakens the claims that would be justified based on the fuller scientific reports). Since they were the subject of intense negotiation, I have repeated the precise wording of the IPCC statements here, rather than paraphrasing.

[23]The first two reports are divided into three component volumes, which address the scientific basis for projections about climate change, adaptation, and mitigation. The 2001 report also includes a synthesis report. The reports are all available from Cambridge University Press. The full 2001 report is also available online at the IPCC web site, http://www.ipcc.ch. Guides to the 1990 and 1995 reports were prepared by John Houghton, the lead author, and published in book form in 1993 and 1997 by Cambridge University Press (see Houghton 1997).

[24]The U.S. National Academy of Science (2001) reviewed the issue in 2001, at the request of the Bush administration, and found itself in general agreement with the IPCC (see U.S. National Academy of Science 2001).

[25]The IPCC's scientific report defines likelihoods in terms of probabilities. Its definitions are as follows: virtually certain (greater than 99% chance that a result is true); very likely (90–99% chance); likely (66–90% chance); medium likelihood (33–66% chance); unlikely (10–33% chance); very unlikely (1–10% chance); and exceptionally unlikely (less than 1% chance) (see IPCC 2001c, p. 152, n. 7).

[26]Some phenomena that are sometimes cited as a source of concern are reported not to show a change as yet. These include tropical storm intensity and frequency, the frequency of tornados, thunder, and hail, and the extent of Antarctic sea ice (IPCC 2001c, p. 154).

The main culprit is carbon dioxide,[27] for which "the concentration has increased by 31% since 1750"; "the present CO2 concentration has not been exceeded during the past 420,000 years and likely not during the past 20 million years"; and "the current rate of increase is unprecedented during at least the past 20,000 years … at about 1.5 ppm [parts per million] (0.4%) per year" (IPCC 2001c, p. 155). The main anthropogenic sources of CO2 are the burning of fossil fuels (about 75%) and changes in land-use patterns (principally, deforestation). Of secondary importance is methane, where the present atmospheric concentration "has increased by … 151% since 1750; and has not been exceeded during the past 420,000 years," and "slightly more than half of current … emissions are anthropogenic (e.g., use of fossil fuels, cattle, rice agriculture and landfills)" (IPCC 2001c, pp. 156–157). Molecule for molecule, methane is a more potent greenhouse gas than carbon dioxide. Still, because CO2 lasts much longer in the atmosphere (about 5–200 years, as opposed to methane's 12 years),[28] it is the more important anthropogenic greenhouse gas.[29]

The IPCC also tries to predict future climate. To do so, it uses computer models to simulate a variety of different possible future scenarios, incorporating different assumptions about economic growth, world population, and technological change. The basic results are as follows. First, carbon dioxide emissions due to the burning of fossil fuels are "virtually certain to be the dominant influence on the trends in atmospheric CO_2 concentration during the 21st century," and by 2100, that concentration should be 90–250% above preindustrial levels (of 280 ppm), at 540–970 ppm (IPCC 2001c, pp. 158–159). Second, if this occurs, the full range of model scenarios predict that surface temperature will increase by 1.4–5.8°C over the century. The IPCC states that this is not only a much larger projected rate of warming than that observed during the twentieth century but one "very likely … without precedent during at least the last 10,000 years."[30] Third, models indicate that "stabilisation of atmospheric CO_2 concentrations at 450, 650 or 1,000 ppm would require global anthropogenic CO_2 emissions to drop below 1990 levels, within a few decades, about a century, or about two centuries, respectively,

[27]Water vapor is the main atmospheric greenhouse gas, but humans have been doing little to increase its concentration. However, the IPCC does report that one expected consequence of global warming would be an increase in water vapor concentration as a positive feedback.

[28]For this reason, David Victor argues that methane emissions do not raise the same issues of intergenerational justice as CO2 emissions. For most of the warming effects of the former will be visited in the short- to medium-term on the present and next generation (Victor 2001).

[29]Other, but less significant, contributing factors include nitrous oxide, halocarbons, aerosols, and natural factors (including variations in solar output) (IPCC 2001c, p. 157).

[30]Furthermore, the temperature rise is not evenly spread. Models suggest that it is "very likely" that the land will warm more quickly, and more so in the Northern Hemisphere. In fact, northern North America and Asia are projected to exceed the global average "by more than 40 percent." Based on these temperature results, over the course of the twenty-first century the IPCC predicts increases in global average water vapor concentration and precipitation, mean sea level, maximum and minimum temperatures, the number of hot days, and the risk of drought; and decreases in the day-night temperature range and (in the Northern Hemisphere) in snow cover and sea ice (IPCC 2001c, pp. 161–163).

and continue to decrease steadily thereafter. Eventually CO_2 emissions would need to decline to a very small fraction of current emissions" (IPCC 2001c, p. 160; emphasis added).

Alarming as the IPCC predictions are, we should also pay attention to the fact that they might be overly optimistic. For some authors argue that the current climate models typically underestimate the potential for nonlinear threshold effects (U.S. National Research Council 2002; Gagosian 2003). One well-known threat of this sort is the potential collapse of the West Antarctic Ice Sheet (WAIS), which would eventually raise global sea levels by 4–6 m. But the recent literature registers even greater concern about a lesser-known issue: the possibility of a weakening or shutdown of the deep circulation system which drives the world's ocean currents. This system, known as "the Ocean Conveyor," distributes "vast quantities of heat around our planet, and thus plays a fundamental role in governing Earth's climate … [and] in the distribution of life-sustaining water" (Gagosian 2003, p. 4).

The Ocean Conveyor has been called the climate's "Achilles Heel" (Broecker 1997), because it appears to be a major threshold phenomenon. There are two grounds for concern. First, there is strong evidence that in the past the conveyor has slowed, and slowed very quickly, with significant climatic consequences. One such event, 12,700 years ago, saw a drop in temperatures in the North Atlantic region of around 5°C in a single decade. This apparently caused icebergs to spread as far south as the coast of Portugal and has been linked to widespread global drought. Second, the operation of the conveyor is governed by factors that can be affected by climate change. In particular, the world's currents are driven by the sinking of a large volume of salty water in the North Atlantic region. But this process can be disrupted by an influx of fresh water, which both dilutes the salty water and can also create a lid over it, restricting heat flow to the atmosphere.[31]

The possibility of dramatic climate shifts of this sort complicates the picture of a global warming world in several ways. First, it suggests that gradual warming at the global level could cause, and coexist with, dramatic cooling in some regions. (Among other things, this has serious ramifications for our ability to plan for future changes.) Second, it envisages that the major losers from climate change may not be the usual suspects, the less developed countries (LDCs). For it is the rich countries bordering the North Atlantic that are particularly vulnerable to Conveyor shifts. Climate models predict that "the North Atlantic region would cool 3 to 5 degrees Celsius if conveyor circulation were totally disrupted," producing winters "twice as cold as the worst winters on record in the eastern United States in the past century" for a period of up to a century (Gagosian 2003, p. 7).[32]

[31]Such changes seem already to be afoot. Gagosian cites recent evidence that over the last fifty years the North Atlantic has freshened considerably, and the flow of salty water into the Atlantic has slowed (Dickson et al. 2002; Hansen et al. 2001).

[32]Gagosian adds: "A persistent string of severe winters, lasting decades to a century, can cause glaciers to advance, rivers to freeze, and sea ice to grow and spread. It can render prime agricultural lands unfarmable" (Gagosian 2003, p. 10).

The IPCC does not emphasize the problem of the Ocean Conveyor. For one thing, though it acknowledges that most models predict a weakening of the conveyor during the twenty-first century, it emphasizes that such changes are projected to be offset by the more general warming; for another, it suggests that a complete shutdown is unlikely during the twenty-first century (though increasingly likely thereafter) (IPCC 2001c, p. 16). Hence, the IPCC's attitude is relatively complacent. Still, it is not clear what justifies such complacency. On the one hand, even if the threshold will not be reached for 100 years, this is still a matter of serious concern for future generations, since once the underlying processes which will breach it are in motion, it will be difficult, if not impossible, to reverse them. On the other hand, the current models of thermohaline circulation are not very robust, primarily because scientists simply do not know where the threshold is. And some models do predict complete shutdown within a range which overlaps with IPCC projections for the twenty-first century (IPCC 2001c, p. 440).[33]

Scientific Uncertainty

> Scientists aren't any time soon going to give politicians some magic answer. Policy makers for a long, long time are going to have to deal with a situation where it's not clear what the costs and benefits are, where lots of people disagree about them, and they can't wait until everything is resolved. (Robert J. Lampert)[34]

> Should the public come to believe that the scientific issues are settled, their views about global warming will change accordingly. Therefore, you need to continue to make the lack of scientific certainty a primary issue. (Frank Luntz, in Lee 2003)

> It is sometimes argued that the uncertainty of the scientist's predictions is a reason for not acting at present, and that we should wait until some further research has been concluded. This argument is poor economics. (Broome 1992, p. 17)

Politically, the most common objection raised to action on climate change is that of scientific uncertainty.[35] In this section, I will explain why most writers on the subject believe this objection to be a red herring.

The first thing to note is that, at least in economics, uncertainty is a technical term, to be distinguished from risk. In the technical sense, a risk involves a known, or reliably estimable, probability, whereas an uncertainty arises when such probabilities are not available. So to say that there is scientific uncertainty surrounding global warming is to claim that we do not know, and cannot reliably estimate, the probability that climate change will occur, nor its extent if it does occur.

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[33]Other respectable scientific groups take the possibility much more seriously. See, e.g., the U.S. National Research Council (2002, Chap. 3), which suggests that the behavior of the THC becomes considerably less predictable as the threshold is approached.

[34]Lampert, senior scientist and expert in risk analysis at the RAND Corporation, quoted in Revkin (2001b).

[35]See, e.g., former White House Spokesman Ari Fleischer, as quoted by Traxler (2002, p. 105).

This distinction is useful, because the first problem with the objection from scientific uncertainty is that the IPCC does not seem to view global warming as uncertain in the technical sense. As we have seen, the 2001 Scientific Assessment explicitly assigns probabilities to its main climate predictions, making the situation one of risk, rather than uncertainty. Furthermore, these probabilities are of considerable magnitude. (For example, the IPCC says that it is "very likely" that in the twenty-first century there will be "higher maximum temperatures and more hot days over nearly all land areas" [IPCC 2001c, p. 162], by which they mean a probability of 90–99% [IPCC 2001c, p. 152, n. 7].) Given that many of the effects assigned high probabilities are associated with significant costs, they would seem to justify some kinds of action.

But perhaps the idea is that the IPCC's probability statements are not reliable, so that we should ignore them,[36] treat the situation as genuinely uncertain, and hence refuse to act. Still, there is a difficulty. For, to an important extent, some kind of uncertainty "is an inherent part of the problem" (Broome 1992, p. 18). Arguably, if we knew exactly what was going to happen, to whom, and whose emissions would cause it, the problem might be more easily addressed;[37] &at the very least, it would have a very different shape. Hence, to refuse to act because of uncertainty is either to refuse to accept the global warming problem as it is (insisting that it be turned into a more respectable form of problem before one will address it) or else to endorse the principle that to "do nothing" is the appropriate response to uncertainty. The former is a head-in-the-sand approach and clearly unacceptable, but the latter is also dubious and does not fit our usual practice.

The third, and perhaps most crucial, point to make about the problem of uncertainty is that it is important not to overplay it. For one thing, many decisions we have to make in life, including many important decisions, are also subject to considerable uncertainties.[38] For another, all uncertainties are not created equal. On the one hand, the reason I am unable to assign probabilities may be that I know absolutely nothing about the situation,[39] or else that I have only one past

[36]There is some case for this. It is not clear how the IPCC generates its "probability" estimates (Reilly et al. 2001).

[37]For example, using ozone depletion and deforestation as his case studies, Rado Dimitrov argues that the crucial variable in resolving global environmental problems is knowledge of their cross-border consequences, rather than of their extent and causes, since this "facilitates utility calculations and the formation of interests" (Dimitrov 2003, p. 123).

[38]For example, suppose I am weighing a job offer in a distant city. Suppose also that one major consideration in my decision is what kind of life my 18-month-old son will have. The information I have about this is riddled with uncertainty. I know that my current location offers many advantages as a place for children to grow up (e.g., the schools are good, the society values children, there are lots of wholesome activities available) but some considerable disadvantages (e.g., great distances from other family members, a high youth suicide rate). But I have no idea how these various factors might affect my son (particularly since I can only guess at this stage what his personality might turn out to be). So, I am in a situation of uncertainty.

[39]For example, suppose that the position is on the other side of the world in New Zealand. Suppose also that I have never been to New Zealand, nor know anyone who has. I might be completely bereft of information on which to make a decision. (These days, of course, I have the internet, the local library, and Amazon.com. But pity the situation of the early settlers.)

instance to go on. But I may also be uncertain in circumstances where I have considerable information.[40]

Now it seems clear that uncertainty in the first kind of case is worse than uncertainty in the second, and potentially more paralyzing. Furthermore, and this is the crucial point, it seems reasonably clear that scientific uncertainty about global warming is of the second kind. As Donald Brown argues: "A lot of climate change science has never been in question, … many of the elements of global warming are not seriously challenged even by the scientific skeptics, and … the issues of scientific certainty most discussed by climate skeptics usually deal with the magnitude and timing of climate change, not with whether global warming is a real threat" (Brown 2002, p. 102).[41] To see this, let us briefly examine a number of sources of uncertainty about global warming.

The first concerns the direct empirical evidence for anthropogenic warming itself. This has two main aspects. First, systematic global temperature records, based on measurements of air temperature on land and surface-water temperature measurements at sea, exist only from 1860,[42] and satellite-based measurements are available only from 1979. The direct evidence for recent warming comes from the former. But skeptics suggest that the satellite measurements do not match the surface readings and do not provide evidence for warming.[43] Second, there is no well-defined baseline from which to measure change.[44] While it is true that the last couple of decades have been the warmest in human history, it is also true that the long-term climate record displays significant short-term variability and that, even accounting for this, climate seems to have been remarkably stable since the end of

[40]For example, suppose I'm considering the job offer again, but now I'm thinking about whether my 15-year-old daughter will like the move. This time I do have considerable information about her personality, preferences, goals, and aspirations. But this does not mean there is not considerable uncertainty about how good the move would be for her. Suppose, e.g., that I know that the most important thing from her point of view is having very close friends. I also know that she is good at making friends, but I don't know whether a suitable friend will present herself.

[41]According to Brown, these facts have been obscured in the American mind by aggressive propaganda campaigns by some business interests, and the media's tendency to run "for and against" articles (and so overrepresent the views of skeptics).

[42]There are also notable issues within this data set, especially in comparing different instruments used, and in a possible locational bias in favor of urban areas, which have quite likely warmed during the period due to industrialization.

[43]In 2000, a U.S. National Research Council group (which included some skeptics) unanimously concluded that the discrepancy did not cast doubt on evidence that the Earth was warming up (MacIlwain 2000). More recently, evidence has emerged that the satellite data are difficult to interpret because of observational uncertainty, and it is claimed that this evidence "strengthens the case for a pronounced human influence on climate" (Santer et al. 2003, p. 1284). The IPCC produces data suggesting a reasonable match in trends between surface and satellite readings, once corrections are made for the Mount Pinatubo volcano eruption and for El Nino events (Houghton 1997, p. 48, citing Nicholls et al. 1996; see also IPCC 2001b, p. 121).

[44]There is, of course, an important presumption here. Dale Jamieson points out that the very idea of climate change presupposes a paradigm of stability versus change, and this brings with it a need to distinguish signal from noise (see Jamieson 1991, pp. 319–321).

the last Ice Age 10,000 years ago, as compared with the preceding 100,000 years.[45] Hence, global temperatures have fluctuated considerably over the long-term record, and it is clear that these fluctuations have been naturally caused.[46]

The skeptics are right, then, when they assert that the observational temperature record is a weak data set and that the long-term history of the climate is such that even if the data were more robust, we would be rash to conclude that humans are causing it solely on this basis.[47] Still, it would be a mistake to infer too much from the truth of these claims. For it would be equally rash to dismiss the possibility of warming on these grounds. For, even though it might be true that the empirical evidence is consistent with there being no anthropogenic warming, it is also true that it provides just the kind of record we would expect if there were a real global warming problem.

This paradox is caused by the fact that our epistemological position with respect to climate change is intrinsically very difficult: it may simply be impossible to confirm climate change empirically from this position. This is because our basic situation may be a bit like that of a coach who is asked whether the current performance of a 15-year-old athlete shows that she will reach the highest level of her sport. Suppose the coach has the best evidence that she can have. It will still only be evidence for a 15-year-old. It will be at most consistent with reaching the highest level. It cannot be taken as a certain prediction. But that does not mean it is no prediction at all, or worthless. It is simply the best prediction she is currently in a position to make.

Fortunately, for the climate change problem, the concern with the empirical record is not the end of the matter. For the temperature record is far from our only evidence for warming. Instead, we also have strong theoretical grounds for concern. First, the basic physical and chemical mechanisms which give rise to a potential global warming effect are well understood. In particular, there is no scientific controversy over the claims (a) that in itself a higher concentration of greenhouse gas molecules in the upper atmosphere would cause more heat to be retained by the earth and less radiated out into the solar system, so that other things being equal, such an increase would cause global temperatures to rise; and (b) that human activities since the industrial revolution have significantly increased the atmospheric

[45]According to data largely from Arctic ice cores, in the last 10,000 years, the variation in average global temperatures was less than one degree Celsius; in the preceding 100,000 years, variations were sometimes experienced of up to five or six degrees Celsius in less than 100 years (Houghton 1997, Chap. 4; United Nations Environment Program 1999, sheet 8).

[46]A significant and poorly understood factor here is energy output from the sun (though fluctuations caused by variations in the earth's orbit are better known).

[47]Interestingly, this does not imply that we should not have a policy to limit emissions. Since a prolonged natural warming would be just as disastrous for current patterns of human life on the planet as artificially induced warming, it could turn out that some abatement of projected anthropogenic emissions would be justified as a counteracting measure.

concentration of greenhouse gases. Hence, everyone agrees that the basic circumstances are such that a greenhouse effect is to be expected.[48]

Second, the scientific dispute, insofar as there is one, concerns the high level of complexity of the global climate system, given which there are the other mechanisms that might be in play to moderate such an effect. The contentious issue here is whether there might be negative feedbacks that either sharply reduce or negate the effects of higher levels of greenhouse gases, or even reduce the amount of them present in the atmosphere. However, current climate models suggest that most related factors will likely exhibit positive feedbacks (water vapor, snow, and ice),[49] while others have both positive and negative feedbacks whose net effect is unclear (e.g., clouds, ocean currents). Hence, there is genuine scientific uncertainty. But this does not by itself justify a skeptical position about action on climate change. For there may be no more reason to assume that we will be saved by unexpectedly large negative feedbacks than that the warming effect will be much worse than we would otherwise anticipate, due to unexpectedly large positive feedbacks.[50]

This is the basic scientific situation. However, three further aspects of uncertainty are worth mentioning. First, the conclusions about feedback are also open to doubt because considerable uncertainties remain about the performance of the models. In particular, they are not completely reliable against past data.[51] This is to be expected because the climate is a highly complex system which is not very well understood.[52] Still, it clouds the overall picture.[53] Second, as mentioned earlier, the current models tend to assume that atmospheric feedbacks scale linearly with surface warming, and they do not adequately account for possible threshold effects, such as the possible collapse of the West Antarctic Ice Sheet. Hence, they may

[48]Elsewhere I point out that the potential gains from carbon emissions are far from exhausted, given the low per capita rates in most parts of the world. Hence, even if global warming were not yet occurring, we would, other things being equal, expect it at some time in the future, as global emissions rise (Gardiner 2004).

[49]These may amplify the direct warming by a factor of two or three (United Nations Environment Program 1999, sheet 7).

[50]In particular, there is no reason to assume that our planet's atmosphere is robustly stable in the face of different inputs. The atmosphere of Venus, e.g., has undergone a runaway greenhouse effect. (It is easy to forget that what we are dealing with fundamentally is a band of gases around the earth that is just a few miles wide.)

[51]They tend to project warming against past data, especially over longer time periods. This is factored out in a linear way when the models are applied to the future, but of course the errors could be nonlinear.

[52]David Frame has suggested to me that the problem has more to do with the models being tuned to fit the current and recent climate record and that the lingering errors may be due to the omission from the models of processes such as fully interactive biogeochemical and cryosphere cycles.

[53]The IPCC is sometimes criticized for now positing a wider projection range in its latest report than before. This suggests expanding uncertainty. But it is worth noting that the IPCC range is not, as might be expected, a statistical measure, capturing error bars. Instead, it encompasses a cluster of model results. (Leading climate scientists such as Stephen Schneider have criticized the IPCC for being misleading here and so leaving themselves open to political manipulation.)

underestimate the potential risks from global warming. Finally, there is a great deal of uncertainty about the distribution of climate change. Though global rises may seem small, they disguise considerable variation within years and across regions. Furthermore, though it is very difficult to predict which regions will suffer most, and in what ways, such evidence as there is suggests that, at least in the medium term, the impact will be heaviest in the tropical and subtropical regions (where most of the LDCs are), and lighter in the temperate regions (where most of the richer countries are).

In conclusion, there are substantial uncertainties surrounding both the direct empirical evidence for warming and our theoretical understanding of the overall climate system. But these uncertainties cut both ways. In particular, while it is certainly conceivable (though, at present, unlikely) that the climate change problem will turn out to be chimerical, it is also possible that global warming will turn out to be much worse than anyone has yet anticipated. More importantly, the really vital issue does not concern the presence of scientific uncertainty, but rather how we decide what to do under such circumstances. To this issue we now turn.

Economics

> Economic analyses clearly show that it will be far more expensive to cut CO2 emissions radically than to pay the costs of adaptation to the increased temperatures. (Lomborg 2001, p. 318)

> Cost-benefit analysis, when faced with uncertainties as big as these, would simply be self-deception. And in any case, it could not be a successful exercise, because the issue is too poorly understood, and too little accommodated in the current economic theory. (Broome 1992, p. 19)

As it turns out, many recent skeptics no longer cite scientific uncertainty as their reason for resisting action on climate change. Instead, they claim to accept the reality of human-induced climate change but argue that there is a strong economic rationale for refusing to act.[54] Prevention, they insist, is more expensive than adaptation; hence, both present and future generations would be better off if we simply accepted that there will be climate change and tried to live with it. Furthermore, they assert, money that might be spent on prevention would be better spent helping the world's poor. I will consider the first of these arguments in this section and the second later on.

Several attempts have been made to model the economic implications of climate change.[55] Politically prominent among these is the DICE model proposed by the Yale economist William Nordhaus. The DICE model is an integrated assessment model.

[54] See, e.g., Lomborg (2001, p. 317) (though Lomborg does argue elsewhere in the chapter that the IPCC overstates both the temperature effect and the importance of the likely consequences).

[55] The models and their results are summarized in Mabey et al. (1997, Chap. 3).

Integrated assessment (IA) models combine the essential elements of biophysical and economic systems in an attempt to understand the impact of climate and economic policies on one another. Typically, such models aim to find a climate policy which will maximize the social welfare function. And many give the surprising result that only limited abatement should occur in the next 20–30 years, since the costs of current reductions are too high in comparison to the benefits.[56] Hence, proponents of these models argue that, based on economic costs, the developed world (and the United States in particular) should pursue adaptation rather than abatement. This is the argument embraced by Lomborg, who cites Nordhaus's work as his inspiration.

The Cost Argument

A full response to Lomborg's proposal requires addressing both the argument about costs and the more general argument for an adaptation, rather than mitigation, strategy. Let us begin with the cost argument.

The first point to make is that, even if Nordhaus's calculations were reliable, the costs of climate change mitigation do not seem unmanageable. As Thomas Schelling puts it:

> The costs in reduced productivity are estimated at two percent of GNP forever. Two percent of GNP seems politically unmanageable in many countries. Still, if one plots the curve of US per capita GNP over the coming century with and without the two percent permanent loss, the difference is about the thickness of a line drawn with a number two pencil, and the doubled per capita income that would have been achieved by 2060 is reached in 2062. If someone could wave a wand and phase in, over a few years, a climate-mitigation program that depressed our GNP by two percent in perpetuity, no one would notice the difference. (Schelling 1997)

Even Lomborg agrees with this. For he not only cites the 2% figure with approval but adds, "there is no way that the cost [of stabilizing abatement measures] will send us to the poorhouse" (Lomborg 2001, p. 323).[57]

The second point is that Nordhaus's work is extremely controversial. For one thing, some claim that his model is simplistic, both in itself and, especially, relative to the climate models.[58] Indeed, one commentator goes so far as to say that "the

[56] Nordhaus claims that even the Kyoto controls are much too aggressive. For why this might be surprising, see the later discussion of the Kyoto Protocol.

[57] Singer adds that, with global emissions trading, Lomborg's own figures suggest that Kyoto would be a net economic benefit (2002, p. 27). Lomborg's argument, of course, is that, even though this is true, the investment would be better placed elsewhere, in direct aid to poor countries (2001, p. 322).

[58] It is worth noting that there is a serious paradox for at least some skeptics here. For some are both very skeptical and demanding on the standards they impose on predictive models from climatology but not at all cautious about the power of the economic models on which they choose to focus. But this should be surprising. For, without wishing in any way to be derogatory about contemporary macroeconomics, it has at least as dubious a status as a predictive science as climatology, if not worse. Hence, if one is going to be quite so critical of the IPCC consensus on climate change as some skeptics are, one should be even-handed in one's approach to the economic models (Gundermann 2002, p. 154).

model is extremely simple – so simple that I once, during a debate, dubbed it a toy model" (Gundermann 2002, p. 150). For another, others offer rival models which endorse the exact opposite to Nordhaus's conclusion: that action now (in the form of carbon taxes, etc.) would be more beneficial in the long term than waiting, even perhaps if global warming does not actually transpire (e.g., Costanza 1996; De Leo et al. 2001; Woodward and Bishop 1997).

Part of the reason that such disputes arise is because the models embody some very questionable assumptions.[59] Some are specific to Nordhaus (e.g., Gundermann 2002, p. 154). But others are the result of two more general kinds of difficulty.

The first is practical. There are severe informational problems involved in any reliable cost-benefit analysis for climate change. In particular, over the timescale relevant for climate change, "society is bound to be radically transformed in ways which are utterly unpredictable to us now," and these changes will themselves be affected by climate (Broome 1992, p. 10; see also Jamieson 1992, pp. 288–289).[60] Hence, Broome, for example, argues that fine-grained cost-benefit analyses are simply not possible for climate change.

The second kind of difficulty, of more interest to ethicists perhaps, is there are some basic philosophical problems inherent in the methods of conventional economic analysis. Here let me mention just two prominent examples.

One concerns the standard economic treatments of intergenerational issues. Economists typically employ a social discount rate (SDR) of 2–10% for future costs[61] (Lomborg uses 5%; Nordhaus 3–6%).[62] But this raises two serious concerns. The first is that, for the short- to medium-term effects of climate change (say, over 10–50 years), model results can be extremely sensitive to the rate chosen. For example, Shultz and Kasting claim that the choice of SDR makes the rest of the climate change model largely irrelevant in Nordhaus's model, and variations in the SDR make a huge difference to model results more generally (Schultz and Kasting 1997, cited by Gundermann 2002, p. 147). The other concern is that, when the SDR is positive, all but the most catastrophic costs disappear after a number of decades,

[59]For example, many models (including Nordhaus's) do not take into account indirect social and environmental costs and benefits not associated with production. But some claim that benefits of this sort might actually outweigh the direct costs of abatement (see, e.g., De Leo et al. 2001, pp. 478–479).

[60]Jamieson is particularly concerned about climate effects. He says that the regional effects are varied and uncertain; predicting human behavior will be difficult since the impacts will affect a wide range of social, economic, and political activities; we have limited understanding of the global economy; and there will be complex feedbacks between different economic sectors.

[61]Discounting is "a method used by economists to determine the dollar value today of costs and benefits in the future. Future monetary values are weighted by a value <1, or 'discounted'" (Toman 2001, p. 267). The SDR is the rate of discounting: "Typically, any benefit (or cost), B (or C), accruing in T years' time is recorded as having a 'present' value, PV of: " (Pearce 1993, p. 54).

[62]For philosophical objections to the SDR, see Parfit (1985, app. F). A (partial) reply is to be found in Broome (1994). However, Broome explicitly denies that a positive SDR should be used for climate change (see Broome 1992, pp. 60, 72).

and even these become minimal over very long time periods.[63] This has serious consequences for the intergenerational ethics of climate change. As John Broome puts it: "It is people who are now children and people who are not yet born who will reap most of the benefits of any project that mitigates the effects of global warming. Most of the benefits of such a project will therefore be ignored by the consumer-price method of project evaluation. It follows that this method is quite useless for assessing such long-term projects. This is my main reason for rejecting it [for climate change]" (Broome 1992, p. 72).[64]

The second philosophical problem inherent in conventional economic analysis is that it cannot adequately capture all of the relevant costs and benefits. The obvious cases here are costs to nonhumans (such as animals, plants, species, and ecosystems) and noneconomic costs to humans, such as aesthetic costs (Sagoff 1988; Schmidtz 2001). But there is also concern that conventional economic analysis cannot adequately take into account costs with special features, such as irreversible and nonsubstitutable damages, that are especially associated with climate change (Shogren and Toman 2000; Costanza 1996).[65]

We can conclude, then, that there are strong reasons to be skeptical about Lomborg's cost argument in particular and about the reliability of fine-grained economic analyses of climate change more generally. Still, John Broome argues that two things can be said with some confidence: first, the specific effects of climate change "are very uncertain," where (as argued in the previous section) "this by itself has important consequences for the work that needs to be done," and, second, these effects "will certainly be long lived, almost certainly large, probably bad, and possibly disastrous" (Broome 1992, p. 12). To these claims we might add that at 2% of world production, the estimated costs of stabilizing emissions do not seem obviously prohibitive.

The Adaptation Argument

We can now turn to the more general argument that, instead of reducing emissions, we should pursue a policy of trying to adapt to the effects of climate change.[66]

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[63]Alex Dubgaard makes the point with an example. Suppose that Denmark needs to be evacuated due to flooding. Current real estate value in Denmark is estimated at about USD$238 billion. If a discount rate of 5% is applied, then over 500 years, the same real estate would be worth just $6. Hence, "If they do not enlarge their property in the meantime, the loss of all real estate in Denmark would be compensated if, today, we make a saving equivalent to half a barbequed chicken with potato fritters." He calls such a conclusion obviously absurd (Dubgaard 2002, pp. 200–201).

[64]This quotation refers specifically to the consumer-price method. But Broome also rejects other ways of generating a positive discount rate for future generations in the case of climate change (Broome 1992, Chap. 3) and, indeed, specifically endorses a discount rate of zero in this context (Broome 1992, p. 108).

[65]Economists tend to operate under the assumption that all goods are readily substitutable for one another, so that in principle any one kind of good (such as clean air or blankets) can be substituted for any other kind (such as jewelry). But this seems dubious in general, and, in the case of environmental quality, to embody a significant value judgment that is not widely shared. Good starting points for discussion of such philosophical issues might be Adler and Posner 2001; and Chang 1997.

[66]This argument received political prominence at a meeting in Delhi in 2002, where it was promoted by the United States and India (Revkin 2002; Harding 2002).

The first thing to note about this argument is that adaptation measures will clearly need to be part of any sensible climate policy, because we are already committed to some warming due to past emissions, and almost all of the proposed abatement strategies envisage that overall global emissions will continue to rise for at least the next few decades, committing us to even more.[67] Hence, the choice cannot be seen as being one between abatement and adaptation, since advocates of abatement generally support a combination of strategies. The real issue is rather whether adaptation should be our only strategy, so that abatement is ignored (Jamieson 2005).

If this is the proposal, several points can be made about it. First, we should beware of making the case for adaptation a self-fulfilling prophesy. For example, it is true that the existing capital stock in the United States made it difficult for America to meet its original Kyoto target for 2008–2012.[68] But it is also true that a significant amount of this capital was invested after the United States committed itself to stabilizing emissions at the Rio Earth Summit of 1992. Furthermore, matters will only get worse. The Bush administration's current energy plan calls for the building of 1,300 new power plants in the next 20 years, boosting supply (and thereby emissions) by more than 30%.

Second, the comparison between abatement and adaptation costs looks straightforward but is not. In particular, we have to bear in mind the different kinds of economic costs at stake in each case. On the one hand, suppose we allow global warming to continue unchecked. What will we be adapting to? Chances are, we will experience both a range of general gradual climatic changes and an increase in severe weather and climate events. On the other hand, if we go for abatement, we will also be adapting, but this time to increases in tax rates on (or decreases in permits for) carbon emissions.[69] But there is a world of difference between these kinds of adaptation: in the first case, we would be dealing with sudden, unpredictable, large-scale impacts which descend at random on particular individuals, communities, regions, and industries and visit them with pure, unrecoverable costs,[70] whereas,

[67]This is why the IPCC and others speak of further emissions reductions as "mitigation," rather than prevention.

[68]Victor argues that, given an actual 12% rise in U.S. emissions from 1990 to 1999, and a projected further 10% rise to 2008, the Kyoto requirement of a 7% cut on 1990 levels amounts to a 30% cut overall from projected emissions. He adds, "Compliance with a sharp 30% cut would force the premature disposal of some of the 'capital stock' of energy equipment and retard significant parts of the US economy. Electricity power generation is especially vulnerable. About half of US electric power is supplied by coal, which is the most greenhouse gas intensive of all fossil fuels. The time to implement easy changes has already passed. About four-fifths of the US generating capacity that will electrify 2010 will already have been built by the end of the year 2000" (Victor 2001, pp. 3–4, emphasis added).

[69]Of course, in reality, the contrast between the two scenarios is not so stark. Since we are already committed to some warming due to past emissions, it is not true that we can completely shield ourselves from the possibility of unpredictable impacts. But we can shield ourselves to some extent from unpredictable impacts from our future emissions.

[70]One effect of this would be to introduce new and more widespread costs. For example, since the impacts are unpredictable, all prudent agents will insure against them, so that some will spend money on emergency services and flood walls that they do not need. This contrasts with an abatement strategy, where the direct costs are incurred only by those responsible for excessive emissions.

in the second, we would be addressing gradual, predictable, incremental impacts, phased in so as to make adaptation easier.[71] Surely, adaptation in the second kind of case is, other things being equal, preferable to the first.[72]

Third, any reasonable abatement strategy would need to be phased in gradually, and it is well documented that many economically beneficial energy savings could be introduced immediately, using existing technologies.[73] These facts suggest that the adaptation argument is largely irrelevant to what to do now. For the first steps that need to be taken would be economically beneficial, not costly. Yet opponents of action on climate change do not want to do even this much.

Risk Management and the Precautionary Principle

> The risk assessment process … is as much policy and politics as it is science. A typical risk assessment relies on at least 50 different assumptions about exposure, dose-response, and relationships between animals and humans. The modeling of uncertainty also depends on assumptions. Two risk assessments conducted on the same problem can vary widely in results. (Raffensberger and Tickner 1999, p. 2)

Serious as they are, these largely technical worries about conventional economic analysis are not the only reasons to be wary of any economic solution to the climate change problem. For some writers suggest that exclusive reliance on economic analysis would be problematic even if all of the numbers were in, since the climate problem is ultimately one of values, not efficiency: as Dale Jamieson puts it, its "fundamental questions" concern "how we ought to live, what kinds of societies we want, and how we should relate to nature and other forms of life" (Jamieson 1992, p. 290).

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[71]Not only do we avoid the unnecessary costs mentioned above, but costs in the second case can be distributed in a rational fashion over the sources of the problem and may even generate revenue (through taxation or the price of permits) which could be used to alleviate the effects of warming to which we are already committed or for other socially beneficial purposes.

[72]There is something of a paradox here in the attitudes of some commentators, in that they appear to have great faith in the ability of the market to adapt in the first case, but not the second. It is not clear what could justify such a prejudice. (Commenting on some early works by Nordhaus and Beckerman, Broome says that they are "evidently assuming that human life is by now fairly independent of the natural world. … I find this assumption too complacent"; Broome 1992, p. 25, n. 31.)

[73]There are many ways in which developed countries waste energy, and thereby carbon emissions, through inefficient practices. For example, the most fuel efficient cars and SUVs/trucks available in the United States are capable of 66 and 29 miles per gallon respectively on the open highway; the least efficient are capable of 14 and 16 miles per gallon (U.S. Environmental Protection Agency 2003). Furthermore, in recent years, manufacturers in the United States have actually stopped making the most fuel efficient cars, as such vehicles have been crowded out of the marketplace by sport-utility vehicles. Hence, average fuel efficiency has declined (Heavenrich and Hellman 2000). Less markedly, substantial energy savings could be made simply by switching to the most efficient currently available models of washing machines, hot water heaters, and the like.

But the problem may not be just that climate change raises issues of value. It may also show that our existing values are insufficient to the task. Jamieson, for example, offers the following argument. First, he asserts that our present values evolved relatively recently, in "low-population-density and low-technology societies, with seemingly unlimited access to land and other resources." Then he claims that these values include as a central component an account of responsibility which "presupposes that harms and their causes are individual, that they can be readily identified, and that they are local in time and space." Third, he argues that problems such as climate change fit none of these criteria. Hence, he concludes, a new value system is needed (Jamieson 1992, pp. 291–292).[74]

How then should we proceed? Some authors advocate a rethinking of our basic moral practices. For example, Jamieson claims that we must switch our focus away from approaches (such as those of contemporary economics) which concentrate on "calculating probable outcomes" and instead foster and develop a set of "twenty-first century virtues," including "humility, courage, … moderation," "simplicity and conservatism" (Jamieson 1992, p. 294).

Other climate change theorists, however, are less radical. For example, Henry Shue employs the traditional notions of a "No Harm Principle" and rights to physical security (Shue 1999a, p. 43). He points out that even in the absence of certainty about the exact impacts of climate change, there is a real moral problem posed by subjecting future generations to the risk of severe harms. This implies a motive for action in spite of the scientific and economic uncertainties. Similarly, many policy makers appeal to the "precautionary principle,"[75] which is now popular in international law and politics[76] and receives one of its canonical statements in the United Nations Framework Convention on Climate Change (1992).[77] The exact formulation of the precautionary principle is controversial; but one standard version is the Wingspread Statement, which reads: "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically" (Wingspread Statement 1998).

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[74]In a later article, Jamieson's position seems more modest. He suggests that there are two moral and legal paradigms associated with responsibility in the Western tradition: a causal paradigm and an "ability to benefit or prevent harm" paradigm. He then argues that the former founders with climate change; but the latter, which he associates with the utilitarian tradition, does not (see Jamieson 1998, pp. 116–117).

[75]The literature on the precautionary principle is voluminous, though mostly written by nonphilosophers, and a thorough treatment of it would require a separate article. Some representative collections are O'Riordan et al. (2001) and Raffensberger and Tickner (1999). Haller (2002) is a recent philosophical study of related issues, with some emphasis on climate change.

[76]Versions appear in the Third North Sea Conference (1990), and the Ozone Layer Protocol (1987); they are also endorsed by major institutions, such as the UN Environment Program (1989), the European Union in its environment policy (1994), and the U.S. President's Council on Sustainable Development (1996). See Raffensberger (1999).

[77]Some take the precautionary principle to be equivalent to a "do no harm" principle and to have roots in the Hippocratic Oath (see, e.g., Ozonoff 1999, p. 100).

Both no harm principles and the precautionary principle, are, however, controversial. No harm principles are often criticized for being either obscure or else overly conservative when taken literally; and the precautionary principle generates similar objections: its critics say that it is vacuous, extreme, and irrational.[78] Still, I would argue that, at least in the case of the precautionary principle, many of these initial objections can be overcome (Gardiner 2004). In particular, a core use of the precautionary principle can be captured by restricting its application to those situations which satisfy John Rawls's criteria for the application of a maximin principle: the parties lack, or have good reason to doubt, relevant probability information; they care little for potential gains; and they face unacceptable outcomes (Rawls 1999, p. 134). And this core use escapes the initial, standard objections.[79]

More importantly for current purposes, I would also claim that a reasonable case can be made that climate change satisfies the conditions for the core precautionary principle (Gardiner 2006). First, many of the predicted outcomes from climate change seem severe, and some are catastrophic. Hence, there are grounds for saying there are unacceptable outcomes. Second, as we have seen, for gradual change, either the probabilities of significant damage from climate change are high or else we do not know the probabilities; and for abrupt change the probabilities are unknown. Finally, given widespread endorsement of the view that stabilizing emissions would impose a cost of "only" 2% of world production, one might claim that we care little about the potential gains – at least relative to the possibly catastrophic costs.

There is reason to believe, then, that the endorsement by many policy makers of some form of precautionary or no harm approach is reasonable for climate change. But exactly which "precautionary measures" should be taken? One obvious first step is that those changes in present energy consumption which would have short-term, as well as long-term, economic benefits should be made immediately. In addition, we should begin acting on low-cost emissions-saving measures as soon as possible. Beyond that, it is difficult to say exactly how we should strike a balance between the needs of the present and those of the future. Clearly, this is an area where further thought is urgently needed.

Still, it is perhaps worthwhile closing this section with one, speculative, opinion about how we should direct our efforts. By focusing on the possibility of extreme events, and considering the available science, Brian O'Neill and Michael Oppenheimer suggest in a recent article in Science that "taking a precautionary approach because of the very large uncertainties, a limit of 2 C above 1990 global

[78]In a recent piece in the New York Times, a self-described "former Reagan administration trade hawk" asserted: "Without any scientific grounds, but on the basis of the so-called precautionary principle – that is, if we can't prove absolutely that it is harmless, let's ban it – the [European] Union has prevented genetically modified food from the United States from entering its markets" (Prestowitz 2003). For more measured, philosophical criticisms, see Soule 2000; and Manson 2002.

[79]I would also argue that it renders many objections made to the principle in practical contexts misguided: instead of calling into doubt the reasonableness of the precautionary principle itself, critics are often arguing that the conditions for its application are not met.

average temperature is justified to protect [the West Antarctic Ice Sheet]. To avert shutdown of the [Thermohaline circulation], we define a limit of 3 C warming over 100 years" (O'Neill and Oppenheimer 2002). It is not clear how robust these assertions are. Still, they suggest a reasonable starting point for discussion. For, on the assumption that these outcomes are unacceptable, and given the IPCC projections of a warming of between 1.4°C and 5.8°C over the century, both claims appear to justify significant immediate action on greenhouse gas stabilization.[80]

Responsibility for the Past

> I'll tell you one thing I'm not going to do is I'm not going to let the United States carry the burden for cleaning up the world's air, like the Kyoto Treaty would have done. China and India were exempted from that treaty. I think we need to be more even-handed. (George W. Bush, quoted by Singer 2002, p. 30)[81]

> Even in an emergency one pawns the jewellery before selling the blankets.… Whatever justice may positively require, it does not permit that poor nations be told to sell their blankets [compromise their development strategies] in order that the rich nations keep their jewellery [continue their unsustainable lifestyles]. (Shue 1992, p. 397; quoted by Grubb 1995, p. 478)

> To demand that [the developing countries] act first is patently unfair and would not even warrant serious debate were it not the position of a superpower. (Harris 2003)

Suppose, then, that action on climate change is morally required. Whose responsibility is it? The core ethical issue concerning global warming is that of how to allocate the costs and benefits of greenhouse gas emissions and abatement.[82] On this issue, there is a surprising convergence of philosophical writers on the subject: they are virtually unanimous in their conclusion that the developed countries should take the lead role in bearing the costs of climate change, while the less developed countries should be allowed to increase emissions for the foreseeable future.[83]

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[80]O'Neill and Oppenheimer 2002 suggest stabilization at 450 parts per million of carbon dioxide, which would require a peak in global emissions between 2010 and 2020.

[81]From the second televised presidential debate of 2000.

[82]Shue usefully distinguishes four issues of distributive fairness here: how to allocate the costs of preventing avoidable change; how to allocate the costs of coping with change that will not be avoided; the background allocation of wealth that would allow fair bargaining about such issues; and the allocation of the gases themselves, both in the long run and during any period of transition to it (Shue 1993, p. 40).

[83]Some try to account for the convergence. For example, Peter Singer claims that it arises because the facts of climate change are such that all the major traditional lines of thought about justice in ethical theory point to the same conclusion (Singer 2002); Henry Shue argues that three "commonsense principles of fairness, none of them dependent upon controversial theories of justice" all support the position (Shue 1999b, p. 531); and Wesley and Peterson believe that the United States should accept heavier burdens because they are justified by "at least four of Ross's prima facie duties" (see Wesley and Peterson 1999, p. 191).

Still, agreement on the fact of responsibility masks some notable differences about its justification, form, and extent; so it is worth assessing the competing accounts in more detail. The first issue to be considered is that of "backward-looking considerations."[84] The facts are that developed countries are responsible for a very large percentage of historical emissions, whereas the costs likely to be imposed by those emissions are expected to be disproportionately visited on the poorer countries (IPCC 1995, p. 94).[85] This suggests two approaches. First, one might invoke historical principles of justice that require that one "clean up one's own mess." This suggests that the industrialized countries should bear the costs imposed by their past emissions.[86] Second, one might characterize the earth's capacity to absorb man-made emissions of carbon dioxide as a common resource, or sink (Traxler 2002, p. 120),[87] and claim that, since this capacity is limited, a question of justice arises in how its use should be allocated (Singer 2002, pp. 31–32).[88] On this approach, the obvious argument to be made is that the developed countries have largely exhausted the capacity in the process of industrializing and so have, in effect, denied other countries the opportunity to use "their shares." On this view, justice seems to require that the developed countries compensate the less developed for this overuse.

It is worth observing two facts about these two approaches. First, they are distinct. On the one hand, the historical principle requires compensation for damage inflicted by one party on another and does not presume that there is a common resource; on the other, the sink consideration crucially relies on the presence of a common resource and does not presume that any (further) damage is caused to the

[84]The term is from Traxler. Singer calls them "historical." Shue objects to that label, preferring to use a fault-based and no-fault distinction. (He argues that no-fault principles are not necessarily ahistorical: an ability to pay principle might emerge from a historical analysis; Shue 1993, p. 52.)

[85]Singer cites Hayes and Smith 1993, Chap. 2, Table 2.4, which says that, even from 1950 to 1986, the United States, with about 5% of world population, was responsible for 30% of cumulative emissions, while India, with 17% of world population, was responsible for less than 2%. (Another study suggests that the developed world is responsible for 85.9% of the increase in atmospheric concentration of carbon dioxide since 1800; see Grubler and Fujii 1991, cited by Neumayer 2000, p. 190; and IPCC 1995, p. 94.) Furthermore, Singer says that "at present rates of emissions … including … changes in land use … contributions of the developing nations to the atmospheric stock of GHG will not equal the built-up contributions of developed nations until about 2038. If we adjust … for population – per person contributions… – the answer is: not for at least another century" (Singer 2002, pp. 36–37).

[86]This approach is reflected in the conventional environmental "polluter pays" principle and in Shue's first "commonsense principle" of equity (Shue 1999b, p. 534). (Shue suggests that his principle is wider than "polluter pays," since he claims that the latter is exclusively forward-looking, demanding only that future pollution costs should be reflected in prices. But many writers seem to use 'polluter pays' in a wider sense than this.)

[87]Shue characterizes the issue as one of an international regime imposing a ceiling on emissions and thereby creating an issue of justice, through making emissions a zero-sum good (see Shue 1995b, p. 385).

[88]Singer suggests that it is this feature of the problem which renders the Lockean Proviso, of leaving "enough and as good" for others, inoperative under the circumstances for climate change.

disenfranchised beyond their being deprived of an opportunity for use.[89] Second, they are compatible. One could maintain that a party deprived of its share of a common resource ought to be compensated both for that and for the fact that material harm has been inflicted upon it as a direct result of the deprivation.[90]

Offhand, the backward-looking considerations seem weighty. However, many writers suggest that in practice they should be ignored.[91] One justification that is offered is that, until comparatively recently, the developed countries were ignorant of the effects of their emissions on the climate and so should not be held accountable for past emissions (or at least those prior to 1990, when the IPCC issued its first report).[92] This consideration seems to me far from decisive, because it is not clear how far the ignorance defense extends.[93] On the one hand, in the case of the historical principle, if the harm inflicted on the world's poor is severe, and if they lack the means to defend themselves against it, it seems odd to say that the rich nations have

[89]Traxler suggests that they produce "very much the same results" (Traxler 2002, p. 120). But this might not turn out to be the case. For example, I might be responsible for some of the costs of upkeep of a common resource, so that the compensation due to me for a given level of pollution might be less than if there were no common property involved; or use of the resource might necessarily involve some imposed costs, of which I am expected to bear a fair share. Neither would be true on the other principle.

[90]A further point to be made about the approaches is that they are potentially rebuttable. In particular, proponents of historical accounts of appropriation generally suggest that due compensation is typically paid, in the form of the increased standard of living for all that the appropriation allows. Singer, however, argues that such arguments will not work for climate change. For one thing, he says, the poor do not benefit from the increased productivity of the rich, industrialized world – "they cannot afford to buy its products" – and, if natural disasters ensue, they may even be made substantially worse off by it (Singer 2002, pp. 33–34). For another, he claims that the benefits received by the rich are wildly disproportionate. (Singer dismisses Adam Smith's argument that there is an invisible hand at work so that, though the rich take the "most precious" things, "they consume little more than the poor … [and] divide with the poor the produce of all their improvements." Instead, Singer claims, there is nothing even close to an equal distribution of the benefits of greenhouse gas emissions, because "the average American … uses more than fifteen times as much of the global atmospheric sink as the average Indian" and so effectively deprives the poor of the opportunity to develop along the same lines [see Singer 2002, pp. 34–35]. Shue argues that "whatever benefits the LDCs have received, they have mostly been charged for" [Shue 1999b, p. 535].)

[91]Other considerations are discussed by Beckerman and Pasek (1995), Neumayer (2000), Shue (1993, pp. 44–45), and Grubb (1995, p. 491).

[92]Singer and Jamieson both want to ignore emissions prior to 1990, and both mention ignorance as a relevant factor. However, their endorsement of the ignorance defence is lukewarm, and this may indicate that they are more concerned with practicality. (Singer suggests that there is a "strong case" for backward-looking principles but imagines that the poor countries might "generously" overlook it [Singer 2002, pp. 38–39, 48]. Jamieson argues that emissions prior to 1990 are at least not morally equivalent to those after, because they do not amount to an intentional effort to deprive the poor of their share [Jamieson 2001, p. 301].)

[93]It is perhaps worth noticing that U.S. tort law allows for circumstances of strict liability – i.e., instances where a party causing harm is liable for damages even when not guilty of negligence – and that this concept has been successfully upheld in several environmental cases and employed in environmental legislation.

no obligation to assist, especially when they could do so relatively easily and are in such a position largely because of their previous causal role. On the other hand, in the case of the sink consideration, if you deprive me of my share of an important resource, perhaps one necessary to my very survival, it seems odd to say that you have no obligation to assist because you were ignorant of what you were doing at the time. This is especially so if your overuse both effectively denies me the means of extricating myself from the problem you have created and also further reduces the likelihood of fair outcomes on this and other issues (Shue 1992).[94]

A second justification for ignoring past emissions is that taking the past into account is impractical. For example, Martino Traxler claims that any agreement which incorporates backward-looking considerations would require "a prior international agreement on what constitutes international distributive justice and then an agreement on how to translate these considerations into practical allocations" and that, given that "such an agreement is [un]likely in our lifetime," insisting on it "would amount to putting off any implementation concerning climate change indefinitely" (Traxler 2002, p. 128). Furthermore, he asserts that climate change takes the form of a commons problem and so poses a significant problem of defection:[95] "Each nation is (let us hope) genuinely concerned with this problem, but each nation is also aware that it is in its interest not to contribute or do its share, regardless of what other countries do. … In short, in the absence of the appropriate international coercive muscle, defection, however unjust it may be, is just too tempting" (Traxler 2002, p. 122).

Though rarely spelled out, such pragmatic concerns seem to influence a number of writers. Still, I am not convinced – at least by Traxler's arguments. For one thing, I do not see why a complete background understanding of international justice is required, especially just to get started.[96] For another, I am not sure that defection is quite the problem, or at least has the implications, that Traxler suggests. In particular, Traxler's argument seems to go something like this: since there is no external coercive body, countries must be motivated not to defect from an agreement; but (rich) countries will be motivated to defect if they are asked to carry the costs of their past (mis)behavior; therefore, past behavior cannot be considered, otherwise (rich) countries will defect. But this reasoning is questionable, on several grounds.

[94]According to Shue, far from being irrelevant, backward-looking considerations exacerbate the problems through creating compound injustice.

[95]I will comment on the appropriateness of describing the climate change problem in this way toward the end of the article.

[96]One reason comes from historical precedent. Thomas Schelling argues that our one experience with redistribution of this magnitude is the post–World War II Marshall Plan. In that case, "there was never a formula … there were not even criteria; there were 'considerations' … every country made its claim for aid on whatever grounds it chose," and the process was governed by a system of "multilateral reciprocal scrutiny," where the recipient nations cross-examined each other's claims until they came to a consensus on how to divide the money allocated, or faced arbitration from a two-person committee. Though not perfect, such a procedure did at least prove workable (Schelling 1997).

First, it seems likely that if past behavior is not considered, then the poor countries will defect. Since, in the long run, their cooperation is required, this would suggest that Traxler's proposal is at least as impractical as anyone else's.[97] Second, it is not clear that no external coercive instruments exist. Trade and travel sanctions, for example, are a possibility and have precedents. Third, the need for such sanctions (and indeed, the problem of defection in general) is not brought on purely by including the issue of backward-looking considerations in negotiation, nor is it removed by their absence. So it seems arbitrary to disallow such considerations on this basis. Finally, Traxler's argument seems to assume (first) that the only truly urgent issue that needs to be addressed with respect to climate change is that of future emissions growth, and (second) that this issue is important enough that concerns about (a) the costs of climate change to which we are already committed, and (b) the problem of inequity in the proceeds from those emissions (e.g., that the rich countries may have, in effect, stolen rights to develop from the poorer countries) can be completely ignored. But such claims seem controversial.[98]

The arguments in favor of ignoring past emissions are then, unconvincing. Hence, contrary to many writers on this subject, I conclude that we should not ignore the presumption that past emissions pose an issue of justice which is both practically and theoretically important. Since this has the effect of increasing the obligations of the developed nations, it strengthens the case for saying that these countries bear a special responsibility for dealing with the climate change problem.

Allocating Future Emissions

> The central argument for equal per capita rights is that the atmosphere is a global commons, whose use and preservation are essential to human well being. (Baer 2002, p. 401)

> Much like self-defense may excuse the commission of an injury or even a murder, so their necessity for our subsistence may excuse our indispensable current emissions and the resulting future infliction of harm they cause. (Traxler 2002, p. 107)

Let us now turn to the issue of how to allocate future emissions. Here I cannot survey all the proposals that have been made; but I will consider four prominent suggestions.[99]

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[97]This concern is exacerbated by the fact that the principle of "differentiated responsibilities" was explicitly agreed to long ago, under the Framework Convention for Climate Change, and ratified by all the major governments. So, LDCs would have a procedural as well as several substantive reasons to defect.

[98]It should also be clear that to restrict concern to future emissions growth has the effect of addressing only the single issue that matters to the rich countries. Again, this heightens the risk of poor country defection.

[99]For critiques of some other possibilities (see Baer 2002; Jamieson 2001).

Equal Per Capita Entitlements

The most obvious initial proposal is that some acceptable overall level of anthropogenic greenhouse emissions should be determined, and then that this should be divided equally among the world's population, to produce equal per capita entitlements to emissions.[100] This proposal seems intuitive but would have a radical redistributive effect. Consider the following illustration. Singer points out that stabilizing carbon emissions at current levels would give a per capita rate of roughly 1 t per year. But actual emissions in the rich countries are substantially in excess of this: the United States is at more than 5 tonnes per capita (and rising); and Japan, Australia, and Western Europe are all in a range from 1.6 to 4.2 t per capita (with most below 3). India and China, on the other hand, are significantly below their per capita allocation (at 0.29 and 0.76, respectively).[101] Thus, Singer suggests (against the President Bush's claim at the beginning of the previous section), an "even-handed approach" implies that India and China should be allowed increases in emissions, while the United States should take a massive cut (Singer 2002, pp. 39–40).[102]

Two main concerns have been raised about the per capita proposal.[103] The first is that it might encourage population growth, through giving countries an incentive to maximize their population in order to receive more emissions credits (Jamieson 2001, p. 301).[104] But this concern is easily addressed: most proponents of a per capita entitlement propose indexing population figures for each country to a certain time. For example, Jamieson proposes a 1990 baseline (relevant due to the initial

[100]Versions of this proposal are made by Agarwal and Narain (1991), Jamieson (2001), Singer (2002, pp. 39–40), and Baer (2002). Politically, it is also advocated by China, India, and most of the LDCs.

[101]Agarwal, Narain, and Sharma point out that "in 1996, one U.S. citizen emitted as much as … 19 Indians, 30 Pakistanis, 107 Bangladeshis … and 269 Nepalis" (Agarwal et al. 1999, p. 107).

[102]This is even without taking into account the historical issues. The IPCC 1995 report says: "If the total CO2 absorption were assigned on an equal per capita basis, most developing countries are in fact 'in credit' – their cumulative emissions are smaller than the global average per capita absorption, and so on this basis their past contribution is not merely small but actually negative" (IPCC 1995, p. 94).

[103]Other issues include the need, in practice, to assign the rights to countries rather than to individuals and the need for large transfers of resources from rich countries to poor. The former undermines the egalitarianism of the proposal, since governments might have other objectives; the latter may undermine its political feasibility. For discussion, see Baer (2002, pp. 402–404); Beckerman and Pasek (2001, p. 183).

[104]Singer suggests merely that it will give nations insufficient incentives to combat population growth and that this is an issue because under a fixed ceiling such growth effectively reduces other country's shares (Singer 2002, p. 40). But note that whether there is an incentive to increase population is an empirical issue, involving more than one factor: while it is true that the growing country's allocation will go up, that country will then have an extra person to look after. So, a larger population is desirable only if an extra person "costs" notably less than their emissions allotment.

IPCC report), whereas Singer proposes 2050 (to avoid punishing countries with younger populations at present). The second concern is more serious. The per capita proposal does not take into account the fact that emissions may play very different roles in people's lives. In particular, some emissions are used to produce luxury items, whereas others are necessary for most people's survival.

Rights to Subsistence Emissions

This concern is the basis for the second proposal on how to allocate emissions rights. Henry Shue argues that people should have inalienable rights to the minimum emissions necessary to their survival or to some minimal quality of life.[105] This proposal has several implications. First, it suggests that there might be moral constraints on the limitation of emissions, so that establishing a global emissions ceiling will not be simply a matter for climatologists or even economists. If some emissions are deemed morally essential, then they may have to be guaranteed even if this leads to an overall allocation above the scientific optimum. Traxler is explicit as to why this is the case. Even if subsistence emissions cause harm, they can be morally excusable because "they present their potential emitters with such a hard choice between avoiding a harm today or avoiding a harm in the future" that they are morally akin to self-defense.[106] Second, the proposal suggests that actual emissions entitlements may not be equal for all individuals and may vary over time. For the benefits that can actually be drawn from a given quantity of greenhouse gas emissions vary with the existing technology, and the necessity of them depends on the available alternatives. But both vary by region, and will no doubt evolve in the future, partly in response to emissions regulation. Third, as Shue says, the guaranteed minimum principle does not imply that allocation of any remaining emissions rights above those necessary for subsistence must be made on a per capita basis. The guaranteed minimum view is distinct from a more robust egalitarian position which demands equality of a good at all levels of its consumption (Shue 1995a, pp. 387–388); hence, above the minimum some other criterion might be adopted.

[105]Shue views the "maintain an adequate minimum" requirement as a no-fault principle and so as having the advantage that no inquiry needs to be conducted to see who is to blame. (Resources are to be generated through an "ability to pay" criterion.) See Shue 1993, pp. 53–54. (Moellendorf endorses an "ability to pay" criterion as a no-fault principle, but only to the extent that the rich countries should pay 40% of the costs, which is equivalent to their current percentage of global emissions; see Moellendorf 2002, p. 100.) Traxler accepts Henry Shue's argument for the importance of subsistence emissions but argues that the difference between subsistence and luxury emissions is one of degree and that a fair allocation of costs would involve a "fair chore division" between nations based on their marginal costs. See below.

[106]Traxler does admit that those committing the harm have an obligation to minimize the damage inflicted on others and may still owe compensation for the damage they cause (Traxler 2002, pp. 107–108).

The guaranteed minimum approach has considerable theoretical appeal. However, there are two reasons to be cautious about it. First, determining what counts as a "subsistence emission" is a difficult matter, both in theory and in practice. For example, Traxler defines subsistence emissions in terms of physiologically and socially necessary emissions but characterizes social necessity as "what a society needs or finds indispensable in order to survive" (Traxler 2002, p. 106). But this is problematic. For one thing, much depends on how societies define what they find "indispensable." (It is hard not to recall the first President Bush's comment, back in 1992, that "the American way of life is not up for negotiation.") For another, and perhaps more importantly, there is something procedurally odd about the proposal. For it appears to envisage that the climate change problem can be resolved by appealing to some notion of social necessity that is independent of, and not open to, moral assessment. But this seems somehow backwards. After all, several influential writers argue that part of the challenge of climate change is the deep questions it raises about how we should live and what kinds of societies we ought to have (Jamieson 1992, p. 290; and IPCC 2001a, 1.4; questioned by Lomborg 2001, pp. 318–322).

Second, in practice, the guaranteed approach may not differ from the per capita principle, and yet may lack the practical advantages of that approach. On the first issue, given the foregoing point, it is hard to see individuals agreeing on an equal division of basic emissions entitlements that does anything less than exhaust the maximum permissible on other (climatological and intergenerational) grounds; and easy to see them being tempted to overshoot it. Furthermore, determining an adequate minimum may turn out to be almost the same task as (a) deciding what an appropriate ceiling would be and then (b) assigning per capita rights to the emissions it allows. For a would also require a view about what constitutes an acceptable form of life and how many emissions are necessary to sustain it. On the second issue, the subsistence emissions proposal carries political risks that the per capita proposal does not, or at least not to the same extent. For one thing, the claim that subsistence emissions are nonnegotiable seems problematic given the first point (above) that there is nothing to stop some people claiming that almost any emission is essential to their way of life. For another, the claim that nonsubsistence emissions need not be distributed equally may lead some in developed countries to argue that what is required to satisfy the subsistence constraint is extremely minimal and that emissions above that level should be either grandfathered or else distributed on other terms favorable to those with existing fossil-fuel intensive economies. But this would mean that developing countries might be denied the opportunity to develop, without any compensation.

Priority to the Least Well-Off

The third proposal I wish to consider offers a different justification for departing from the per capita principle: namely, that such a departure might maximally

(or at least disproportionately) benefit the least well-off.[107] The obvious version of this argument suggests, again, that the rich countries should carry the costs of dealing with global warming, and the LDCs should be offered generous economic assistance.[108] But there are also less obvious versions, some of which may be attributable to some global warming skeptics.

The first is offered by Bjorn Lomborg. Lomborg claims that the climate change problem ultimately reduces to the question of whether to help poor inhabitants of the poor countries now or their richer descendents later. And he argues that the right answer is to help now, since the present poor are both poorer and more easily helped. Kyoto, he says, "will likely cost at least $150 billion a year, and possibly much more," whereas "just $70–80 billion a year could give all Third World inhabitants access to the basics like health, education, water and sanitation" (Lomborg 2001, p. 322).

But this argument is far from compelling. For one thing, it seems falsely to assume that helping the poor now and acting on climate change are mutually exclusive alternatives (Grubb 1995, p. 473, n. 25).[109] For another, it seems to show a giant leap of political optimism. If their past record is anything to go by, the rich countries are even less likely to contribute large sums of money to help the world's poor directly than they are to do so to combat climate change (Singer 2002, pp. 26–27).

A second kind of priority argument may underlie the present President Bush's proposal of a "greenhouse gas intensity approach," which seeks to index emissions to economic activity.[110] Bush has suggested reducing the amount of greenhouse gas per unit of US GDP by 18% in 10 years, saying "economic growth is the solution, not the problem" and "the United States wants to foster economic growth in the developing world, including the world's poorest nations" (Singer 2002, p. 43). Hence, he seems to appeal to a Rawlsian principle.

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[107]I have in mind both the Rawlsian requirement of fairness, captured in his famous Difference Principle, and the milder views of present-day "prioritarians." For the former, see Rawls (1999); for the latter, see Parfit (1997) and, for climate change in particular, Beckerman and Pasek (2001).

[108]Offhand, one would expect utilitarian approaches to recommend the same thing, based on global inequalities in welfare and diminishing marginal returns to utility. But two things make the utilitarian approach difficult. The first is logistical: calculating the maximally happiness-inducing climate policy seems to be impossible; the second is ethical: the rich might claim that they have become so used to emissions-intensive lifestyles that they will suffer more from losing them than the poor will through being denied access to them and, hence, should be required to sacrifice less. Singer claims that the logistical problem can be dealt with by treating the other distributive criteria as secondary principles to utilitarianism and that there is no ethical problem since the rich have a legitimate concern, but one that can be accommodated by allowing them to buy emissions permits from the poor (Singer 2002, pp. 45–48). Beckerman and Pasek are more pessimistic (1995, p. 406).

[109]Lomborg himself seems to recognize the criticism at the end of his chapter (Lomborg 2001, p. 324).

[110]This would give the United States a larger share of global emissions than per capita principles, since it has a large share of the global economy. Raul A. Estrada-Oyuela suggests a more complex, international "standard of efficiency for work performed approach," with different criteria for different economic sectors (Estrada-Oyuela 2002, p. 44).

Peter Singer, however, claims that there are two serious problems with this argument. First, it faces a considerable burden of proof: it must show that U.S. economic activity not only makes the poor better off, but maximally so. Second, this burden cannot be met: not only do CIA figures show the United States "well above average in emissions per head it produces in proportion to per capita GDP,"[111] but "the vast majority of the goods and services that the US produces – 89 per cent of them – are consumed in the US" (Singer 2002, pp. 44–45). This, Singer argues, strongly suggests that the world's poor would be better off if the majority of the economic activity the United States undertakes (with its current share of world emissions) occurred elsewhere.

Equal Burdens

A final proposal superficially resembles the equal intensity principle but is advocated for very different reasons. Martino Traxler proposes a "fair chore division" which equalizes the marginal costs of those aiming to prevent climate change. Such a proposal, he claims, is politically expedient, in that it (a) provides each nation in the global commons with "no stronger reasons to defect from doing its (fair) share than it gives any other nation" and so (b) places "the most moral pressure possible on each nation to do its part" (Traxler 2002, p. 129).

Unfortunately, it is not clear that Traxler's proposal achieves the ends he sets for it. First, by itself, a does not seem a promising way to escape a traditional commons or prisoner's dilemma situation. What is crucial in such situations is the magnitude of the benefits of defecting relative to those of cooperating; whether the relative benefits are equally large for all players is of much less importance.[112] Second, this implies that b must be the crucial claim, but b is also dubious in this context. For Traxler explicitly rules out backward-looking considerations on practical grounds. But this means ignoring the previous emissions of the rich countries, the extent to which those emissions have effectively denied the LDCs "their share" of fossil-fuel-based development in the future, and the damages which will be disproportionately visited on the LDCs because of those emissions. So, it is hard to see why the LDCs will experience "maximum moral pressure" to comply. Third, equal marginal costs approaches are puzzling for a more theoretical reason. In general, equality of marginal welfare approaches suffer from the intuitive defect that they take no account of the overall level of welfare of each individual. Hence, under certain conditions, they might license taking large

[111]It is worth noting that the "per capita" clause makes all the difference. Developed countries typically produce more GDP per unit of energy than LDCs; see Jamieson 2001, p. 295.

[112]For a discussion of the commons in reference to climate change, see Gardiner 2001.

amounts from the poor (if they are so badly off anyway that changes for the worse make little difference), while leaving the rich relatively untouched (if they are so used to a life of luxury that they suffer greatly from even small losses).[113] Now, Traxler's own approach does not fall into this trap, but this is because he advocates that costs should be measured not in terms of preferences or economic performance but, rather, in terms of subsistence, near subsistence, and luxury emissions. Thus, his view is that the rich countries should have to give up all of their luxury emissions before anyone else need consider giving up subsistence and near-subsistence emissions. But this raises a new concern.[114] For in practice this means that Traxler's equal burdens proposal actually demands massive action from the rich countries before the poor countries are required to do anything at all (if indeed they ever are). And however laudable, or indeed morally right, such a course of action might be, it is hard to see it as securing the politically stable agreement that Traxler craves, or, at least, it is hard to see it as more likely to do so than the alternatives. So, the equal marginal costs approach seems to undercut its own rationale.

What Has the World Done? The Kyoto Deal[115]

> This has been a disgraceful performance. It is the single worst failure of political leadership that I have seen in my lifetime. (Al Gore, quoted by Hopgood 1998, p. 199)[116]

> The system is made in America, and the Americans aren't part of it. (David Doniger)[117]

We have seen that there is a great deal of convergence on the issue of who has primary responsibility to act on climate change. The most defensible accounts of fairness and climate change suggest that the rich countries should

[113]This kind of point is made by Amartya Sen in a classic piece (Sen 1980).

[114]One might also object that there are plenty of rich people in poor countries, and poor people in rich countries, so that it doesn't seem fair to deny some rich people (those in rich countries) their luxuries, while leaving the luxuries of others (the rich in poor countries) untouched.

[115]The best guide to the Kyoto agreement is Grubb et al. 1999. Also very informative is Victor 2001. On the role played by ethical considerations in international environmental agreements in general, see Albin (2001).

[116]Gore, then a U.S. senator, was criticizing the first Bush administration's performance in Rio. The subsequent irony of this remark is, perhaps, tempered by Gore's subsequent comment, early in his term as vice president, that "the minimum that is scientifically necessary [to combat global warming] far exceeds the maximum that is politically feasible" (McKibben 2001, p. 38).

[117]Doniger, a former Kyoto negotiator and director of climate programs for the Natural Resources Defense Council, is quoted by Pohl (2003).

bear the brunt, and perhaps even the entirety, of the costs. What, then, has the world done?

The current international effort to combat climate change has come in three main phases. The first came to fruition at the Rio Earth Summit of 1992. There, the countries of the world committed themselves to the Framework Convention on Climate Change (FCCC), which required "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" and endorsed a principle of "common but differentiated responsibilities," according to which, the richer, industrialized nations (listed under "Annex I" in the agreement) would take the lead in cutting emissions, while the less developed countries would pursue their own development and take significant action only in the future.[118] In line with the FCCC, many of the rich countries (including the United States, European Union, Japan, Canada, Australia, New Zealand, and Norway) announced that they would voluntarily stabilize their emissions at 1990 levels by 2000.

Unfortunately, it soon became clear that merely voluntary measures were ineffective. For, as it turned out, most of those who had made declarations did nothing meaningful to try to live up to them, and their emissions continued to rise without constraint.[119] Thus, a second phase ensued. Meeting in Berlin in 1995, it was agreed that the parties should accept binding constraints on their emissions, and this was subsequently achieved in Japan in 1997, with the negotiation of the Kyoto Protocol. This agreement initially appeared to be a notable success, in that it required the Annex I countries to reduce emissions to roughly 5% below 1990 levels between 2008 and 2012. But it also contained two major compromises on the goal of limiting overall emissions, in that it allowed countries to count forests as sinks and to meet their commitments through buying unused capacity from others, through permit trading.

The promise of Kyoto turned out to be short lived. First, it proved so difficult to thrash out the details that a subsequent meeting, in the Hague in November 2000, broke down amid angry recriminations. Second, in March 2001, the Bush administration withdrew U.S. support, effectively killing the Kyoto agreement. Or so most people thought. For, as it turned out, the U.S. withdrawal did not cause immediate collapse. Instead, during the remainder of 2001, in meetings in Bonn and Marrakesh, a third phase began in which a full agreement was negotiated, with the European Union, Russia, and Japan playing prominent roles,[120] and sent to participating

[118]Articles 2 and 3.1, FCCC. This treaty was later ratified by all the major players, including the United States.

[119]The United States, e.g., posted a 12% increase for the decade. Only the European Union looked likely to succeed; but this was merely because, by a fortuitous coincidence, the United Kingdom and Germany posted sharp reductions in emissions for economic reasons unrelated to climate change.

[120]The latter two countries won substantial concessions on their targets, and so a further weakening of the overall goal.

governments for ratification. Many nations swiftly ratified, including the European Union, Japan, and Canada, so that, at the time of writing, the Kyoto Treaty needs only ratification by Russia to pass into international law.[121]

On the surface, then, the effort to combat global climate change looks a little bruised, but still on track. But this appearance may be deceptive. For there is good reason to think that the Kyoto Treaty is deeply flawed, both in its substance and its background assumptions (Barrett 2003; Gardiner 2004). Let us begin with two substantive criticisms.

The first is that Kyoto currently does very little to limit emissions. Initial projections suggested that the Bonn-Marrakesh agreement would reduce emissions for participants by roughly 2% on 1990 levels, down from the 5% initially envisaged by the original Kyoto agreement (Ott 2001). But recent research suggests that such large concessions were made in the period from Kyoto to Marrakesh that (a) even full compliance by its signatories would result in an overall increase in their emissions of 9% above 2,000 levels by the end of the first commitment period; and (b) if present slow economic growth persists, this would actually match or exceed projected business-as-usual emissions (Babiker et al. 2002). Coupled with emissions growth in the LDCs, this means that there will be another substantial global increase by 2012.[122] This is nothing short of astounding given that by then we will be "celebrating" 20 years since the Earth Summit (Gardiner 2006).

It is worth pausing to consider potential objections to this criticism Gardiner 2006, in Journal of Political Philosophy. Some would argue that, even if it achieves very little, the current agreement is to be valued either procedurally (as a necessary first step),[123]

[121]At the time of writing, the situation with Russia is unclear. President Putin promised in 2002 to have the process under way by the beginning of 2003, but by October 2003 this had still not occurred. Many commentators had initially assumed that Russia would be eager to ratify, since the economic collapse following the end of communism had reduced its own emissions and therefore appeared to give it a large surplus of permits to sell once the Kyoto targets were in place. More recently, however, some have expressed doubts about this scenario. For example, in October 2003, Andrei Illarionov, an advisor to President Putin on economic policy, was widely reported to oppose Russian participation, saying that it would "doom Russia to poverty, weakness and backwardness" (Hirsch 2003). And by December, Illarionov was reported to have said that Russia definitely would not ratify (Myers and Revkin 2003). However, accounts of the Conference of the Parties meeting in Milan suggest that other countries did not take this statement as decisive (Pew Center 2003; Earth Negotiations Bulletin 2003, p. 18). Russian reticence seems to be caused in part by the low price of its excess permits, given the United States' refusal to participate in Kyoto.

[122]Grubb suggests that non–Annex I emissions will grow by 114% during the period and that (even if the United States had been included in Kyoto) this would have led to a global emissions rise of 31% above 1990 levels; see Grubb et al. 1999, p. 156. A recent United Nations report anticipates that developed country emissions will increase by 8% from 2000 to 2010 (http://www.usinfo.state.gov/topical/climate/03060501.htm, June 3, 2003).

[123]For example, Eileen Claussen, the president of the Pew Center on Global Climate Change, concedes that "the protocol does not do much of anything for the atmosphere" but goes on to say that "you've got to get a framework in place before you can take more than relatively small steps" (Revkin 2002). See also Desombre 2004.

symbolically (for showing that some kind of agreement is possible),[124] geopolitically (for showing that the rest of the world can act without the United States),[125] or as simply the best that is possible under current conditions (Athanasiou and Baer 2001, 2002, p. 24). There is something to be said for these views. For the current Kyoto Protocol sets targets only for 2008–2012, and these targets are intended as only the first of many rounds of abatement measures. Kyoto's enthusiasts anticipate that the level of cuts will be deepened and their coverage expanded (to include the developing countries) as subsequent targets for new periods are negotiated.[126]

Nevertheless, I remain skeptical. This is partly due to the history of climate negotiations in general, and the current U.S. energy policy in particular; and partly because I do not think future generations will see reason to thank us for symbolism rather than action. But the main reason is that there are clear ways in which the world could have done better (Gardiner 2004).

This leads us to the second substantive criticism of Kyoto: that it contains no effective compliance mechanism. This criticism arises because, although the Bonn-Marrakesh agreement allows for reasonably serious punishments for those who fail to reach their targets,[127] these punishments cannot be enforced.[128] For the envisioned treaty has been set up so that countries have several ways to avoid being penalized. On the one hand, enforcement is not binding on any country that fails to ratify the amendment necessary to punish it (Barrett 2003, p. 386).[129] On the other, the penalties take the form of more demanding targets in the next decade's commitment period – but parties can take this into account when negotiating their targets for that commitment period, and in any case a country is free to exit the treaty with one year's notice, 3 years after the treaty has entered into force for it (FCCC, article 25).[130]

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[124]For example, Kate Hampton of Friends of the Earth said when the Bonn deal was made: "The Kyoto Protocol is still alive. That in itself is a triumph. But the price of success has been high. It has been heavily diluted" (Clover 2001).

[125]For example, Jennifer Morgan of the World Wildlife Fund said in Bonn: "The agreement reached today is a geopolitical earthquake. Other countries have demonstrated their independence from the Bush administration on the world's most critical environmental problem" (Kettle and Brown 2001).

[126]Grubb et al. 2003 is one recent, broadly optimistic, assessment.

[127]It allows for parties who do not meet their targets in a given period to be assigned penalties in terms of tougher targets in subsequent periods (subject to a multiple of 1.3 times the original missed amount) and to have their ability to trade emissions suspended (United Nations Framework Convention on Climate Change 2002, decision 24/CP.7, p. 75).

[128]My reasons for skepticism here all have to do with the particular format of the Kyoto Treaty. But some claim that it is also true that countries cannot be forced to keep to their international agreements (Barrett 1990, p. 75).

[129]Article 18 of the Kyoto Protocol requires that the enforcement of compliance rules be approved by amendment to the Protocol. But article 20 allows that such an amendment would be binding only on those parties that ratify the amendment.

[130]For more extensive discussions, see Barrett (2003, pp. 384–386); and Gardiner (2004).

The compliance mechanisms for Kyoto are thus weak. Some would object to this, saying that they are as strong as is possible under current institutions.[131] But I argue that this is both misleading and, to some extent, irrelevant. It is misleading because other agreements have more serious, external sanctions (e.g., the Montreal Protocol on ozone depletion allows for trade sanctions), and also because matters of compliance are notoriously difficult in international relations, leading some to suggest that it is only the easy, and comparatively trivial, agreements that get made. It is somewhat irrelevant because part of what is at stake with climate change is whether we have institutions capable of responding to such global and long-term threats (Gardiner 2004).

Kyoto is also flawed in its background assumptions. Consider the following three examples. First, the agreement assumes a "two track" approach, whereby an acceptable deal on climate can be made without addressing the wider issue of international justice. But this, Shue argues, represents a compound injustice to the poor nations, whose bargaining power on climate change is reduced by existing injustice (Shue 1992, p. 373). Furthermore, this injustice appears to be manifest, in that the treaty directly addresses only the costs of preventing future climate change and only indirectly (and minimally) addresses the costs of coping with climate change to which we are already committed (Shue 1992, p. 384).[132] Second, the Bonn-Marrakesh deal eschews enforcement mechanisms external to the climate change issue, such as trade sanctions. Given the apparent fragility of such a commitment on the part of the participant countries, this is probably disastrous. Third, Kyoto takes as its priority the issue of cost-effectiveness. As several authors point out, this tends to shift the focus of negotiations away from the important ethical issues and (paradoxically) to tend to make the agreement less, rather than more, practical.[133]

Why is Kyoto such a failure? The reasons are no doubt complex and include the political role of energy interests, confusion about scientific uncertainties and economic costs, and the inadequacies of the international system. But two further factors have also been emphasized in the literature. So, I will just mention them in closing. The first is the role of the United States, which, with 4%

[131]For example, Doniger called it "by far the strongest environmental treaty that's ever been drafted, from the beginning to the end, from the soup of measuring emissions to the nuts of the compliance regime. … The parties have reached complete agreement on what's an infraction, how you decide a case and what are the penalties. That's as good as it gets in international relations" (Revkin 2001a).

[132]Kyoto allows for help with coping through its Clean Development Mechanism (CDM) and Joint Implementation (JI) programs.

[133]For the first claim, see Brown (2002). Victor makes the second claim in relation to Kyoto's provisions for international permit trading, saying that "under international law … it is not possible to create the institutional conditions that are necessary for an international tradable permit system to operate effectively" (Victor 2001, p. xiii). Shue makes both claims in his objections to the workings of the CDM and JI (Shue, in press).

of the world's population, emits roughly 25% of global greenhouse gases. From the early stages, and on the most important issues, the United States effectively molded the agreement to its will, persistently objecting when other countries tried to make it stronger. But then it abandoned the treaty, seemingly repudiating even those parts on which it had previously agreed. This behavior has been heavily criticized for being seriously unethical (e.g., Brown 2002; Harris 2000a).[134] Indeed, Singer even goes so far as to suggest that it is so unethical that the moral case for economic sanctions against the United States (and other countries which have refused to act on climate change) is stronger than it was for apartheid South Africa, since the South African regime, horrible as it was, harmed only its own citizens, whereas the United States harms citizens of other countries.

The second reason behind Kyoto's failure is its intergenerational aspect. Most analyses describe the climate change problem in intragenerational, game theoretic terms, as a prisoner's dilemma (Barrett 2003, p. 368; Danielson 1993, pp. 95–96; Soroos 1997, pp. 260–261) or battle-of-the-sexes problem (Waldron 1990).[135] But I have argued that the more important dimension of climate change may be its intergenerational aspect (Gardiner 2001). Roughly speaking, the point is this. Climate change is caused primarily by fossil fuel use. Burning fossil fuels has two main consequences: on the one hand, it produces substantial benefits through the production of energy; on the other, it exposes humanity to the risk of large, and perhaps catastrophic, costs from climate change. But these costs and benefits accrue to different groups: the benefits arise primarily in the short to medium term and so are received by the present generation, but the costs fall largely in the long term, on future generations. This suggests a worrying scenario. For one thing, so long as high energy use is (or is perceived to be) strongly connected to self-interest, the present generation will have strong egoistic reasons to ignore the worst aspects of climate change. For another, this problem is iterated: it arises anew for each subsequent generation as it gains the power to decide whether or not to act. This suggests that the global warming problem has a seriously tragic structure. I have argued that it is this background fact that most readily explains the Kyoto debacle (Gardiner 2004).[136]

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[134]Harris argued in 2000 that the Clinton administration had not in fact repudiated "common but differentiated responsibilities" but merely wanted something ("virtually anything") which indicated that the LDCs would aim to limit their projected future emissions (Harris 2000b, p. 239).

[135]A battle-of-the-sexes analysis is also briefly suggested by some remarks of Mabey et al. (1997, pp. 356–359, 409–410); and, for the specific issue of ratification of the Kyoto Protocol, by Barrett (1998, pp. 36–37). Against this, I have argued (Gardiner 2001) that the intragenerational problem is more likely a prisoner's dilemma and that we have reason to treat it as if it were if there is any doubt.

[136]A theoretical analysis of the intergenerational problem is to be found in Gardiner 2003. Other intergenerational problems relevant to global warming include Derek Parfit's infamous Non-Identity Problem (Parfit 1985; Page 1999).

Conclusion

This article has been intended as something of a primer. Its aim is to encourage and facilitate wider engagement by ethicists with the issue of global climate change.[137] At the outset, I offered some general reasons why philosophers should be more interested in climate change. In closing, I would like to offer one more. I have suggested that climate change poses some difficult ethical and philosophical problems. Partly as a consequence of this, the public and political debate surrounding climate change is often simplistic, misleading, and awash with conceptual confusion. Moral philosophers should see this as a call to arms. Philosophical clarity is urgently needed. Given the importance of the problem, let us hope that the call is answered quickly.

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[137]This has the paradoxical consequence that, if it succeeds, this survey will soon appear obsolete and simplistic.

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Chapter 14
Nanotechnology

Christopher M. Kelty

Abstract Ethical issues concerning nanotechnology and products based on research conducted at the nanoscale include toxicity, environmental impacts, the knowledge gap, and various risks.

Keywords Nanotechnology • Environmental impacts • Risk assessment • Nanotubes • International aspects

Case: Nanotechnology*

Dr. Wright has passed out another case study for discussion. Written by Deb Bennett-Woods of Regis University, it is titled "NBIC [for Nanotechnology, Biotechnology, Information Technology, Cognitive Science] and Human Enhancement" (Bennett-Woods 2008). When Emily sits down to read it she begins to feel as if she is being transported into the future. This is what she reads.

> The most difficult part of attaining perfection is finding something to do for an encore.
> (Author unknown)
>
> The year is 2050 and you are observing a group of what appear to be young adults interacting in a public space. You are accompanied by a human design specialist who points out the specifications and current functionalities of the beings you are observing. What becomes immediately apparent is that they are all very well-formed in terms of body size, weight and musculature as well as being particularly attractive. This is due, in part, to the careful genetic sorting and manipulation that ensured they would be free from known genetically-based defects and weaknesses, as well as the introduction of various genetic

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enhancements in the form of preferred traits and abilities related to bodily appearance and function. What are not obvious are the genetic enhancements to their immune systems, cognitive development and metabolism that, in some cases, are the result of particularly useful genes borrowed from other species.

Although they all appear to be the same age, it is impossible to estimate their age very precisely by simply looking at them. The combination of careful prenatal genetic selection and ongoing cellular therapies that repair genetic mutations, reverse cellular damage, and maintain optimal cellular functioning has more or less arrested the normal, genetic and environmentally determined aging process. You are assured their life span could easily extend to 150 years.

The primary threat to their health is physical trauma. Your companion points out that he, himself, has an artificial kidney and liver due to an unfortunate accident a few years ago. The organs are a perfect biocompatible match to her body, constructed at the molecular level from composite materials and powered by the same basic metabolic reactions as the original organs; however, they are not as susceptible to normal wear, infection or other disease, so she does not anticipate having to replace them for many years – if ever.

In order to address some of the dangers of ongoing problems with environmental toxins and air pollution, the bodies of the beings you are watching have replaced most of their red blood cells with nano-engineered respirocytes and a web of O_2/CO_2 exchange ports, embedded in their skin, that provide much more effective environmental monitoring and filtering of air-borne organisms, toxins and damaging particulates than the naturally functioning human lung and respiratory system. Other engineered blood cells filter toxins and unwanted microorganisms directly from the bloodstream. With the exception of certain bio/chemical weapons and rare microorganisms that have adapted to avoid detection, the threat of infectious disease has largely been eliminated.

You observe that the mood of those around you is consistently energetic and optimistic. Your companion explains that, in addition to the management of mood, everyone is now capable of extended periods of highly focused concentration thanks to personalized pharmaceutical production units implanted within the body that constantly assess and maintain ideal levels of neurotransmitters and other chemical mediators of optimal neurofunction. Mental disorders resulting from biochemical imbalances in the brain have also been largely eradicated. When you notice people who appear to be communicating but not speaking, she explains that genetically enhanced cognitive abilities, coupled with biocompatible nanoscale circuitry, allow them to communicate telepathically. They can also connect and search virtually every available data repository and perform complex calculations and analyses at roughly the same rate as an early twenty-first century computer (Bennett-Woods 2006).

When class begins, Dr. Wright opens with a quotation from Bennett-Woods' text:

The prior description is a composite of projected capabilities that currently appear in the enhancement literature, all of which are on the proverbial drawing board.[1] Many are expected to hit the open market, in as few as 5–10 years. The question raised by these relatively rapid advancements is whether or not there is a crucial and irreversible tipping point along the continuum between the YOU of the present and the THEM of a few decades into the future at which a new species has emerged.

[1] For reference, the reader is recommended to related works by Ray Kurzweil, Ramez Naam, Douglas Mulhall, Gregory Stock, Ted Hughes, Ronald Bailey, Ted Sargent, and Joel Garreau.

Case: Discussion Questions

1. Is there a point at which the experience of being human could differ so radically from the current human experience that existing models of human biological, psychological, sociological, and cultural functioning will simply no longer apply in a meaningful way?
2. And, if so, should we be worried, hopeful, excited or terrified?

Nanotechnology[2]

Nanotechnology could become the most influential force to take hold of the technology industry since the rise of the Internet. Nanotechnology could increase the speed of memory chips, remove pollution particles in water and air and find cancer cells quicker. Nanotechnology could prove beyond our control, and spell the end of our very existence as human beings. Nanotechnology could alleviate world hunger, clean the environment, cure cancer, guarantee biblical life spans or concoct superweapons of untold horror. Nanotechnology could be the new asbestos. Nanotechnology could spur economic development through spin-offs of the research. Nanotechnology could harm the opportunities of the poor in developing countries. Nanotechnology could make the molecules in ice cream more uniform in size. Nanotechnology could enable a digital camera to work in the dark. Nanotechnology could clean up toxic waste on the atomic level. Nanotechnology could change the world from the bottom up. Nanotechnology could become an instrument of terrorism. Nanotechnology could lead to the next industrial revolution. Nanotechnology could transform the food industry. Nanotechnology could repair the ozone layer. Nanotechnology could change everything.

These are all *bona fides* lines culled from the headlines that start 'Nanotechnology could…'. What are we to make of this incredibly contradictory welter of promises and warnings? How can one thing hold so much potential, even taking into account the hyperbolic enthusiasm of public relations experts and journalists? Despite these wild promises, there is in fact something specific to nanotechnology, and there are a handful of very specific concerns that should occupy citizens, politicians, scientists and businesspeople interested in this area. In order to assess the ethical, legal and political aspects of nanotechnology it is essential to separate the tractable potential of nanotechnology from the imponderable possibilities. This document outlines what the science of nanotechnology is, and presents some of the ethical, legal and political issues that face the international community in the near future.

[2] A slightly different version of this article by Christopher Kelty appears as (United Nations Educational, Scientific and Cultural Organization 2006).

What is Nanotechnology?

There are currently dozens of different definitions of what nanotechnology is or could be; and it is important to realize that none has been agreed upon. Definitions are also political and ethical–they can determine what people will pay attention to, worry about, ignore or investigate. The fact that there are many definitions is a good indication that nanotechnology (like other emerging sciences such as biotechnology) will likely confuse the settled categories of pure and applied research, and of publicly and privately funded research. Different disciplinary backgrounds and different national scientific establishments will bring different concerns and ideas to bear on what nanotechnology will become.

To begin with, is it nanoscience or nanotechnology? Throughout this chapter, the word 'nanotechnology' is used to mean both basic and applied scientific research. Many things we might want to characterize as 'basic' nonetheless require tools, practices, materials and techniques that are fundamentally technological to begin with (computers and software, complex microscopes and tools for physical and chemical measurement and manipulation). Similarly, many activities we might call engineering, because they involve the creation of devices or machines, are seen today by scientists as 'fundamental research' into the mechanics of nature. Hence in nanotechnology, science and technology are tightly interconnected and dependent on one another.

When it comes to nanotechnology, the familiar distinction between 'applied' and 'basic' research is also troublesome. It encourages people to confuse the actual research of scientists and engineers with the projected outcomes of observers, advocates, financiers and enthusiastic scientists. Very often, when people speak of nanotechnology, they confuse the proposed outcomes – the potential benefits and potential risks – of nanotechnology with the current state of the art in labs and corporations. The proposed outcomes of science are the stuff of social policy – they are and should be the subject of debate amongst all citizens of all nations, not just scientists or politicians. They are neither inevitable nor determined by basic research, but are constrained by it. Scientists' duty as citizens should be to challenge and critique unrealistic or dangerous outcomes – not simply to propose rosy ones. Existing research in nanotechnology should be at the center of social policy as part of a system of checks and balances, not as the foundation for that policy.

So what is nanotechnology? Perhaps the simplest and broadest definition is that nanotechnology is research conducted at the nanoscale (10^{-9} m, or one billionth of a meter. For reference, a human hair is roughly 20,000 nm in diameter). How small is the nanoscale? Molecules, viruses and atoms are objects that range from less than 1 nm (atoms) to about 100 nm (large molecules like DNA). They are too small to see with the eye, or even with microscopes that use visible light. Hence the importance of new visualization technologies like the scanning tunneling microscope and the atomic force microscope, not only for seeing but also manipulating things at this small scale.

Such a definition is clearly too broad, however. Chemistry, physics and biology have worked with objects that are at the nanoscale for at least 100 years, and have debated their structure, composition and even existence for much longer. A more specific definition, for instance, would be one such as that often used by the US National Nanotechnology Initiative: research and technology development at the atomic, molecular, or macromolecular levels, in the length scale of approximately 1–100 nm range, to provide a fundamental understanding of phenomena and materials at the nanoscale and to create and use structures, devices, and systems that have novel properties and functions because of their small and/or intermediate size.

Most of what we know about how atoms, molecules and the physical world behave is based on research at larger scales (think of the physics of a baseball or the hardness of a diamond). At the nanoscale, however, properties can be observed to be quite different. For instance, a chunk of gold appears yellow to the human eye in natural light, but tiny nano-particles of gold (floating in water, for instance) can appear to be red because they reflect only the red light in the spectrum; similarly the electrical conductivity of carbon in the form of 'nanotubes' is much higher than carbon in the form of diamonds, due to it having a different structure at the molecular (nanoscale) level. These new properties, as the definition implies, might be exploited for novel applications – and this is at the heart of much of the enthusiasm about nanotechnology.

Definitions vary around the world, depending on national strengths. China, Japan and Korea emphasize the focus on materials and especially electronics, while researchers in Africa and Latin America often emphasize the materials in the context of medicine and environmental science. The Royal Society of the UK makes the distinction between 'nanoscience' and 'nanotechnology' where the former includes the 'study and manipulation' of nanoscale particles, and the latter the 'design, characterization and production' of 'structures, devices and systems' at the nanoscale. The fact that gold reflects red light at the nanoscale is exploited in the design of experimental systems that kill cancerous cells with normal visible light, but leave normal cells unharmed.

There is a yet more specific set of definitions that have been proposed for nanotechnology, and these relate to the role of *control* at the nanoscale. Understanding and observing new properties of nanoscale objects is only useful (in an engineering sense) if they can be manipulated and exploited by creating novel combinations of molecules, new machines and devices or, in the most speculative case, tiny factories. Often this definition of nanotechnology goes by the name of 'molecular manufacturing' and has long been one of the most enticing aspects for science fiction writers of the last two decades. By defining it in this manner, the *proposed outcomes* of nanotechnology are significantly narrower – engineers and scientists imaging ways of constructing all kinds of products and materials 'from the bottom up' – meaning that they are created atom by atom using nanoscale factories. The advantage of this approach would be a nearly infinite flexibility to create any substance, object, device, machine or material through atom by atom construction. The alternative 'top-down' approach – the one we use today – uses natural and man-made substances

that are then joined or constructed using a process specific to the product. No scientists working today have created such 'bottom-up' machines, few are even working in this area, but the debates about the theoretical possibility of such a manufacturing process have nonetheless been conducted very publicly and in the absence of any significant experimental work.[3] The possibility, and the threat, of molecular manufacturing are extremely peripheral to the other near-term issues addressed in the third part of this document.

The definition of nanotechnology as the manufacturing of nanoscale devices, rather than just the study of objects at the nanoscale has led some scientists to propose yet another definition –or re-definition in this case (Whitesides 2001). The study of 'nano-bio-technology' redefines the ubiquitous nano-sized objects of biology and chemistry (molecules) as tiny machines. So for instance, the molecule ATP, which is an essential component in the cell cycle of all living things, has come to be called a 'nano-motor'. So has the actin of the molecular duo, actin/mycin, which are responsible for the electrical stimulus that causes a heart to beat (Goodsell 2004). The redefinition of biology and chemistry as nano-bio-technology may seem like simply a craven attempt to garner attention for traditional science – but the same distinction applies here as above: If these tiny biological motors and machines are being harnessed and manipulated to do hitherto unknown or inconceivable things – if DNA is being used as a pair of tweezers, or the molecule 'prestin' is used to rotate a tiny gear – then the crucial component of the definition is not just the study, but the exploitation of molecular motors, molecules and the machines of life.

Finally, there is yet another definition of nanotechnology, namely that of the National Science Foundation's Nano-Bio-Info-Cogno (NBIC) Convergence (Roco and Bainbridge 2003). This definition proposes that nanotechnology represents a new kind of science that emerges at the nexus of biology, information technology and cognitive science at the nanoscale. This definition is in some ways the most radical, in that it is meant to capture the way nanotechnology will be used to 'improve human performance'. While it is true that many of the issues that are raised by studying and exploiting objects at the nanoscale require expertise in several fields, there are as yet very few scientists or laboratories capable of working at this 'convergence'.

Different groups define nanotechnology differently, depending on what they hope it will achieve – whether that relates to the body and human medicine, the environment, new materials or new biological objects. These definitions also vary according to the interests of nations and social actors interested in nanotechnology.

[3] The exception to this is the creation of quantum and molecular computers, but these machines do not manufacture anything, nor are they yet considered reliable or robust enough to be of much practical use. They demonstrate the possibility of using nanoscale objects as semiconductors and transistors for calculation and memory storage.

Because there is still a gulf between the *proposed outcomes* and the *actual research* that has been conducted, the definition is hotly contested – and is an important aspect of the ethical and political aspects of nanotechnology.

History

In the absence of such a definition, nanotechnology will be defined by the corporations and nations that pursue their own interests most vigorously. At this early stage, citizens of every nation have a stake in understanding what nanotechnology is becoming and could be.

As with the definitions of nanotechnology, its history can be – and is – told in multiple ways, with various points of origin and important milestones.

Perhaps the most commonly discussed origin point is a lecture by the famous physicist Richard Feynman called 'There's Plenty of Room at the Bottom (Feynman 1960)[4] in which Feynman speculates about all the possible ways in which miniaturization, computer and information technologies and physics can be used to explore the sub-microscopic world. With bravado that was typical of Feynman, he laid out a series of things he thought should be easy to accomplish in the near future. Forty years later, many engineers and scientists are still excited by these predictions – but none of them have yet come true. A related work that is occasionally referenced from the same period is that of John von Neumann's General and Logical Theory of Automata which similarly combined his knowledge of physics, engineering and information technology to propose the creation of autonomous machines – though in his case, not at the nanoscale (von Neumann 1966).

Neither Feynman nor von Neumann discussed these possibilities in terms of the word 'nanotechnology' however. The term was popularized in a book written by K. Eric Drexler – an inveterate nanotechnology visionary – in a book of 'future history' called *Engines of Creation* (Drexler 1986). Drexler used the word to describe his vision of a world where molecular manufacturing would allow people to manufacture *anything* they might need – from automobiles to pieces of beef – simply by feeding waste material into a box that would use nanoscale assemblers to re-configure it into the necessary form. Drexler's book is more often remembered today for its dystopian, rather that its utopian promise: Drexler warned that as this technology developed it would be necessary to guard against the accidental release of autonomous self-replicating nano-machines that could – if they spun out of control and started to consume or transform the natural and man-made world – turn

[4] See also Jean-Pierre Dupuy's contribution to (European Commission Community Health and Consumer Protection 2004).

the planet into a mass of uninhabitable 'gray goo'. Drexler has played an important role in generating both excitement and fear about nanotechnology over the years. He has founded an institute devoted to studying the potential scientific and social impacts of nanotechnology (the Foresight Institute) and written a book of theoretical engineering which claims to demonstrate the feasibility of molecular manufacturing (Drexler 1992). At this point in time, however, there are no convincing experimental or engineering demonstrations of even very simple molecular control, and as a result, there has been a significant backlash against the idea of nanotechnology as molecular manufacturing, driven in part by the appearance of popular fiction scenarios (such as *Prey* by Michael Crichton) that many scientists and engineers consider to be scientifically and socially infeasible. One of the other prominent scientists involved in the promotion of nanotechnology, Rice University's Richard Smalley, has accused Drexler of 'scaring our children' and promulgating a vision of the future based on poor scientific reasoning.[5] The marginalization and ostracism by the scientific community of the concept of molecular manufacturing has recently led Drexler to regret coining the term 'gray goo'.

Over the last 40 years, however, a significant number of real scientific and engineering breakthroughs have transformed older scientific questions into new nanotechnological ones. At the top of the list is the invention of the scanning tunneling and atomic force microscopes, which have allowed scientists to visualize, investigate, and ultimately probe and experiment with things at a scale never before possible. Between the late 1970s and 1983, Gerd Binnig and Heinrich Rohrer laid the groundwork for modern Scanning Tunneling Microscopes (STM) for which they shared the 1986 Nobel Prize with Ernst Ruska, who designed the first electron microscope. STM microscopes rely on the weird quantum property of 'quantum tunneling' to accurately probe and measure the configuration of electrons circling individual atoms. From this information, a computer can generate a visual representation of the atom.

Just a few years later, Gerd Binnig was also involved in the invention of the atomic force microscope (AFM) at IBM in Zürich, Switzerland. The AFM has been commercially available to scientists only since about 1990 and works on a principle very similar to a classic gramophone, in which a cantilever with a fine point is dragged over a surface. Using a laser, the tiny nanoscale variations of the tip of the head as it bumps up and down over the atoms of a sample can be recorded and transformed into a digital image, as in the case of the STM.

These tools allowed engineers and scientists to create stunning images that display the configuration of atoms and molecules. However, it is not just the ability to see atoms that makes these tools so fascinating, but the ability to actually manipulate, move or arrange atoms into artificial configurations. One of the leaders in the

[5] A public and slightly acrimonious debate was carried out in (Chemical and Engineering News 2003).

use of such tools is Donald Eigler of IBM Research, Almaden in California. In 1989, Eigler demonstrated such a use of the STM by arranging several Xenon atoms in a vacuum to spell out "IBM." Later, Eigler and his students were able to use the STM to create a wide variety of images based on the manipulations of atoms and molecules, such as the 'quantum corral' which visually demonstrates the wave-particle duality of electrons at the atomic scale, and the creation of logic gates (gates like those use in computers to determine the logical function AND, OR and NOT) using carbon monoxide atom arranged precisely to 'fall' like dominoes, depending on the input to the gate (Eigler and Schweizer 1990).

Buckyballs are named after the famous architect and futurist Buckminster Fuller, whose geodesic domes share the characteristic soccer ball shape of the molecule. They are, like diamond and graphite, composed entirely of carbon, but their shape and molecular structure give them special properties. In a 1984 experiment, Professors Richard Smalley and Robert Curl, graduate students Jim Heath and Sean O'Brien of Rice University (USA), and Harold Kroto of the University of Sussex (UK), were the first to identify and characterize 'buckminsterfullerenes'. Buckyballs were first synthesized using a complicated device designed for vaporizing graphite and blowing through a tiny aperture, and characterized by Curl as having 60 carbon atoms arranged in alternating pentagons and hexagons. At the time, they did not call this work nanotechnology, but simply chemistry. The ability to synthesize these molecules soon drew attention to them as having significant and new properties that might be exploited. Smalley, Curl and Kroto were awarded the 1996 Nobel Prize for their work.

In 1991, S. Iijima, then working at NEC in Japan, discovered another variation on buckyballs, called nanotubes. Nanotubes come in single-and multi-walled forms, and the single-walled form is essentially a long cylinder of carbon with half of a buckyball on either end. Single-walled nanotubes (SWNTs) are more versatile than the buckyball form, and are estimated by some to be the strongest and most flexible material yet discovered. In addition, they have very high electrical conductivity (rivaling copper and gold, but in a much smaller wire), as well as high thermal conductivity. These properties have led to a proliferation of predictions, from the mundane (a new nanoscale wire for conducting energy and information) to the fantastic (an 'elevator to space' – a long thin 'cable' made of nanotubes that would lift a spaceship into space, rather than requiring a rocket to propel it).

One of the less glamorous disciplines to jump quickly into nanotechnology research has been the polymer sciences, which for over 60 years have been experimenting with processes for making new materials, both natural and synthetic. It has been suggested that carbon nanotubes in particular will make exceptional materials for things like car bumpers or jet fighter wings, but the widespread experimentation on, distribution or exposure of these materials is currently limited by the difficulty of producing a large quantity of them. One of the early areas of commercial investment (and of potential regulatory and environmental concern) is the large scale production of SWNTs for use in experiments in universities and corporate labs. Mitsubishi Japan, for instance, has begun a significant effort to create larger volumes of fullerenes (Tremblay 2003).

The excitement about buckyballs and nanotubes has come primarily from chemists, chemical engineers and physicists. But electrical engineers and, in particular, engineers who create and refine semi-conductors and micro-electronics have been quickly approaching the nanoscale in their drive to miniaturize electronic devices and components. The humble transistor, which has been around since the late 1940s, has reached proportions so small that engineers are now facing the 'novel properties' that nanoscale materials begin to express. As these new properties appear, new kinds and configurations of materials become essential for smaller, faster, lower power devices. Perhaps the smallest such device that has been developed so far is the 'quantum dot' which is designed to confine a single electric charge that might be used as the basis for a computer. Quantum dots have been the subject of investigation and experiment since the early 1990s, but are not yet used in commercial computing devices. Quantum dots also have unique photophysical properties and are being investigated for use in biomedical imaging.

In addition to chemistry and electrical engineering, the fields of molecular biology and genetic engineering have become expert over the last 10–15 years at manipulating the basic components of cellular life at the molecular nanoscale. Techniques and tools that are available to biochemists and molecular biologists, like recombinant DNA and polymerase chain reaction (PCR) have vastly accelerated the kinds of manipulations and experiments that can be done on DNA, RNA and proteins. As mentioned earlier, some of this work is now being redefined as 'nanotechnology' because it is aimed at exploiting the properties of living organisms or molecules involved in organic life. Since about 2000, nano-bio-technology has begun to appear as a research field of its own.

It is only since about 1996 that the US government (and subsequently the Japanese and EU governments) began to seriously consider funding research under the label of nanotechnology. In 2001, the US government launched the National Nanotechnology Initiative – an interagency initiative designed to coordinate research amongst the various government agencies seeking to fund research and development in nanotechnology. The US National Science Foundation has been a leader in funding nanotechnology, and in particular through the creation of regional centers, focused on specific issues in nanotechnology. These 14 centers (as of 2005) are themselves charged with dispersing the funds to researchers, and coordinating projects and goals in their specific areas.

Following this initial surge of research money in the US, several other nations have begun funding nanotechnology-related research in earnest. Japan's Ministry of Education, Culture, Sports, Science and Technology has contributed some $250 million to research in various areas of nanotechnology. The UK Royal Society reports that the 2005 level of EU research is about €1 billion, and that the United Kingdom has spent upwards of roughly £45 million annually. In addition, China, the Islamic Republic of Iran, Brazil and Israel have all made clear that national research priorities in science and technology include research into nanotechnology.

Nanotechnology Research Now

The array of nanotechnology research projects currently underway today is enormous. It is safe to say that, with the recent influx of funding and attention, there is nary a field of science that has not gotten into the game. Core fields like physics, chemistry, electrical engineering, molecular biology and computer science are the most well positioned to conduct research – but others like materials science, chemical engineering, environmental engineering, bio-engineering, medical research, optics and photonics all possess knowledge that contributes to the growth of nanotechnology – and especially to its practical realization. Even the social sciences and humanities have seen a surge of proposals and calls for research, largely in the areas of ethics and policy analysis.

Most current research in nanotechnology is not motivated by immediate practical applications – a great deal of it is exploratory and experimental, or devoted to the kind of characterization and careful investigation that forms the core of any science. While there is no shortage of proposals for possible future uses, nanotechnology as it stands in 2006 is in a state of transition – old disciplines are recognizing that there are a variety of new problems that overlap with neighboring disciplines, and new tools and techniques are producing a generation of scientists who can research and understand phenomena their mentors could not.

To take just one example of such work, consider the attempt to use nanotechnology in cancer therapy. Researchers at various universities and medical centers around the world make use of 'gold nanoshells' and normal visible light in order to kill cancer cells. 'Nanoshells' are tiny beads of glass coated with gold in different thicknesses. The optical absorption of gold (the property that causes it to look yellow in daylight) can be varied with the thickness of this shell, so that only certain wavelengths of light are absorbed and certain wavelengths reflected. Researchers then attach antibodies to these shells that are specific to cancer cells, so that when the shells are injected into a mouse body, they attach themselves only to the cancer cells, and not the normal cells. When the specific wavelength of light is then shone through the body (ultraviolet light in the form of a low power laser), this causes the gold nanoshells – and only the gold nanoshells – to heat up to a temperature at which they kill the surrounding cancer cells. Despite such promising and innovative uses, the drive for university scientists and engineers to find practical applications and to make partnerships and collaborations with industry and government remains extremely strong. And it necessarily gives current nanotechnology research a business and consumer market orientation.

While only a handful of products have been developed to date, it is nonetheless important to understand the significance of this 'rush to commercialization'. For if the use of nanomaterials and nanoscale production processes does reach commercial maturity quickly, it can potentially generate new ethical and political issues as well as activate older ones. Many corporations are concerned about the public reception of new products and the public understanding and perception of nanotechnology. Their reasons are self-interested of course – they hope to build successful

products – but they are also based on the recent experience of the backlash against genetically modified foods and organisms (GM/GMO). Because of the status of science today – in the wake of nuclear power, Chernobyl and Bhopal, the GM foods debate, BSE in the UK and EU, and the tremendous rise in tort litigation in the US – nanotechnologists are hyper-aware of the need to study both potential uses and potential harms well in advance of their commercialization. This recognition and precautionary direction to corporate research is novel.

The international implications of this are clear – as in the case of GM foods, lack of knowledge about the health and safety effects of nanotechnology can result in restrictions, outright bans, and complex international conflict over production and transport of such materials. In addition to calls from non-governmental, civil society and international observers for more research, many corporations see a need for increased research in the areas of safety, toxicity, health and environmental effects and, to some extent, ethical and political issues related to the production of nanotechnology. The adoption of voluntary standards, the creation of international standards, and the creation of international best practices for production and engineering of nanoscale materials are all the subject of corporate concern – but the institutional and organizational framework for addressing these concerns across competing interests is not yet well developed. This is a role that UNESCO and UNESCO's Member States can clearly play – facilitating the development of both required and voluntary standards for commercial production, and encouraging the promulgation of ethical standards for commercial as well as traditional university research practices.

Ethical, Legal and Political Implications of Nanotechnology

Just as nanotechnology covers a broad range of scientific and technical fields, the ethical, political and legal implications will as well. There are a number of areas where nanotech will intersect with existing policy issues or old ethical dilemmas – and a few that may be new.

International Aspects of Nanotechnology

Research into nanotechnology is currently taking place in both developed and developing nations around the world, but the level of financing and investment, access to scientific and technical infrastructure and materials, and cooperation across sectors varies a great deal. As with previous advances in science and technology, developing nations risk being distanced by a 'knowledge divide' if they cannot find ways to participate on equal footing with other countries. But there is increasing evidence that the nature of this divide will look different today than it might have 15 years ago. Researchers are much more likely to have ready access to publications

via the Internet, and with the changing economic fortunes of China, Brazil and India, researchers in the US and the EU are far more likely to travel to, interact with and form collaborations with scientists in these nations. As a result, nanotechnology stands to be a much more international scientific project than, for instance, research into biotechnology was in the 1980s and 1990s. Different national interests may clash as a result, but it is clear that the nature of the 'knowledge divide' will look different.

It is quite possible that inequalities of access to research may be greater within nations, than between them. The communication between experts and elites of different countries at the highest levels of research and development has become easier and more common – but the communication between the experts and elites of a nation and the poorer and less well educated has grown less common and incentives to do so have dwindled. There is therefore a need for scientists and experts in the international community to find ways of mending the 'knowledge gap' within their own countries as well as between nations.

Related to the question of a knowledge gap is the degree to which the kinds and direction of nanotechnology research will benefit all nations equally. As Salamanca-Buentello et al. (2005) outlines, there are a number of areas that could benefit the poorest nations far more than any commercial development would – areas such as energy storage and conversion, water treatment, and health and disease diagnosis and treatment. The article goes so far as to suggest that the top ten applications of nanotechnology for developing nations could also address the UN's 'Millennium Development Goals'.

However, by what mechanisms should such research be promoted? How can scientists in universities and corporations be given incentives (above and beyond mere commercial viability) to pursue these goals? International cooperation can help to guide the work of university and corporate scientists towards research in the areas of greatest need and impact. Many of these areas have strong commercial and development possibilities, but not without the commitment of nations and private actors, first, to encourage such research and, second, to make use of it in the various infrastructures of developing nations.

Toxicity and Environmental Implications of Nanotechnology

The most pressing near-term issues related to nanotechnology are toxicity and exposure to humans and the environment. This is more properly a safety and health issue – not an ethical or political issue – but because of nanotechnology's perceived novelty, there are heightened concerns that nanotechnology might pose new forms of hazard or exposure risks, and therefore new questions about how to deal with them. Most corporations and many researchers address this area through 'risk management' – a highly technical form of assessment that is necessarily narrow in scope. While this approach has the benefit of accurately stating the risks (and occasionally the benefits) of newly created substances, materials and devices, it does not

address any wider issues of the ethical or political meaning of this risk – such as who will bear it, how it will be distributed internationally, and who will be given the power to make decisions based on these analyses.

To date, there have been a handful of studies about these risks. Several recent reports (listed at the end of this document) go into greater detail on the current state of research. There are two concerns: the hazardousness of nanoparticles and the exposure risk. The first concerns the biological and chemical effects of nanoparticles on human bodies or natural ecosystems; the second concerns the issue of leakage, spillage, circulation, and concentration of nanoparticles that would cause a hazard to bodies or ecosystems.

Defined as 'nanoparticles' there are only a couple of novel substances that might conceivably be in wide circulation in the near future. The most obvious are carbon-based nanostructures such as buckyballs, single-walled and multi-walled carbon nanotubes. Other substances such as titanium dioxide, zinc oxide, or gold nanoparticles are also likely to be (or already are) in use in diverse settings. It is best to distinguish between three types of nanoparticles: 'engineered' nanoparticles (such as buckyballs and gold nanoshells), 'incidental' nanoparticles (such as those found in welding fumes, cooking and diesel exhaust), and 'naturally occurring' nanoparticles (salt spray from the ocean, or forest-fire combustion). Only 'engineered' nanoparticles constitute an entirely new class of particles and, to date, buckyballs are the only engineered nanoparticles that have been seriously studied, whereas 'incidental' nanoparticles (often referred to as 'ultrafine particulate matter') such as auto exhaust have clearly been more extensively studied. *The handful of studies on the toxicity of fullerenes so far suggest that they are indeed hazardous – but also that they can be engineered to be less so,* in particular by conjugating other chemicals to the surface of buckyballs, thus changing their chemical properties.[6] Such findings suggest that the proper question for regulators and policy makers to ask of nanotechnology is not 'Is it safe?' but 'How can we make nanotechnology safer?' International cooperation and coordination can play a role in setting minimum ethical norms for the creation and testing of such substances: Scientists should be expected not only to announce the discovery or creation of such nanoparticles, but the requirements necessary to make them safe, or safer than other materials that achieve the same purposes.

Environmental and ecological impacts can also be extremely complicated to assess. Because of the natural complexity of ecological cycles, and the impossibility of directly experimenting with the natural environment, knowledge about the hazard and exposure risks of nanoparticles to an ecology is slim. As in many other cases, however, the most pressing issue may not be determining the exact oxicity of nanoparticles, but creating new and enforcing old regulations on the industries who

[6] Several studies have been done on the toxicity of fullerenes, including one that has demonstrated oxidative damage to the brain in the largemouth bass (Oberdörster 2004) and one that measures the cytotoxicity of buckyballs in rats (Colvin 2003).

create and process these new materials. In many countries oversight of some of the most clearly hazardous chemicals, such as arsenic and mercury, is weak – and if nanoparticles are shown to be less toxic than such substances, the challenge to regulators will be significant. Corporations who practice green chemistry and who develop processes for recycling and reusing waste products will naturally create fewer exposure risks than those that do not; but creating incentives for practices that are more costly is a political problem much older than nanotechnology.

Both the EU and the US possess established regulatory systems through which hazard and exposure risks of nanotechnology might be assessed. The European Commission has already published a preliminary report on the potential process by which these risks can be dealt with. In addition, the new Registration, Evaluation and Authorisation of Chemicals (REACH) regulation in the EU will have far-reaching effects on the chemical industry with unknown consequences for manufacturers of nanoparticles (http://europa.eu.int/comm/enterprise/reach/overview.htm).

The US Environmental Protection Agency (US EPA), the Food and Drug Administration, the Occupational Safety and Health Administration, and the National Institute of Occupational Safety and Health have also begun to inquire into the need to change existing processes to accommodate nanotechnology. In particular, the US EPA has already evaluated its first 'pre-manufacturing notice' from a company seeking regulatory approval for carbon nanotubes. In addition to the regulatory mandates of these agencies, several are also funding intramural and/or extramural research projects targeted at understanding hazard and exposure risks posed by engineered nanomaterials. The UK Royal Society has recently published a report as well, and recommends a 2–5 year window within which corporations and universities are urged to investigate and understand the toxicity and design processes for managing it, before the government should undertake any new regulation in nanotechnology.

An issue that is clearly related to toxicity is that of consumer awareness, labeling and the promotion of standards and regulation of nanoparticles. One of the core questions concerning the production of any kind of scientific or technical object today is the degree of trust and reliability that consumers and citizens put in the information they are given. Genetically modified foods have been an obvious example, and a frightening one, for most corporations interested in investing in nanotechnology. The decision by some corporations to create and distribute GM foods without either seeking public approval or openly labeling the foods as such created a substantial backlash, and opened up discussions about the labeling of food products and the reliability of government and corporate oversight and assurance of the safety of GM foods.

Nanotechnology faces similar issues, especially if scenarios like the 'gray goo' story are used for emotional or persuasive purposes. Even in the absence of such alarmism, however, the normal course of health and safety reporting produces so many conflicting and often incomprehensible warnings and approvals that it will be difficult to effectively communicate the precise risks of nanoparticles, whatever they are. To further complicate matters, there is as yet no consensus on whether

nanoparticles or nanomaterials should be treated as something entirely new, or as a subset of existing materials, for the purposes of regulation or labeling. The standards bodies that oversee materials, from national standards organizations to the International Organization for Standardization (ISO), will be faced with the challenge of determining what, if anything, makes nanoparticles novel substances distinct from larger structures of the same chemical composition. Only then will it be easier for regulators to know if they should refine existing systems of regulation, or create new ones.

If it is true that familiar materials behave differently in the nanoscale size range, it is possible that existing regimes for assessing risk will not capture these potentially new dangers. The recommendations of the European experts address some of these issues by calling for new standards, tools, nomenclatures, and systems of measurement specific to the nanoscale and the new kinds of nanoparticles. International organizations can play a role in both facilitating such developments and encouraging their widespread use and adoption not only in the US and Europe, but more importantly in developing nations like China, India, Brazil and the Islamic Republic of Iran, as they begin to develop both nanotechnology research programs and forms of regulation.

There is a political and cultural component to this problem – that is, the attitudes that politicians and citizens have towards risk and regulation. A spectrum of attitudes might be taken on these issues, with the more precautionary style of EU regulation on the left, and the market-and corporation-friendly style of the US on the right. The precautionary style takes the lack of data on the safety or efficacy of nanotechnology to be a caution against marketing products, while the market-friendly style takes the lack of data to mean no additional regulations are necessary before going to market. What makes this divergence of styles particularly alarming is that globalization has rendered the efficacy of national regulation and safety assurance both more political and more difficult.

Beyond Risk Assessment

Issues of safety, toxicity and environmental impact are clearly important issues, about which more research and more international oversight is needed. They are, however, relatively narrow technical problems that are best dealt with through the use of sophisticated techniques of risk analysis, scientific experimentation, and the legal re-evaluation of existing regulatory systems.

There are, however, a number of other issues that cannot be strictly accounted for through the technical mindset of risk analysis. These broader ethical and political issues include those of intellectual property, secrecy and legitimacy of scientific results, the potential for a knowledge divide based both on funding and on the legal implications of intellectual property. At a very broad level, the question concerns whether nanotechnology as a science will look like, and proceed like, the traditional

science of the past, or whether it will be transformed by new political, social and legal pressures into something that is no longer so familiar.

Recent research in biotechnology and genetically modified foods represents a certain 'loss of innocence' with respect to the purity and disinterestedness of science. The overt regulation and social direction of basic scientific research no longer seems to be taboo for many nations – and the case of nanotechnology may represent one of the first where scientists themselves are no longer capable of autonomously directing scientific research due to the growth of external pressures, not only commercial, but from civil society and State actors as well. The outcome of such new interaction is far from clear.

Intellectual Property, Secrecy and the Legitimacy of Scientific Results

One of the most troubling issues that nanotechnology raises is that concerning the very structure of science itself, and is not restricted only to nanotechnology. The danger concerns the legitimacy of scientific results, as well as the public trust in those results and the use and abuse of them by governments, corporations or non-profit entities. Science in the twentieth century has increasingly come under new forms of scrutiny and new pressures that guide the creation, publication and sharing of scientific information. One of these is clearly the expanding system of intellectual property rights and rewards; another is the increasing public scrutiny of scientific research, and the demands that it be made accountable to the public; a third is the use and abuse of scientific information by governments in the context of increased secrecy and novel antiterrorism efforts. Taken together, these pressures can have negative effects on the kind and quality of science performed, and can introduce incentives that are contrary to the values of objectivity and disinterestedness.

Furthermore, in large part due to the ever-increasing globalization of scientific research and the expansion of networks that contribute to it and feed off it, the question of who will benefit or who will suffer from these potential threats is newly unclear. Good science requires strong infrastructures for managing it; and the lack of these infrastructures in developing countries could leave them without the best and most reliable scientific knowledge and practices, either because they cannot afford to pay for premium scientific information or because they cannot access scientific data and material that is digitally archived. Both the digital divide and issues of the political control of networks by particular nations could have an impact on what forms of knowledge about nanotechnology will circulate globally.

As in the case of hazard and exposure risks, the biggest problem surrounding our knowledge of the risks and benefits of intellectual property is that we don't have much. There is almost no evidence available that proves the (economic) effectiveness of increased patent or copyright protection, nor any that proves decreased

protection is beneficial. One can, however, look to other areas of science and intellectual property, for guidance with respect to nanotechnology.

Three kinds of controversies have bedeviled the use of intellectual property in science and in science-based commerce recently: an over-liberal granting of patents, which can lead to increased litigation costs and extremely complex systems of cross-licensing and patent trading amongst corporations and governments; new database laws, which effectively give single corporations rights over facts – something the intellectual property systems of the world have long been explicitly opposed to, and which can curtail even the most innocuous basic research by introducing prohibitive costs; and the rise of so-called 'business-method' patents in information technology.

Business-method patents are a good example of overzealous expansionism in intellectual property. Business-method patents essentially give broad rights to corporations who perform established processes using computer technology (two famous examples are patents on online auctions and patents on online shopping). Such a patent land-grab may also face nanotechnology precisely because it is defined as 'exploiting novel properties' of well known materials.

The danger created by excessive patenting in nanotechnology is that of the 'patent thicket' or the 'tragedy of the anti-commons'. Patents on basic nanoparticles and processes using nanoparticles could end up being so finely and acutely propertized that the ability to create a novel material – for instance a water filtration system that uses carbon nanotubes to produce clean drinking water – could face nearly unnavigable complexity in terms of competing and overlapping patent claims. It introduces a need for legal expertise even before research can begin, and places not only commercial interests at risk, but those of universities and academic centers as well. Rather than producing incentives for more rewards, it introduces anxiety concerning the legality and liability of using what might be perceived as products of nature, or natural processes. The chilling effect could drive all but the richest away from some kinds of research.

Such chilling effects are all the more pronounced when what is protected is scientific information – not necessarily processes or devices – such as the use of gene sequences, information contained in a database or other kinds of essential but intangible inputs to the scientific process. In this case, even the use of information about nanoscale products could require licensing fees and contracts. The fact that developing nations may have, or design, their own intellectual property laws within country does not exclude them from such problems. International organizations like the World Intellectual Property Organization, the World Trade Organization, and industry groups whose sole commercial revenue comes from exploiting intellectual property (such as the motion picture and recording industries) have fought hard over the last 10 years to harmonize and strengthen intellectual property laws in nearly every corner of the globe.

The solution to this problem is to encourage – and amongst national governments, to require – open access to publicly funded research results and materials. The current trend towards ever increasing protection of intellectual property will at best introduce significant transaction costs because of the complexity it introduces,

and at worst actually stifle the ability of scientists to independently investigate and verify scientific questions. Incentives are easy to create, but intellectual property deadlocks are very difficult to untangle. The patent system is a poor substitute for peer review and replication, and yet the incentives force scientists in the direction of novel and patentable research rather than reliably reproducible results, or clear and broad experimental evidence which may have little practical applications. There is a great need for widespread dissemination of open access repositories containing publicly funded research – not only in electronic form, but in print form in countries where access to the Internet may be intermittent or unreliable. There is also a great need for the dissemination of new norms for publicly funded scientists – norms that encourage scientists to make their work public first, and seek intellectual property protection second. Only by encouraging scientists to work in the global public interest can a system of open, reliable, and replicable science be maintained.

A second pressure on science comes from increasing public scrutiny on the research and results of science. A number of high-profile events –from the Asilomar controversy over the invention of recombinant DNA, through the disasters at Chernobyl and Bhopal, and the crisis over BSE to the public controversy in Europe of GM foods have made both governments and publics wary of trusting the statements of scientists. However, by the same token, scientific research has become increasingly responsive to social and public demands – two good examples are the pressure that AIDS activists have exerted on medical science to increase research on that disease, and the success of environmentalists in creating and sustaining wildlife habitats alongside fishing or agricultural needs. These new modes of interaction between scientists and the public are often mediated by the interests of large corporations. In the case of nanotechnology, in particular, there is a greater sense than ever before that the public need be involved earlier and more often, in order to avoid the kind of backlash that accompanied the introduction of GM foods.

If nanotechnology research is to be socially directed towards solving the problems that are most urgent for the largest number of people, then there is a need for people and institutions who can connect scientists, funders and entrepreneurs in search of problems with local experts, and experts in areas other than nanotechnology (for instance, in environmental remediation, or experts in the areas of water policy and/or energy policy in developing nations).

A third pressure is much less certain: that from secrecy and the threat of terrorism. Two kinds of concerns are at issue here. The first is the concern that nanotechnology research, even basic research, may be used to contribute to the creation of new and nefarious kinds of weapons by terrorists, or that such weapons created by national governments may end up in the hands of terrorists. This concern drives the pressure to classify or make secret much research in nanotechnology (as well as in biotechnology or chemistry). The second concern is the opposite: that national governments are abusing the threat of terrorism to classify research, or more likely, to dismiss scientific results it finds out of sync with its political goals. The issue

here concerns not so much the particular goals of national governments as the legitimacy of scientific results along with the effective separation of science and government interests. The less separate the two are the less likely even top-notch science will appear legitimate and disinterested to national or international publics. Again, international organizations can play a role here in helping define new norms of scientific conduct –norms that balance the manifest need for openness in science with the political pressures to keep potentially dangerous information from spreading.

Red Herrings: Ethical Issues That Aren't

Two recent discussions surrounding nanotechnology have received the lion's share of attention when it comes to ethical or social implications and risks: the so-called gray-goo scenario, and the concerns about post-humanism. The gray goo scenario is based on the fear that nano-technological devices will either be programmed to self-replicate, or that they will evolve into devices capable of self-replicating, and that should they proceed to do so, they may destroy the natural world. Currently there are no nanotechnological objects capable of self-replication (unless one includes objects such as DNA and viruses under the definition of nanotechnology, which muddies the discussion further). Yet philosophers, ethicists and many scientists frequently speak as if such objects exist now, or will in the very near future. Often such claims depend on some form of technological determinism in which advocates or opponents presume that technology develops autonomously, and is incapable of human, social, or governmental control. In the absence of experimental science, the debate is quickly polarized: one must be either for or against nanotechnology.

Gray goo is a red-herring – not because the threat might not someday exist, but because it forces the discussion to revolve around the technical risks and possibilities of future research – rather than the real system for research oversight and regulation that exists today. The solutions for guarding against gray goo are as hypothetical as the scenario itself, and this distracts attention away from the current practices of science and technology and the need for careful oversight and deliberation that attends to current problems and practices, not imagined future scenarios.

A similar trap is set by discussions of post-humanism. In this debate, a variety of proposed uses for nanotechnology to enhance, repair, replace, or augment human characteristics are introduced. Such enhancements run the gamut from nano-scale sensors that might be added to the retina to improve sight to cochlear implants that improve hearing to performance enhancement technologies for athletes to new forms of plastic surgery.

Discussions of post-humanism fall into the opposite trap: they assume that the ethical dilemmas that nanotechnology will create await us in the future, and that we must prepare for them – but they are based on dilemmas that face us today, such as

performance enhancing drugs in sports, or genetic screening for human characteristics, or privacy concerns over the handling of information technologies that we carry on our bodies. If anything, Nanotechnology should provide an occasion to renew our focus on these concerns and try to achieve real answers to both present and future issues of this sort. UNESCO has already published analyses that would apply (for example, the ethics of human cloning) with only minor modification to issues of human-enhancement through nanotechnology. Debates about post-humanism are a smokescreen – an excuse to imagine that ethical issues will arise in the future, rather than facing us already today.

If policy makers, elected and appointed officials, non-governmental and advocacy organizations can be convinced to look beyond these two red herrings, a number of other pressing issues present themselves as in need of serious discussion and creative forms of policy and regulatory oversight. These include toxicity and environmental hazard and exposure risks; labeling, consumer awareness and product regulation; and intellectual property, secrecy and the reliability and legitimacy of international scientific research; the potential for international scientific and technical divides, and most importantly, the promotion of uses for nanotechnology that help solve the most pressing needs for the greatest number of people.

Many of these issues overlap with other existing ethical and political discussions – they should be made to dovetail with them, rather than starting from scratch. For example, intellectual property issues are already widely discussed in the contexts of biotechnology and information technology; likewise, medical ethics discussions already concern issues of enhancement, medical risk, and the use of human subjects. Although nanotechnology is new and exciting, the ethical and political issues it raises are not radically different than the ones we face already – but it may provide a chance to address them with more success than ever before.

Conclusion

Nanotechnology is at a crossroads. The emergence of consensus concerning the direction, safety, desirability and funding of nanotech will depend on how it is defined, and on who will be included as a result. It is safe to say that as our world comes to depend more and more on science and technology, and as public awareness of the dangers and possibilities continues to increase, the involvement of all manner of participants will move farther upstream – into the heart of scientific work itself.

Furthermore, the broad attention and enthusiastic concern of a variety of groups – from governments to non-profits to corporations to activist groups – will require a concerted coordination as well. It is clear that there are already enough people interested in doing something that there the need for the creation of new institutes, agencies or isolated groups is diminishing, as the need for the strengthening of existing ones grows.

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Part III
Case Studies

Chapter 15
Environment: Marine Mammal Protection

Donald J. Orth

Abstract This chapter provides introduction to approaches to marine mammal protection, a brief history of global whaling, current ethical issues surrounding whaling, and a primer on evaluating moral arguments.

Keywords Whales • Whaling • Ethical reasoning • International Whaling Commission

Relevant Facts About Marine Mammals

Biologically, marine mammals are those members of the Class Mammalia that are morphologically adapted to life in the ocean.[1] They include three taxonomic Orders, the Cetacea (whales and porpoises), Pinnipedia (seals, walruses and sea lions), and Sirenia (manatees and dugongs). Other groups (sea otters and polar bears) are considered marine mammals in US legislation. Many coastal cultures hunted whales and thrived on the meat, skins, and other products of whales, seals, and polar bears. Threats to these creatures have been well publicized. Some whales were hunted to near-extinction, porpoises were killed during purse netting for Pacific tuna, contaminated sea lions aborted young, Northern fur seals were overharvested, and manatees were injured from motorboat collisions.

The Marine Mammal Protection Act, passed by the U.S. in 1972, is the most comprehensive protective mechanism for marine mammals. It established a moratorium on hunting, capturing, or killing marine mammals in U.S. waters and by

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U.S. citizens on the high seas and on importing marine mammals and marine mammal products into the U.S. The MMPA also directs that commercial fishing operations reduce incidental kill or serious injury to marine mammals. Taking of marine mammals is permitted only after scientists determine that a population is at or above the Optimum Sustainable Population (OSP) level. Additionally, the U.S. Endangered Species Act (1973) protects 16 marine mammals (as of Aug. 1996) threatened with extinction. Internationally, 35 marine mammals receive indirect protection under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which regulates trade in threatened plants and animals. The International Whaling Commission (IWC), formed to serve the whaling industry concerns, now primarily addresses whale concerns.

Cetacean Biology and Classification

There are over 75 species of whales and dolphins, arranged in nine families: Balaenidae (right whales), Balaenopteridae (rorquals, which include Brydes, blue, fin, minke, and sei whales), Eschrichtiidae (gray whale), Physeteridae (sperm whales), Monodontidae (Narwhal and Beluga), Ziphiidae (beaked whales), Delphinidae (oceanic dolphins), Phocoenidae (true porpoises), and Platanistidae (river dolphins) (Blix et al. 1995). The first three families are baleen whales, collectively known as Mysticeti ("mustache whales"), which feed by trappping prey in keratinous plates (baleen) that hang from the roof of their mouth. Baleen whales are usually found alone or in small groups during non-breeding times. The other families are toothed whales, or Odontoceti, which are predators on squid and fish. The mysticetes have paired blowholes while the odontocetes have a single orifice. The toothed whales are usually highly social and capable of rapid evasive action.

Several traits of whales make them particularly vulnerable to harvest. The population rate of increase is low (from 0.03% to 0.08% per year) due to delayed sexual maturity, long gestation periods (16 months in some whale species), a single offspring at each birth, and longevity up to 90 years or more (i.e., K-selected). Their large size, air breathing, and social behavior have all further contributed to vulnerability.

Much has been written about intelligence of cetaceans. The widely-held belief that a large brain implies a high level of intelligence has led to claims about intelligence of cetaceans. However, there are no objective definitions of what constitutes "intelligence" and how to measure intelligence in animals (even human animals); whether cetaceans are more intelligent than pigs, for example, cannot be definitively answered. The neocortex (brain structure associated with advanced mental processes) in cetaceans is extensive, but that fact leaves many questions of cetacean intelligence unanswered. Cetaceans are sentient beings, capable of experiencing pleasure and pain.

Products

Oil was historically the most economically important product from whales. Oil of baleen whales is similar to that found in plants and other animals, i.e., triglycerides, consisting of one molecule of glycerine with three molecules of fatty acids. In the past, these oils were used for lighting, heating, foodstuffs, margarine, soaps, and lubricants. Oil of toothed whales is a wax used for candles, leather dressing soaps, and lubricants. One exceptionally valuable byproduct from sperm whales was ambergris, a gray, waxy substance formed as an impaction in whale intestines. Ambergris was incorporated in cosmetics, love potions, headache remedies, and perfume. Whale bone, or the keratin baleen plates, were used to make corsets. Bones were used to make furniture (vertebrae), fence pickets (ribs), and housing beams. Whale meat is still popular in Japan and Norway, where the lack of agricultural lands limits space for economical production of livestock.

History of Whaling

> a whale ship was my Yale College and my Harvard. (Ishmael in *Moby-Dick*)

Early human-whale encounters (hundreds of years BC) were due to whale stranding behavior; today the mystery of whale beaching remains (Ellis 1991). Early descriptions of whales were based on beached specimens and these encounters would eventually lead to whaling. Somewhere around 1,000 B.C. the Basques began commercial whaling for right whales (so named because they had thick blubber, did not swim too fast for little boats, and floated when killed). Use of protected bays and inlets for breeding made some whales particularly vulnerable to whalers.

As stocks were depleted, the Basque, British, and Dutch whalers expanded the hunt to bowhead whales in arctic waters and eventually to sperm whales worldwide (Gambel 1993). Early whaling was a dangerous profession as men, armed with slim iron harpoons, attacked whales from rowboats and held on to wounded, thrashing 60-ton whales. Despite the inefficient hunting techniques, bowhead, sperm, gray, right, and humpback whale populations were seriously depleted by the beginning of the twentieth century. Late in the nineteenth century the Norwegians developed mechanized whaling (exploding grenade harpoons, bow-mounted cannons, and steam catcher boats), which made the fast-swimming rorqual whales (blue, fin, sei, Brydes, minke) vulnerable to capture.

Whales were a common property resource, implying freedom of access. Consequently, local coastal stocks were quickly depleted, demonstrating the "tragedy of the commons." The response was for whalers to move farther in search of whales. Floating factory ships with stern slipways allowed processing far from land and whale stocks in the Antarctic and all oceans were targeted by various whaling nations. International agreements to regulate whaling were not made until the 1930s and 1940s. First regulations were intended more to stabilize the market,

preventing overproduction of whale oil, and to increase the output of oil per whale. Harvest was restricted to after summer feeding had fattened the whales.

In 1946, the International Whaling Commission was formed to "provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry." The commission is open to whaling and non-whaling nations. Developing regulations for whaling are complicated by highly uncertain estimates of historical catches, intrinsic rates of increase, and historical and current abundance (Lubick 2003; Baker and Clapham 2004). Furthermore, regulations of the International Whaling Commission are difficult to enforce; any nation may object to decisions of the IWC and thereby exempt itself from certain IWC rules. Since regulations are left to the national fisheries agencies to enforce, international pressure and trade sanctions are the only way to encourage compliance (Lones 1989; Peterson 1992; Stoett 1993, 1997).

Scientific management was slow to be applied to whaling. In the mid 1950s virtually no quantitative studies were being done on whale stocks and scientists attending IWC meetings had little, if any, quantitative expertise. As expertise in whale population analysis was applied in the 1960s, the world demand for whale products declined. Some American whaling persisted for pet food as recently as 1960s. However, by the mid 1970s all eight great whales were widely regarded as endangered and the public acceptance of whaling was changing, especially in the U.S.

Since 1970 U.S. society has treated whales as conservation symbols and herculean efforts were made to "save the whales" For example, in 1988, $5.8 million was spent in an attempt to save three trapped gray whales (see Tom Rose, *Freeing the whales*). During recent development of U.S. policy the protectionist community has advanced a non-consumptive use philosophy, often supplanting scientific management decisions with emotion pleas or ethical arguments against whaling.

Support for a moratorium on whaling has shifted the issue from a resource management question to an ethical question. Former Chairman of the U.S. Marine Mammal Commission, writes: "Whales are different. They live in families, they play in the moonlight, they talk to one another, and they care for one another in distress. They are awesome and mysterious. In their cold, wet, and forbidding world they are complete and successful. They deserve to be saved, not as potential meatballs but as a source of encouragement to mankind." Popular culture reinforces a mediagenic image of whales. In *Startrek IV: The Return Home* humankind is saved because whales are brought back from the brink of extinction.

Management procedures followed by the IWC are based on the maximum sustained yield (MSY) concept. The MSY concept states that the surplus of recruits beyond natural mortality is greatest at some intermediate population level and the surplus can be harvested without depleting the population. Estimating the MSY and population levels for whale species proved very difficult, preventing agreement on management recommendations. Therefore, in 1982, the IWC imposed a moratorium on all commercial whaling because data on whale stocks and dynamics were deficient. The moratorium took effect in 1986 and was to last until 1990, by which time the IWC's Revised Management Procedure (RMP) would set scientifically defensible quotas (Cherfas 1992; also see International Whaling Commission

website at www.iwcoffice.org). The moratorium remains in effect today, despite the unanimous recommendation by the IWC's scientists that the RMP quota setting is defensible. Japanese, Norwegian, and Soviet whalers continued to take whales under scientific research permits. The worldwide ban on commercial whaling cannot be justified on efforts to "save the whales" because not all species of whales are endangered. However, you must realize that the demography of cetaceans is a highly imprecise science. Furthermore, the blue whale and humpback whale have been totally protected from commercial hunting since 1965 and right whales and gray whales since the 1930s; yet there are few signs of recovery (Baker and Clapham 2004).

Lessons Learned

The history of whaling and attempts to regulate whaling highlight several important lessons for natural resource management.

1. Sustainable use requires science-based management.
2. Early intervention to limit access is needed to prevent overharvest.
3. Accurate biological data are needed to manage harvests or facilitate recovery on each species and subspecies.
4. Monitoring of users is needed to ensure compliance with regulations.
5. Political agreement that your goal is desirable (e.g., sustainable whaling) must be reached before you can do science-based management.
6. Scientific advice is seldom neutral. It is generated in a cultural context, which influences the outcome. Consequently, interpretations of the same information by the whaling industry, environmentalists, and cetologists are usually conflicting.

Current Controversies Over Whaling

The case for whaling – Once petroleum based products replaced whale oil (circa: 1900) and vegetable oils could be hydrogenated to make margarine (1960s), the justification for large-scale whaling ceased to exist. In the 1970s and 1980s, whaling continued to provide meat in those societies where it had historically been an important part of the diet. Meeting this need requires small-scale fisheries, not the industrial-scale factory ships that decimated the great whale stocks. Total value of whale products in 1972 was estimated at $100 million with potential value up to $500 million. Iceland, Japan, and Norway currently express interest in resuming commercial whaling and most other nations have low consumer demand for whale meat. Therefore, the market demand for whale products is limited, alleviating fears of overharvest. Furthermore the Norwegian quota of minke whales has increased steadily since 1990 (currently 1,052) under the assumption that the northeast Atlantic population of minke whale is stable.

A ban on whaling does not safeguard ecosystem integrity. The three countries involved have limited land areas suited for modern agricultural meat production. Whaling is energy efficient and results in less environmental damage than land-based food production (e.g., soil erosion, wildlife habitat loss, contaminants, greenhouse gases). Compared to coastal whaling where fossil-fuel energy input to protein-energy output ratios are 2:1, farm raised chicken, pork, and feedlot beef production ratios are 22:1, 35:1 and 78:1, respectively. Small-scale whaling is also ten times more fuel efficient than major fisheries for finfish (cod, tuna, etc.) and shrimp. Whale fisheries can be effectively regulated with quotas because the targeted whale can be identified to species and sex and prohibitions against catching females with calves can be enforced.

The coastal communities of Japan, Norway, and Iceland have traditionally acquired most of their dietary protein from marine fisheries. Many whalers also derive income from fishing; thus whales and humans compete for seafood. Food consumption by sperm whales worldwide is 100 million tons per year; by comparison the total world catch of seafood is ~100 million tons per year. Therefore, increasing whale stocks may threaten the livelihood of coastal communities dependent on fisheries.

The argument for whaling is not entirely based on use values. In Japanese coastal whaling villages, minke whale meat and blubber are important for thirty different culturally significant events. Hunting, processing, distribution, consumption and celebration phases of whale use are important components of the society's cultural identity. The promotion of whales as conservation symbols to be protected at all cost has ignored the cultural values of those communities that have historically harvested whales. Many Japanese view the protectionist attitudes of Western countries as ethnocentric or racist.

The case against whaling – Although historically the case against whaling has centered on the ethics of contributing to the extinction of whales, the rebound in whale populations has forced whale protectionists to develop an alternative position. Whales have intrinsic values apart from their human uses. This value can only be protected by recognizing cetacean rights and preventing inhumane treatment and killing.

The intrinsic values far exceed the economic value of whale products. Whales are unique in their intelligence level, playfulness, and grace (Klinowska 1992). As sentient beings it is morally wrong for humans to unnecessarily cause them pain and suffering (Scarff 1980). Furthermore, there are alternatives for most products derived from whales and it is not necessary to kill whales to fulfill essential human needs. Other non-consumptive uses of whales are more acceptable to our society and contribute to economies. For example, in 1991 over 4 million people spent over $300 million on whale watching activities.

Oversimplifying the case – Those opposed to whaling tend to talk about the whale in the singular, not the 75 or more species of cetaceans (Freeman and Kreuter 1994). Consequently the image of the "super-whale" is created. The super-whale is the largest mammal on earth (blue whale), has a large brain-to-body-weight ratio (bottlenose dolphin), sings (humpback whale), has nurseries (some dolphins), is

friendly (gray whale), and is endangered (blue whale, right whale). The super-whale is endowed with all the qualities we like to see in fellow humans: kindness, caring, playfulness. The super-whale is the image of a single whale possessing all these generalized traits; such a creature does not exist. Reasonable people must understand the full range of types of whales and types of whaling (Darby 2008) and their roles in ocean ecosystems (Estes et al. 2006) if they are to engage in the dialog on ethical issues in whaling.

Norwegian whaling – Norway, Japan, and Iceland oppose the current IWC moratorium on commercial whaling. Norway has been most successful in preserving its whaling industry. Currently Norwegian whalers operate out of small (50–60 ft), family-financed boats. They do not see themselves as a threat to whale populations. Norway ceased commercial whaling in 1987, pending research into the status of minke whale population of the northeast Atlantic. They resumed harvest in 1993 with a quota of 293 minke whales, which has increased to 1,052. Minke whales, at eight tons, are the smallest of the great whales. Most recent estimates suggest the North Atlantic supports from 125,000 to 245,000 minke whales. Whalers shoot them with a small harpoon; in the 1994 season 30% died instantly and the average time to death was 3 min. Whalers earn $13 a kilogram for the whale meat, which in shops cost four times that. What is your opinion on whaling by Norway? Is it wrong? Why or why not?

Aboriginal subsistence whaling – In 1982, the IWC distinquished between commercial and subsistence whaling. Aboriginal subsistence harvest means whaling for purposes of local aboriginal consumption, carried out by native peoples who share community, family, societal, or cultural ties related to traditional dependence on whaling or on the use of whales. The U.S. government requested an IWC permit for harvest of endangered bowhead whales by the Alaskan Inuits; the justification was to satisfy cultural and nutritional needs. The bowhead quota for Alaskan Inuits was a total of 141 for the 3 years 1992, 1993 and 1994. A maximum of 54 bowheads may be hit (by harpoons) every year, a maximum 47 may be landed every year (a number of wounded whales escape after being hit) and no mothers with calves may be hunted. The quota for 1994–1998 was 204 bowheads and Russian and Canadian natives are now requesting quotas. The Alaskan Inuits continue to use seal-skin boats (umiak), but have adopted penthrite projectiles, small grenades designed to ensure a quick death when a whale is harpooned. The Bering-Chukchi stock in the Beaufort Sea (from which the Inuits hunt) is estimated to be 6,400 to 9,200 animals (most likely number is 7,500). Scientists estimate the replaceable yield of bowhead whales is 254 animals (most likely), or 92 animals (minimum) per year.

In 1996 the U.S. petitioned the IWC on behalf of the Makah Tribal Council to kill 5 gray whales off the coast of Washington. The Makah support resumption of the hunt for cultural reasons. Because they stopped hunting gray whales in the 1920s when gray whales were approaching extinction the Makah cannot prove that they have a subsistence need. The gray whale came off the endangered list in 1994, and there are now about 21,000 gray whales. World Wildlife Fund, Sea Shepherd Conservation Society, Cetacean Society International, and the US Congress

pressured the U.S. delegation to drop the petition. How can the U.S. justify dropping the request of the Makah to hunt a recovered whale population while it supports Alaskan harvest of an endangered bowhead population?

Ethical Dilemma

The whale controversies involve ethical dilemmas in addition to scientific problems (Simmonds and Hutchinson 1996). It is important to separate the two in order to make the rationale for one's position clear. Is it morally wrong to kill whales (or other cetaceans)? Should commercial whaling be banned? Should aboriginal whaling be banned? Whose rights take precedence? Human rights to pursue traditions or animal rights? Think about the logical consequences of your arguments. What general moral principle did you use to support your argument?

Is it possible that anti-whaling forces are missing a larger threat? What is our ethical obligation to preserve ocean habitats for the whales, other marine life and humans? Depleted fisheries, pollution from oil tankers etc., ozone depletion and phytoplankton productivity declines, coastal development, harassment of whales by enthusiastic whale watchers, and other difficult dilemmas affect all forms of life dependent on the oceans.

Evaluating Moral Arguments

General moral principles guide our everday decisions. For example, one principle is "one must respect human rights or be banned from society." Along with the rights come responsibilities as rights granted to one individual may limit the freedom of another. The form of your moral argument regarding whaling should take the following form:

- Empirical premises
- General moral principle
- Conclusion

One example would be:

1. Whaling involves the infliction of unnecessary suffering and death on sentient beings.
2. Causing unnecessary suffering, or unnecessary death, in sentient beings (whales) is wrong.
3. Conclusion: Whaling is wrong.

Another possible example is:

1. Whale hunting is a part of the cultural tradition of certain societies.
2. Whale hunting provides protein in coastal communites with limited land for crop production.

3. Whale killing can be done in ways to minimize pain and suffering.
4. Whale hunting is sometimes permissible.

In order to evaluate these and other arguments, you should evaluate three questions:

1. Are the empirical premises true?
2. Does the conclusion follow logically from the premises? and
3. Is the general moral principle justifiable?

The best arguments will survive this scrutiny. Develop an alternative argument to suppport your position on whaling.

Take Home Message

The controversies surrounding marine mammal protection and management are similar to many controversies in fisheries and wildlife. Scientists and decision makers are involved in making hard choices about dynamic world situations in the face of uncertainty. Some of the decisions are scientific, some are moral decisions, but all are difficult. To foster dialog and continued learning we must alleviate tensions among conflicting interests and develop creative solutions. We also must learn to debate moral as well as scientific arguments and recognize the difference.

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Chapter 16
Land: Hybrid Corn

Jochum Wiersma, Deon Stuthman, David Fan, Donald Duvick, and Victor Konde

Abstract Crop plant modification through both breeding and genetic engineering have the potential for both improving human welfare and causing problems for people as well as the environment.

Keywords Genetic engineering • Plants • Hybrid corn • Environment • Industry

This case study consists of three parts. Please read the narrative and answer the questions following that section before continuing. This case is partially based on events in the past. It is very useful for the case to limit yourself to the facts as they are presented and imagine yourself as if you were there. There are several additional resources listed that you can use for background information.

Part I

In the 1920s and early 1930s, corn breeders in the United States developed a practical way to make hybrid corn. Seed of "double cross hybrids" could be produced at a price farmers could afford. Farmers therefore could take advantage of the benefits of inbreeding followed by directed cross breeding of corn inbred lines that resulted in an increase in vigor and yield of the hybrid offspring. Donald Duvick describes the rise of hybrid corn in the article "*Biotechnology in the 1930s: the development of hybrid maize*" in the January 2001 issue of Nature Reviews/Genetics. He writes that the technology was introduced even though corn breeders and other scientists did not (and still do not) understand the genetic principles of hybrid vigor, one of the major reasons for increased yield of hybrid corn.

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The introduction of hybrids also allowed, for the first time, a cost effective protection of intellectual property in corn breeding. Farmers buying the seed could not maintain or recreate the hybrid themselves and thus needed to buy seed from the seed corn companies each year if they wanted to maintain the yield advantage the corn hybrids provided. This gave rise to a viable plant breeding industry. Numerous "seed corn companies" soon were responsible for much of the breeding and virtually all of the production and sales of hybrid corn in the USA (Fig. 16.1). The farmers in the Corn Belt readily adopted this new technology and the majority of the acreage was planted to corn hybrids in just a few years (Fig. 16.2). Corn yields immediately started to rise due in large part to annual improvements in hybrid genetics (Fig. 16.3).

As with of any new endeavor, the start-up companies did have their share of doubts and problems. Attached below are excerpts from two letters written by the

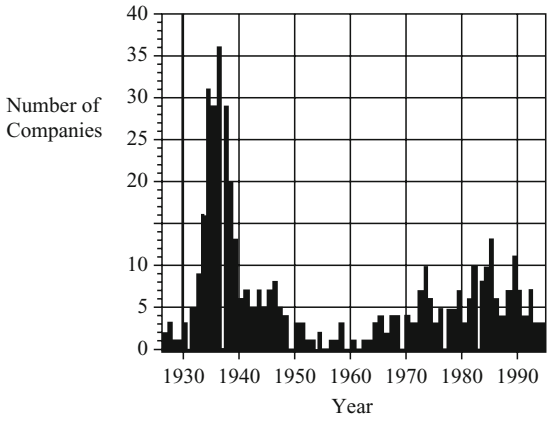

Fig. 16.1 Year in which companies were formed or reorganized for business in hybrid maize (Duvick 1998)

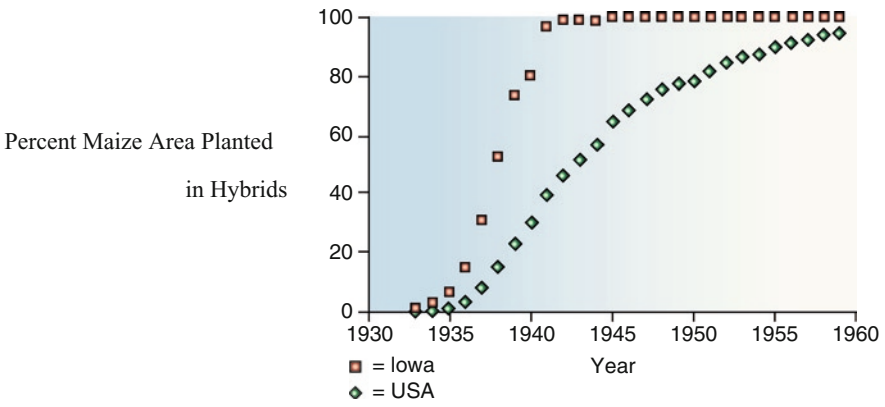

Fig. 16.2 Hybrids as percent of total maize plantings, Iowa (squares) and U.S. (diamonds) (Duvick 2001)

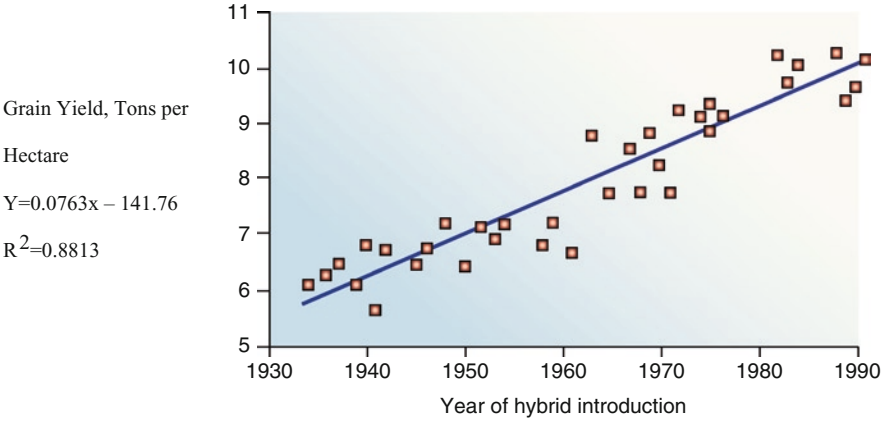

Fig. 16.3 Grain yield of 36 popular hybrids introduced from 1934 to 1991. Tests conducted in central Iowa, 1991–1994 (Duvick 2001)

president of one of those start-up hybrid corn breeding companies. Both letters illustrate some of the dilemmas the president of the company was facing at the time.

Letter 1

July, 1934
[Our Company] is either something big or it is nothing at all. There is no halfway position. If it is nothing at all, we are wasting our time and effort and it makes little difference whether we waste it this way or that way. Our problems are imaginary, our solutions immaterial.
If [Our Company] is big, and we all believe it is, our problems are very real and the answers make a real difference to us and to the Iowa farmer. We have a selfish ambition to make money. We also have an unselfish desire to provide a better seed corn. Both ambitions are worthy and they are consistent with one another. We owe it to ourselves and to our neighbors to strive for proper solutions to our problems.
Our capital is $30,000.00. This is about 1% of what it should be. You know the task it has been to raise this 1%. The other 99% will not raise itself.

Letter 2

November 21, 1935
Dear ——,
I have always thought that [Our Company] had but one serious threat: The chance that we would someday be fooled by a cross which would pass our tests, put it out commercially and then discover it was not any good.... I feel we may have done this with [Hybrid X].[1]
I think it is a fine corn if conditions are just right [but I believe it is] too sensitive to minor adversities. If I am right it is not a proper seed corn for general sale. ...

[1] The hybrid had germinated poorly in 1935, and subsequently yielded less than expected.

> We gave [Hybrid X] the benefit of the doubt last spring and sold it. We made a sales profit. I doubt if we made a real long-run profit. I am afraid of [Hybrid X]. I want to take it off the market. ... If I jerk it off the market, [the Sales Department] will go wild for [they] can sell every grain of it. ... [But] I have told the boys ... to sell no more [Hybrid X] until further word.
> ——— ———, Pres.

Questions

1. What do you think were the reasons to introduce hybrid corn in the USA?
2. Given the information presented, can you think of any objections to the introduction of hybrid seed corn?
3. Given the pro and cons that you listed in questions 1 and 2, was it morally right to commercialize hybrid seed corn (defend your answer)?
4. On what grounds do you think did the president of the company decide to halt the sale of the corn hybrid?
5. Was it morally wrong for the company to release the hybrid in the first place (defend your answer)?
6. Is it morally justifiable to protect and profit from the intellectual property and consequently create a dependency of the farmer on a seed source?

Part II

Hybrid corn was, and still is, a scientific and commercial success. There were, however, unforeseen consequences of this technology. Existing (and genetically diverse) open-pollinated varieties throughout the Corn Belt quickly disappeared and consequently uniformity in the cornfields greatly increased. This increased the potential for genetic vulnerability as was demonstrated by the outbreak of Southern Corn Leaf Blight Race T, a fungal disease, in 1970. It was virulent to most hybrid cultivars at the time because of the genetic uniformity of the cytoplasm in those hybrids, due to use of a particular kind of Cytoplasmic Male Sterility (CMS) as an aid in production of the hybrids. The yield losses in the southern and central parts of the Corn Belt were disastrous. The average yield in the USA dropped considerably (Fig. 16.4). The seed companies responded quickly and unilaterally abandoned Cytoplasmic Male Sterility in favor of mechanical detasseling to produce the hybrid seed. Already the next year, there were hybrids on the market that were produced using normal cytoplasm, not vulnerable to the disease. Thus corn hybrids were no longer susceptible to Southern Corn Leaf Blight and individual farmers avoided any yield losses due to the disease.

Question

7. Given the additional information provided in this section, would you change any of the answers you gave to questions 1 through 5 in Part I?

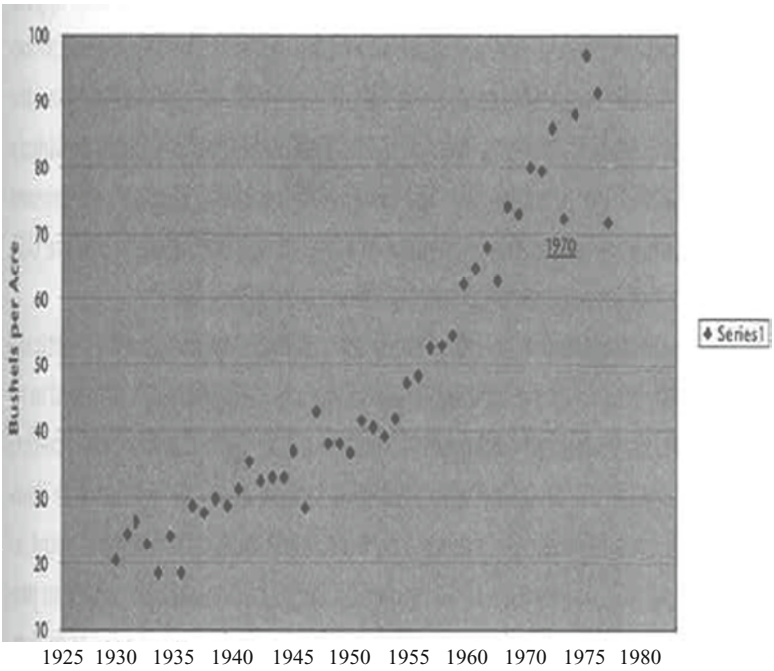

Fig. 16.4 US maize yields, 1930–1974. 1970: Southern Corn Leaf Blight Race I in southern and eastern Corn Belt. 1974: Abnormally cool summer, early frosts in northern Corn Belt (Data from USDA/NASS: *Corn grain and silage – planted and harvested – area, yield and production – 1930–1974*)

Part III

Now, fast forward to the present. Most of the opposition to genetic engineering and transgenic crops has focused on the potential risks of introducing genetically engineered plants into the environment and the purported unprincipled greed of multinational companies which, it is argued, will threaten food security and food safety. Some people are even willing to resort to violence to make their point as is illustrated by the press release below. In many of the debates, people use the precautionary principle to defend their stand on the issue. According to the international Cartagena Protocol on Biosafety (see Wikipedia for details), the precautionary principle implies that "potentially dangerous activities can be restricted or prohibited even before they can be scientifically proven to cause serious damage" (http://www.gene.ch/genet/2000/Feb/msg00003.html).

When hybrid corn was introduced there appeared to be a lot less opposition and little if any discussion about the potential risks of hybrid corn. With the introduction of genetically engineered corn, the debate is very lively and discussions about

the potential risks and benefits have been extensive. Pool and Esnarayra (2001) provided a nice overview of the potential risks and benefits of transgenic crops. At the present there are hundreds of genetically engineered corn hybrids on the market in the USA that are planted on a significant percent of the acreage in the USA.

As with the introduction of hybrid corn, there have been unforeseen consequences with genetically engineered hybrid corn. In 2000, Aventis Crop Sciences was forced to remove the Starlink brand of corn hybrids from the market. The Starlink brand confers both resistance to the broad-spectrum herbicide Liberty as well as resistance to European corn borer and related pests. The insect resistance results from production by the plant of a compound that is toxic to the Leptidoptora class of insects. At the time the Federal Drug and Food Administration had not yet approved the particular Bt toxin (Cry9A) incorporated in the hybrid corn for human consumption. However, traces of Starlink corn were found in several brands of corn tortillas, including Taco Bell, in the USA. Moreover, Japanese authorities found traces of Starlink corn in export shipments of corn to that country. These findings, ultimately, resulted in a voluntary withdrawal of any Starlink hybrid from the market by Aventis Crop Sciences on October 12, 2000.

Press Release

ANTI-GENETIC ENGINEERING GROUP SMASHES WINDOWS AT WISCONSIN PIONEER SITE

GENETIX ALERT
NEWS RELEASE
FOR IMMEDIATE RELEASE
Date: October 29, 1999
Contact: Jeffrey Tufenkian 619-584-6462

An underground group opposed to genetic engineering (GE) claimed responsibility for breaking windows at the Eau Claire, Wisconsin Pioneer Hi-Bred facility on October 27th according to a communiqué released today. The group known as "Seeds of Resistance" charged Pioneer and other proponents of GE with deceiving the public and profiting off of growing GE crops. "Seeing their profits as a slap in the face of the earth and all its occupants, we took the liberty of paying them back,' according to the communiqué.'We, Seeds of Resistance, smashed all the windows on one side of their disgusting building. Wisconsin is now another state that cannot hide from this growing resistance against GE culture." This action is the thirteenth known nonviolent destruction of GE crops or other property in the U.S. this year. Details of past anti-GE actions are available at www.tao.ca/~ban/ar.htm.

GenetiX Alert is an independent news center that works with other aboveground, anti-genetic engineering organizations. GA has no knowledge of the person(s) who carryout any underground actions. GA does not advocate illegal acts, but seeks to explain why people destroy genetically engineered crops and undertake other nonviolent

actions aimed at resisting genetic engineering and increasing the difficulty for entities which seek to advance genetic engineering or its products. GA spokespeople are available for media interviews.

Questions

8. Are there differences between the introduction of hybrid corn and the introduction of transgenic crops? Why or why not?
9. Can you defend the precautionary principle on moral grounds?

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Chapter 17
Farms: Lost in the Maize

Isabel Lopez-Calderon, Steven Hill, L. Horst Grimme, Michael Lawton, and Anabela M.L. Romano

Abstract A fictional case study involving a farmer growing genetically modified crops without informing his neighbors.

Keywords Genetically modified crops • Transparency • Ethics • Case study • Moral justification

Genaro Moura (GM) and Oswaldo Fernándes (OF) are farmers who grow their crops in neighboring fields. GM has planted a non-sweet forage maize that is genetically engineered to contain high levels of essential amino acids. He has followed all regulations but has not informed anyone that he is planting transgenic plants. This is because he is afraid that the environmental organization "Maize Liberation Front" will destroy his plantation and organize a campaign against him.

His neighbor OF, is opposed to genetic modification and uses only organic methods of agriculture. He is under a strict contract to sell his crop of sweet corn to the Berger (Baby Food Company). His crop must be certified as organic (under current regulations, organic food must be substantially free of transgenic material).

GM has noticed that lately some of the corn kernels of his own crop that he has eaten are sweet. He suspects that some of the pollen from OF's field has drifted into his field and has pollinated his plants. This does not affect the value of his crop. But he realizes that pollen from his genetically modified plants may have also drifted into his neighbor's field. GM realizes that if foreign genes have been transferred to OF's maize, the entire organic crop will be rejected by the Berger Baby Food Company.

GM decides NOT to inform OF that his crop may be contaminated with foreign genes.

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Question 1. Has GM made the right decision?

Identify the ethical principles behind GM´s decision.

Identify the interested parties and how they may be affected by GM's decision.

Later that week, GM reconsiders his decision. He decides to tell OF about the possible cross pollination. OF is upset but realizes that his own economic livelihood is threatened if it is revealed that his organic crop is contaminated by the GM maize.

Question 2. What do you think OF should do? Justify your position.

OF decides to find out more about the genetically modified maize that GM has grown. He spends six hours on the internet to research this topic. He finds that the maize has been approved by the Federal authorities, and that it has been grown for over three years, without there being any health problems reported. Although OF is opposed to genetically modified food, he concludes that in this case the risk of substantial contamination is very low. He decides not to inform the Berger Baby Food Company about the problem.

Question 3. Did OF make the right decision? Justify your answer.

OF performs tests that show that his crop is completely free of any genetically modified material. He informs the Maize Liberation Front about GM´s crop, knowing full well that they may destroy it.

Question 4. Did OF do the right thing? Justify your answer.

Chapter 18
Food: Edible Antibiotics in Food Crops

Mike Zeller, Terrance Riordan, Halina Zaleski, Dean Herzfeld, and Kathryn Orvis

Abstract Examines the moral/ethical issues surrounding the placing of an antibiotic in a major food crop.

Keywords Edible antibiotics • Food antibiotics • Phytopharmaceuticals • GM crops • Precautionary principle

Imagine that a large land-grant university has partnered with a major agricultural company to create a consortium to produce low cost, high quality phytopharmaceuticals. Phytopharmaceuticals are compounds that can be and are used as drugs, and can be natural products as well as genetically modified products derived from plants. In this case, corn was bioengineered to produce large quantities of a vital antibiotic: penicillin. The production of this crop containing the antibiotic in the seed will largely benefit developing nations by providing a steady, reliable supply of cheap product that can easily be consumed orally. Ultimately, the cost of the drug will be 10% of the cost of producing penicillin using current production methods. Storage and transportation of antibiotic will be simplified by eliminating the need to refrigerate the drug. The use of needles and their associated risks will also be removed. In the United States, strict rules concerning genetically modified food crops exist and

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are routinely enforced. Presently, the USDA, FDA, and EPA have approved the modified maize for human consumption under prescription in the United States.

Opponents of the GM crop have raised the following issues. The potential for contamination of other, non-GM, crops is very high when a GM crop like corn expresses an allergenic compound. The reason is that corn is wind-pollinated. In addition to pollen drift, storage contamination and the potential for contamination through mixing of supplies raise serious risks for those allergic to antibiotics. Because of the seriousness of the consequences, it has been suggested that the risks be evaluated using the precautionary principle as opposed to risk assessment, the standard method currently relied on by regulatory agencies. Dosing and intake control have surfaced as major problems with consuming antibiotic in a food crop. Development of antibiotic resistance in infectious agents could pose serious risk. Potential environmental impacts include cross contamination of neighboring maize fields with the GM crop pollen. Isolation and refugia (a 'refuge' of GM crop among non-GM crop) of the genetically modified maize crop becomes undisputedly necessary.

An anti-GM activist group advances the claim that the consortium is not proposing the new crop as an altruistic action. Rather, the consortium is proposing the new crop in order to make huge profits in the animal feed industry in the US. The idea is that the new crop would be grown primarily, on large acreages, in the US. The major use of the new crop, in other words, would not really be for disease treatment in developing countries but rather for market animal growth promotion. In the US, low levels of antibiotics are used in animal feed. These antibiotics modify the microorganisms in the gut of the animal, thereby improving the animal's weight gain and feed efficiency.

Genetically modified 'traditional' pharmaceuticals are already in use and are widely accepted by consumers in the US. These pharmaceuticals have been deemed safe by the relevant US regulatory agencies. Recombinant insulin, for example, is widely used by diabetics. As a result of GM in the medical industries, insulin is now much cheaper and in greater supply.

What Ethical Issues Are at Stake Here?

1. Consider each of these potential complicating factors:

   Wind pollination; humans with allergies; underlying issues of giving away the product, yet acquiring large profits from animal uses in the U.S.; dosing of the 'drug' and following up with taking entire prescription; control of who eats it and shares it; regulatory issues; issues surrounding growing the crop in developing nations, including use of chemical and fertilizer inputs, intensive row cropping and weeding, to produce a sufficient quality and quantity of a crop for production to be profitable; resistance issues.

2. Should we be doing this?
3. How should it be regulated?

4. Will your agronomist become your pharmacist? Will your grocer become your pharmacist?
5. Should the GM maize be limited to human use? To animal use? How would such a limitation change the risks and benefits?
6. Is the opposition based on the actual risk implied or only on the alleged immorality of producing GM organisms?
7. Should the university receive benefits, financially or otherwise, from this product?
8. Should the consortium be allowed to patent, and thus control, the product?
9. If industry won't support this type of, or exact research, should the federal government subsidize the research? If this is to help developing countries then are we morally obligated to do it? Should government support depend on industry support?
10. Should the targeted users/audience have a say in the process? Should it pass though international aid agencies or the governments of the developing countries?
11. Should U.S. agencies (USDA/FDA/EPA) or other agencies (for example the WHO (World Health Organization) or FAO (Food and Agriculture Organization)) regulate the product?
12. What might the effects of different cooking/culinary methods on the antibiotic imply for the consumer who is ill and needs the full benefit of the drug?

Web sites

http://biotechknowledge.com
– Monsanto (industry) educational site

www.eurekalert.org
– Various articles on many scientific and technical topics, searchable content

http://scoped.educ.washington.edu/gmfood/
– Controversy Forum sponsored in part by the AAAS (Science magazine)
– Has facts, email list, discussion group, and an extensive resource/reference list

www.columban.com/gencon.htm
– A nice essay written from a religious perspective

http://216.129.146.198/Lauren's%20Lit%20Review
– A literature review written by a student on internship (Dietetic Intern)

www.anth.org/ifgene/proscons.htm
– A table of pros and cons of various aspects of genetic engineering

www.psrast.org/ecolrisk.htm
– Risks of genetically engineered crops to the ecosystem

www.newswise.com
– Searchable content of various news articles on science topics
– See "Are Genetically Engineered Foods Natural?"

www.cast-science.org/

– Center for Agricultural Science and Technology
– CAST is an excellent source for issue papers and reports eg. “Applications of Biotechnology to Crops: Benefits and Risks”

www.ers.usda.gov/publications/aib766/

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Chapter 19
Biotechnology: Trait Protection System

Thomas Peterson and Bryony Bonning

Abstract Should technology designed to stop growers from saving seed from industry developed, high yielding crops be adopted to protect intellectual property rights?

Keywords Trait protection • Terminator technology • Plant breeding • Seed industry • Brown bagging

Description of the New Technology

Seeds for many high yielding crop varieties are patented and farmers are legally obliged *not* to save and use seed from the crop that they grow, but rather to buy more seed from the company. A technique has been developed to prevent farmers from saving or re-using patented seed. This technology results in the F2 seed (offspring of the plants grown by farmers) being inviable. This technology is called the trait protection system and is covered under US Patent No. 5,723,765 (Oliver et al. 1998).

The technology works as follows: The plant genome is engineered so that it produces a protein that is toxic to the plant. The promoter that controls expression of the gene and subsequent production of the toxin is only active late in embryo development. In order to produce the transgenic F1 seed, a spacer is put between the promoter and the toxin gene so that the toxin gene is inactive. On either side of the spacer are sequences that are recognized by a "recombinase" enzyme that cuts out the spacer. This event brings the gene and promoter together so that the toxin is produced late in embryo development. A promoter that is activated by the chemical treatment of the seed sold to farmers controls the production of the recombinase. Thus, until the seed is chemically treated, the toxin gene remains inactive. The result

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of chemically treating seed purchased by farmers is that the farmer can buy viable seed and harvest the crop, but any seed collected from the crop will not grow. Opponents of the new technology refer to it as the "Terminator Technology".

The Current State of Affairs in the World Agronomic Seed Industry

The mode of reproduction of a crop plays a significant role in the seed industry. *Hybrid crops* like corn, sunflower, sorghum automatically require that farmers purchase new seed each year to maintain yield. If farmers kept their own seed of hybrids, 50% of the advantage of growing the hybrid would be lost in the next year. The incentive for farmers to buy new seed of a hybrid each year is quite large.

Self-pollinated crops, like wheat, soybean, and rice do not require that farmers purchase new seed each year. This is because the seed harvested from the crop is genetically identical to what was planted. It is common practice both in the US and the rest of the world for growers of self-pollinated crops to keep and plant their own seed.

Brown Bagging

The practice of farmers saving their own seed or "brown bagging" as it is usually called causes significant economic problems for commercial companies. Farmers may only purchase seed of a new variety once and in future years produce their own seed of this variety. This limits investment by the commercial sector in self-pollinated crop breeding because there is limited potential return on investment. Much of the breeding of self-pollinated crops is done in the public sector, both in the US and the rest of the world. Brown bagging has also limited the use of biotechnology in self-pollinated crops, because it is difficult to control this practice. Hybrid crops do not have this problem and offer built in protection for intellectual property.

Patenting crop varieties and requiring farmers to sign grower agreements has been one way of circumventing the brown bagging issue in the US. Both the patents and the grower agreements prohibit farmers from saving seed to plant the following year. There are obvious enforcement issues, but US farmers have been prosecuted for brown bagging patented crop varieties.

In the Case of Corn

Even though hybrids offer a tremendous yield advantage in corn, hybrids are not grown by farmers worldwide. Hybrid seed production can be expensive and technically challenging to subsistence farmers. For example in corn, nearly 100% of the

US acreage is planted with hybrids and farmers purchase new seed each year. In contrast, 62% of the corn acreage in developing countries is planted with local germplasm or open-pollinated varieties, whereas only 38% is planted with hybrids. The local germplasm or open-pollinated varieties are grown from seed saved the previous year by the farmer, purchased from other farmers, purchased from a public or government agency, or in some cases purchased from a commercial company. Forty percent of the hybrid seed planted in developing countries is of public origin. The developing countries represent a potentially huge market for corn hybrids. The primary hindrance has been that farmers in developing countries do not have the capital to purchase hybrids and intellectual property laws are weak in developing countries.

In the Case of Wheat

The situation with a self-pollinated crop like wheat is much different. Greater than 90% of the US hard red winter wheat acreage is planted with publicly (usually from land grant institutions) developed varieties. The situation is very similar in developing countries. Biotechnology has not been introduced into wheat because companies have no way to protect investment in their intellectual property. Few commercial companies breed improved wheat varieties, because the return on investment from breeding is very low.

Controversy Over This New Technology

The case for introduction of the new technology – the industry perspective

1. The trait protection system is essentially a means to protect intellectual property. Seed companies invest a great deal of time and money to produce new improved varieties for farmers to plant. These substantial costs can only be recovered when the seed providers can be confident that their products will not be illegally reproduced and distributed. A similar situation is seen in the illegal copying and subsequent sales of software, music CDs, and movies. It is an accepted practice for these valuable electronic media to contain embedded "poison pills" which prevent their unauthorized reproduction. The trait protection system is a conceptually identical means of protection. Seed companies have a right to protect their intellectual property and recoup the costs they incur in developing improved varieties.
2. The use of the trait protection system will increase availability of superior genetic stocks to third world farmers. Currently, seed companies are reluctant to sell their best germplasm in third world countries where there is a high probability that their lines would be illegally propagated and distributed. Because the trait protection system removes the potential for subsequent illegal propagation, seed

companies will have no reason not to offer their best genetic materials to farmers in developing countries. The increased availability of superior genetic stocks to farmers worldwide will increase the choices available to farmers. Farmers will have the freedom to choose either their traditional varieties, or from the best seed offered in the commercial sector.

3. Seed protection technology will spur breeding efforts to improve genetic characteristics of many more crops than are being done today. Currently, corn breeding is profitable because farmers purchase hybrid seed each year in order to get the superior performance of hybrids. Much less genetic research and varietal improvements have been achieved in other crops, partly due to the inability to recover the costs of producing improved varieties. Seed protection technology will protect investments in genetic improvement, and will thereby promote such efforts in the private sector. While it is true that such improved seed will no doubt cost more than varieties available today, this higher initial cost will be more than made up for by higher yields. Thus, the farmer will realize a greater income, and more food can be produced per acre, thereby lessening the overall environmental impacts of agriculture.

The case against introduction of the new technology

1. The use of terminator technology will result in a loss of biodiversity. First, the engineered seed will replace native seed. Second, relatively few varieties of any particular crop are suitable for engineering, so industry will be restricted in the varieties that can be engineered with the terminator technology. The result will be an increase in crop uniformity with potential increased vulnerability to pests and diseases.
2. The traditional role of farmers as plant breeders will be eliminated. Farmers that currently use traditional practices of plant breeding to produce varieties suitable for their local needs will cease to do so. In addition, the public sector that currently produces hybrids for distribution for profit in some countries will be forced to adopt the terminator technology to remain competitive.
3. The cost of the engineered seed will be more than the cost of lower-yield seed and farmers in under developed countries will not be able to afford to buy seed every year.
4. There are risks associated with the use of this technology. First, there is a catastrophic risk associated with dependence on terminator technology products. If seed production were interrupted or lost, farmers would be left with nothing to plant. Second, there is a risk that the killer gene would be transmitted to related species of plants via the pollen, which would have a deleterious impact on neighboring plants/farmers.
5. Use of this new technology could result in control of global food production by relatively few companies.

International dialog is required to address the potential impacts of this new technology on global agriculture and food production.

Questions

1. Should it be illegal to use biotechnology to sterilize second generation seed for the purpose of preventing farmers from saving and replanting the seed?
2. Should industry be allowed to engineer seed for the purpose of protecting their intellectual property?
3. Should the United States government support this research, and if not, should this research be made illegal?

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Chapter 20
Genetically Modified Foods: Golden Rice

Kristen Hessler, Ross Whetten, Carol Loopstra, Sharon Shriver, Karen Pesaresi Penner, Robert Zeigler, Jacqueline Fletcher, Melanie Torrie, and Gary L. Comstock

Abstract An interactive classroom exercise for guiding discussions of ethical concerns about agricultural biotechnology.

Keywords Golden rice • Ethics • Genetic engineering • Foods • Crops

The Background

The World Health Organization (WHO) estimates that vitamin A deficiency affects 230 million children around the world, and at least one million children per year are dying of diseases related to this deficiency. Ingo Potrykus and his research group, with financial support from the Rockefeller Foundation, developed a variety of rice that contains beta-carotene, the plant pigment that is the precursor of Vitamin A. This rice supplies enough beta-carotene in a typical serving to supply 10% of the daily requirement for Vitamin A. Potrykus and Rockefeller have provided this variety of rice to the International Rice Research Institute (IRRI) in the Philippines, which will breed improved rice varieties using their traditional rice breeding methods and make the seeds freely available to farmers in the developing world.

IRRI has been doing rice breeding for decades, and has been on the front lines of the Green Revolution, developing and releasing new rice varieties with improved productivity (and increased dependence on fertilizers and pesticides). The institute's services are provided without charge to the farmers it serves and are supported by philanthropic foundations in the developed world (including the Rockefeller Foundation). Many people regard this development as an example of how biotechnology can be used to help developing nations, while others consider it

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a smokescreen to divert attention from the fact that biotechnology companies are trying to dominate the food supply.

Several questions surround golden rice, including when, if ever, it will be ready for commercial use and whether it might have unpredictable, untoward health effects on those who eat a lot of it.

Your Assignment

A charitable organization appeals to the WHO to stop Rockefeller Foundation from releasing golden rice, on grounds that it isn't a good strategy for dealing with malnutrition. The WHO will soon convene a hearing, the WHO Panel of Arbitrators, to determine whether to block the development of golden rice. The organization has invited four groups to advise it on this matter.

The four groups are: (1) Friends of the Earth, (2) Philippine Partnership for Development Farmer-Research Scientists (MASIPAG), (3) People from Developing Nations; and the (4) International Rice Research Institute (IRRI). The first two groups argue that the technology should not be pursued because they think golden rice is an expensive high-tech experiment, a gambit that is unlikely to solve the real causes of hunger in developing countries. The second two groups see golden rice as a viable solution to some problems, and argue strenuously for its development.

You will be assigned to serve either on one of the four teams, or on the WHO arbitration board.

General Instructions for Advisory Groups

Consider your group's position and generate moral and/or scientific reasons supporting your position. Plan to include both factual statements ("Many children suffer from vitamin A deficiency") and moral principles ("We should provide aid"). Formulate a strategy for briefly presenting your position to the WHO panel in a persuasive manner, and be prepared to answer questions from the panel about your position. You will have only 5 min to present your position, so choose one representative to speak for your group.

The Groups

Panel: WHO Arbitrators: You will be asked to decide whether to block distribution of the golden rice. Use your time to decide what additional facts you need to make a good decision, and what moral questions need to be answered. After you hear testimony from each interested group, you should ask the groups any questions that you think remain unanswered. After all the testimony is complete, you will have time to make your decision. Please select a representative to present your decision, and support it with your moral reasons.

Friends of the Earth: You represent an organization dedicated to protecting the environment and promoting sustainable development. You think that golden rice, as well as all genetically modified plants and animals, pose unknown threats to the environment and human health. In your view, the introduction of genetically modified organisms continues because of the power wielded by large agribusiness companies. You will argue that golden rice should not be released because of the environmental risks it poses, and you will urge the WHO to resist the influence of Monsanto and other large biotech firms.

Philippine Partnership for Development Farmer-Research Scientists (MASIPAG): MASIPAG was formed in 1986 as a collaboration between farmers and agricultural researchers to improve rice farming practices. The organization hopes to make rice farmers independent of loans and chemicals through training in sustainable agriculture. You will argue that poor Asian farmers are not likely to benefit from golden rice. Instead, you see golden rice as a chance for the biotechnology industry to improve its image.

People from Developing Nations: Some (though not all) of you may be desperately poor and may have children exhibiting symptoms of vitamin A deficiency. No solution to this critical health problem is immediately available, and you will argue that golden rice is desperately needed because the effects of malnutrition are so severe.

International Rice Research Institute (IRRI) Scientists: IRRI is an organization that does research in plant breeding and development of new rice varieties for farmers in Asia. Products of IRRI development are freely distributed to farmers and local plant breeders. You will argue that distributing golden rice will benefit malnourished children.

The following sections are for instructors to use as a guide to this case study exercise.

Purpose

This case is designed to explore the social and political ramifications of biotechnology, providing provocative and meaningful information about both biotechnology and conceptual bioethics. The goal is for students to understand arguments for and against new agricultural applications of biotechnology. The exercise is intended to illustrate the raw power of biotechnology to alter the lives of billions of people, either for good or ill. With the power to change the world comes a great deal of responsibility, for where there is the potential to do truly great things there is also potential for disastrous consequences. The students will discuss the social and environmental issues that must be considered with regard to biotechnology.

Procedure

The exercise has been used successfully, with university faculty, in a single hour-and-a-half session. With college students, however, we recommend a minimum of four one-hour class periods.

Class Period #1

The instructor gives an introduction to golden rice, handing out the one-page description of the exercise. Students are assigned to one of the five groups. We recommend that the instructor divide students randomly by, for example, asking them to count off from one to five. The group of students numbered "one" is assigned to the role of the WHO, the group of students numbered "two" is assigned to the role of Friends of the Earth, and so on.

The rest of this class period is spent giving instructions, meeting in groups, choosing a spokesperson for the group, and beginning to formulate strategy for the final presentation. The instructor also directs all students to read all of the supporting documents, paying special attention to the documents supporting their group's position. The arguments provided in these materials are not exhaustive; there are other arguments that can be made. It is up to the instructor's discretion whether to encourage students to do additional research on the web, or in their groups, to discover other arguments. Instructors should carefully monitor the groups, as some groups may need more assistance than others in extrapolating arguments from the information provided.

Class Period #2

Groups meet to discuss the readings, marshal the arguments for their position, and plan their final presentation. The WHO group discusses its decision and takes a preliminary vote, which it keeps secret from the other groups. The purpose of the vote is simply to inform members of the WHO how the respective members of the WHO are disposed. The WHO group also plans its behavior during final presentations. For example, it may wish to assign one student to be responsible for posing one question to the Friends of the Earth after the Friends have presented their arguments on the third day. Another student may be assigned to pose a question to IRRI, and so on.

Class Period #3

Final presentations from each group. Each presentation must be no longer than 5 min. At the end of each presentation, the WHO is entitled to ask one question of each group, and the group's spokesperson must respond, taking no more than 2 min to do so.

After all four groups have made their presentations, the WHO recesses to another room. Taking no more than 10 min, it discusses the arguments one last time and votes. It then returns to the room and announces its decision.

Class Period #4

This period is spent discussing the exercise, and permitting students to vent feelings of frustration. Students in groups that lost the argument may feel disenfranchised. They may feel that the WHO did not adequately appreciate the weight of their arguments, did not understand the gravity of their concerns, and so on. The instructor can use this time for productive discussion of democratic institutions, the place of minority opinions, the difficulty of governing, the importance of open and transparent decision-making, and so on.

With the instructor's consent, students may use information not included in these materials. However, they must seek the instructor's approval before the debate about using the information. At that time they must also present documentation showing the information's source so the instructor may determine its admissibility.

Background Materials

These materials are reproduced to aid students in researching the arguments made by their respective groups. Students should be instructed to pay careful attention to specific factual claims as well as to any indication of the moral values that their groups endorse.

Panel: World Health Organization (WHO)

Objectives and Functions (http://www.washingtonpost.com/ac2/wp-dyn/A59811-2001Aug24)

WHO is defined by its Constitution as the directing and coordinating authority on international health work. Its aim is "the attainment by all peoples of the highest possible level of health." The following are listed among its responsibilities.

- To assist governments, upon request, in strengthening health services
- To establish and maintain such administrative and technical services as may be required, including epidemiological and statistical services
- To provide information, counsel and assistance in the field of health; to stimulate the eradication of epidemic, endemic, and other diseases
- To promote improved nutrition, housing, sanitation, working conditions and other aspects of environmental hygiene
- To promote cooperation, among scientific and professional groups, which contributes to the enhancement of health

- To propose international conventions and agreements on health matters; to promote and conduct research in the field of health
- To develop international standards for food, biological and pharmaceutical products; and
- To assist in developing an informed public opinion among all peoples on matters of health

Mission Statement

The objective of WHO is the attainment by all peoples of the highest possible level of health. Health, as defined in the WHO Constitution, is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

Group: Friends of the Earth (FOE)

Friends of the Earth is an international organization concerned with environmental and social issues. Friends of the Earth members view golden rice as a smokescreen used by biotechnology companies to convince the world that biotechnology is necessary to combat hunger and malnutrition, and to distract people from the risks of biotechnology. In a statement on golden rice, the group asks, "Is Golden Rice a triumph of biotechnology that could eradicate unnecessary suffering? Or is it merely a PR maneuver by a threatened industry that would thrust an unproven, unwanted, and perhaps even harmful technology upon the developing world?" (Friends of the Earth 2000).

One reason for the group's suspicion about golden rice is that vitamin A deficiency is usually correlated with general malnutrition. Presumably, general and widespread malnutrition can be addressed most effectively by addressing food security issues like ensuring that the poor have land on which to grow a varied diet or enough money to buy healthy foods. Golden rice therefore seems to Friends of the Earth like an excessively technical solution to a problem that might best be solved with traditional, low technology efforts to improve food security and combat poverty.

Friends of the Earth estimates that $100 million has been spent to develop golden rice (Friends of the Earth 2000). Critics of golden rice point out that the charitable organizations that funded the development of golden rice might just as well have funded low-tech solutions to vitamin A deficiency, such as already-existing programs to distribute vitamin A capsules. While vitamin A capsules are neither problem-free nor a complete solution to malnutrition in the developing world, distribution programs are already in place, while golden rice is still in the research and testing phase. Moreover, the risks of capsule distribution are fairly well-known compared with the less-understood risks of biotechnology.

Other options exist as well. Friends of the Earth reported that many agricultural and public education programs exist in areas where malnutrition is a problem, including an advertising campaign in Thailand to encourage people to grow a variety of vitamin-A rich foods, and the use of natural predators to control pests in food crops in Africa. Friends of the Earth sums up: "One must wonder how many other low-tech, sustainable, people-centered solutions to hunger and malnutrition go unfunded thanks to government and biotech industry obsession with the hugely expensive technology of genetic engineering" (Friends of the Earth 2000).

Group: MASIPAG: Philippine Farmer Scientist Partnership

Students in this group represent an indigenous group of farmers in the Philippines whose name translates into English as the Farmer Scientist Partnership for Development. MASIPAG believes all of the following claims: That golden rice is a technofix solution to a problem that requires a more fundamental restructuring of the global agricultural system. That golden rice only helps biotechnology companies and the governments friendly to them to continue the Green Revolution path, a path ensuring that "malnutrition will even reach greater heights, as people will have more unbalanced diets, based on only a few foods" (Genetic Resources Action International (GRAIN) 2001).

While those pushing golden rice have declared that the seeds will be distributed to poor farmers free of charge, MASIPAG believes that the technology will bear other costs. MASIPAG cites the case of Mr. Afsar Ali Miah, a Bangladeshi farmer, who lived through the Green Revolution and now observes that "Nothing comes in free anymore, without its consequence, especially if it is driven by profit motives." Ali Miah interprets the Green Revolution as follows:

> At that time, the technology was started with all out support from the government and many farmers responded positively, making use of the packaged technology of modern high-yielding varieties, together with pesticides, and chemical fertilizers and a certain amount of credit. But when the uncertainty and fear of the new crop varieties were mitigated, the government slowly started withdrawing support and the farmers were left to deal with poor soil, lost seeds, and declining diversity in the field, and dependency on pesticides and fertilizers. In the process, farmers lost control of their food system. According to Mr. Ali Miah, "Because of pesticides, people are no longer eating what little edible green leafy vegetables (and fishes) there are left in the fields anymore. If we allow this golden rice, and depend for nutrition on it, we might further lose these crops, our children losing knowledge of the importance of other crops such as green leafy vegetables". (Genetic Resources Action International (GRAIN) 2001)

MASIPAG believes that the roots of Vitamin A deficiency are in the industrialization of agriculture. MASIPAG argues that as the diverse crops of yesteryear are replaced with monocultures, the diversity of nutrients will be increasingly narrowed, citing Ardhendu Chatterjee of the Development Resource and Service Center (DRCSC) in Calcutta, India:

> The problem of malnutrition is linked not with rice per se, but with the way rice is produced now [Personal communication with Ardhendu Chaterjee, Director, DRCSC, 21 July 2000]. "In the past [writes Chaterjee], integrated rice-fish-duck-tree farming was a common practice in wetlands. This does not only meet peoples' food, fodder and fuelwood needs, but it provides superior energy-protein output to that obtained from today's monoculture practice of growing high-yielding varieties. These fields also serve as the hatcheries for many fishes and aquatic organisms, which multiplied and spread to other wetlands. In the rainy season, these lowland rice fields often become connected to the water bodies like lakes and rivers. Agrochemicals applied in the paddy pollute these water-bodies and hence affect the entire food chain, thereby causing a decline in the overall fish, shrimp and frog supply – a resource freely available to the poor. Aquatic weeds which are rich in vitamin A are also becoming scarce." Sadly this is a scenario fast becoming common in most of Calcutta and over the whole Asian region. (Genetic Resources Action International (GRAIN) 2001)

MASIPAG believes that there are alternative, better, ways to provide vitamin A. The organization encourages integrated and sustainable forms of agriculture, including backyard or "kitchen" gardens, arguing that local, small-scale gardens can supply ample amounts of fruits and vegetables, foods that go a long way toward meeting micronutrient needs. MASIPAG notes that groups promoting gardens in West Bengal have had great success with this strategy.

> After just two seasons of her garden, Kobita Mondall relates that, "We have already consumed all that we can, have given some to the neighbors and sold some in the market, and still we're getting something from our backyard." Kobita's garden consists of a 300 square foot plot near their home, planted with more than 30 kinds of fruits and vegetables. (Genetic Resources Action International (GRAIN) 2001)

Hence, MASIPAG concludes as follows:

> While many doubt the ability of golden rice to eliminate vitamin A deficiency, the machinery is being set in motion to promote a GE strategy at the expense of more relevant approaches. The best chance of success in fighting vitamin A deficiency and malnutrition is to better use the inexpensive and nutritious foods already available, and in diversifying food production systems in the fields and in the household. The euphoria created by the Green Revolution greatly stifled research to develop and promote these efforts, and the introduction of golden rice will further compromise them. Golden rice is merely a marketing event. But international and national research agendas will be taken in by it. The promoters of golden rice say that they do not want to deprive the poor of the right to choose and the potential to benefit from golden rice. But the poor, and especially poor farmers, have long been deprived of the right to choose their means of production and survival. Golden rice is not going to change that, nor will any other corporately-pushed GE crop. Hence, any further attempts at the commercial exploitation of hunger and malnutrition through the promotion of genetically modified foods should be strongly resisted. (Genetic Resources Action International (GRAIN) 2001)

Group: People from Developing Nations

Dr. Florence Wambugu is a scientist who has worked to bring the benefits of agricultural biotechnology to her home country of Kenya and to other countries in Africa. Dr. Wambugu herself developed a genetically engineered virus-resistant

sweet potato. This development has significant potential to improve the nutritional status of Kenyan farmers, whose sweet potatoes are often shriveled and sparse due to the ravages of viruses.

Dr. Wambugu and others from developing countries argue that biotechnology can drastically improve agriculture in their homelands (Wambugu 2001). They view the opposition to biotechnology in agriculture as a predominantly privileged kind of activism. In their view, American environmentalists are neither vitamin A deficient nor otherwise malnourished, so they tend to underestimate, or even totally ignore, the potential nutritional benefits of biotechnology. In a statement she published in the Washington Post, Dr. Wambugu claimed that the critics of biotechnology are insensitive to the needs of Africans: "These critics, who have never experienced hunger and death on the scale we sadly witness in Africa, are content to keep Africans dependent on food aid from industrialized nations while mass starvation occurs" (IRRI Retrieved May 6, 2009).

Dr. Norman Borlaug, the recipient of the 1970 Nobel Peace Prize, succinctly endorses Dr. Wambugu's main point:

> The affluent nations can afford to adopt elitist positions and pay more for food produced by the so-called natural methods; the 1 billion chronically poor and hungry people of this world cannot. New technology will be their salvation, freeing them from obsolete, low-yielding, and more costly production technology. (Borlaug 2000)

In response to the critics of golden rice who argue that biotechnology will only benefit agribusiness corporations, Gregory Conko of the Competitive Enterprise Institute points out that it is a common phenomenon that new technologies may take some time to "trickle down" to the needy, but once they do, the benefits are real. "Wealthy consumers are usually first to benefit from innovations – from automobiles to antibiotics. Today, those once exorbitantly priced luxury items can be found across the globe and in use by many of modest means. The reason is that costs tend to fall over time due to economies of large-scale production, after R&D expenditures are recouped" (Conko 2001).

Applying this general analysis to biotechnology, he points out that we can expect more and more biotechnology products to benefit those in the developing world: "Once developed and commercialized, the technological knowledge used by for-profit endeavors is easily applied to far less profitable products. Many patented genetic discoveries are already being used to create extraordinarily promising plants solely for use in developing countries" (Conko 2001).

If this analysis is correct, there is no reason to be skeptical of the potential benefits of golden rice for the developing world.

Group: International Rice Research Institute

Students in this group will defend a nongovernmental organization involved with developing golden rice. Part of IRRI's mission is to deliver agricultural products, largely free of charge, to developing country farmers. Believing golden rice may

help IRRI achieve its objectives, it believes further that golden rice is just the first of many biotechnologies that may assist IRRI's clients, who are among the poorest people of the world (http://www.irri.org/media/press/press.asp?id=113).

IRRI's mission statement reads as follows:

> IRRI is a nonprofit agricultural research and training center established to improve the well-being of present and future generations of rice farmers and consumers, particularly those with low incomes. It is dedicated to helping farmers in developing countries produce more food on limited land using less water, less labor, and fewer chemical inputs, without harming the environment. (http://www.fumento.com/)

In January 2001, IRRI received its first research samples of golden rice. The sample came from the co-inventor, the German scientist, Dr. Ingo Potrykus. IRRI, aware of criticisms of the technology, read with interest Dr. Potrykus's interview with Michael Fumento of *American Outlook* magazine (Fumento 2001). Here is the substance of that interview:

AO: Do you believe biotech companies have "overhyped" the value of golden rice?

Potrykus: I did not follow the advertisements of the industry, but it is difficult to overhype the value of golden rice.

AO: How many companies had to grant you licenses for golden rice to be distributed?

Potrykus: As our partner AstraZeneca [now its spin-off, Syngenta Crop Protection] took care of many IPRs [intellectual property rights], we ultimately needed free licenses from only four companies.

AO: Isn't it true that golden rice not only contains added iron but has been engineered to make the iron already present in rice more readily absorbed by the human body? Has Greenpeace or the Union of Concerned Scientists [UCS] made any mention of this?

Potrykus: This is true and the opposition has, so far, ignored this. However, the golden rice we can currently give out has only beta-carotene. For the iron traits we again first have to settle the [licensing problems].

AO: I have heard that research is already being conducted on a new and improved version, which will express vitamin A at a higher level. Is there any truth to that? Also, what about the claims that people must have a diet rich in fat and protein in order to absorb beta-carotene?

Potrykus: The golden rice that everybody is talking about is the first prototype, and we are, of course, continuously working on its improvement. It is true that uptake of beta-carotene requires fat (though not protein), but there is oil in rice endosperm [the nutritive, starchy mass in the center of grains] that will be studied to see whether it alone is sufficient for efficient uptake.

AO: To your knowledge, has Greenpeace, other advocacy groups, or any other biotech company, misrepresented your words on the nutritional value of golden rice?

Potrykus: Greenpeace has a strategy to convince people that golden rice provides so little beta-carotene that it is useless. This group and its allies base their argument on 100% of the recommended daily allowance [RDA], thus hiding the fact that far lower values are effective against mortality, morbidity, and blindness. The golden rice that the public will receive will provide true benefits at just 300 grams [10.5 ounces] per day.

AO: Greenpeace and the UCS claim that the timing of the announcement of golden rice was "suspicious," intended to give the agbiotech [agriculture biotechnology] multinationals a needed publicity boost. Can you refute this?

Potrykus: This is so stupid. When we initiated our work 10 years ago, agbiotech definitely had no acceptance problems.

AO: Do you see golden rice as "the answer" to nutritional problems in the underdeveloped world where rice is a staple, or is it merely a tool to be used alongside others?

Potrykus: Golden rice is meant only to complement traditional interventions and to improve the vitamin A intake in poor populations. That said, it will probably be the cheapest and most sustainable solution.

AO: Do you see a role for golden mustard, golden canola, or other transgenic plants in providing more vitamin A and more nutrition in general to people in underdeveloped countries?

Potrykus: Of course I see a role for further food crops providing beta-carotene. We've already had discussions with scientists who want to introduce the trait into wheat, maize (white maize of Africa), cassava, sweet potato, banana, and so on. Naturally, the work with mustard and canola helps also. What I want is not only the addition of beta-carotene but nutritional improvement in general. That ís why I have also added the iron trait, and I am working on a high-quality protein trait.

AO: Do you concur with the assertion that simply by raising nutrition levels of underdeveloped nations, we can help them become less poor, leading to overall better nutrition?

Potrykus: Yes, I certainly do.

AO: What do you think of Greenpeace's insistence that it reserves the right to take "direct action" against golden rice test plots?

Potrykus: If Greenpeace does this, they will be guilty of a crime against humanity.

AO: What measures were taken in the past to address vitamin A deficiency, and what were the problems with those alternatives? Do you think that Greenpeace's suggested plan of mass distribution of vitamin pills make sense in terms of distributing them to hundreds of millions of people?

Potrykus: There is a need for distribution, fortification, dietary diversification, and education. All of these are important. These interventions have used an impressive amount of funds that have been spent over the last 20 years and have been very helpful. But we still have 500,000 blind children and millions of vitamin A deficiency deaths every year.

The problem with vitamin A pill distribution is that it does not reach many of those who need it.

AO: Greenpeace has declared the rice to be "fool's gold." How do you respond to their accusation that it would take an incredible amount of golden rice consumption to give children the recommended daily allowance of vitamin A, plus prevent blindness?

Potrykus: This is not true. The golden rice that will finally be given out to the public will be effective on 300 grams of rice in the diet per day.

AO: In many parts of the world, people who eat rice value its whiteness. It has a special meaning to them. Will they eat rice that is not very white? Hasn't this been a barrier to previous efforts in adding supplements to rice?

Potrykus: This is a problem in some parts of the world, although probably not in India. People will have the freedom to decide whether they want healthy children or white rice. We are, however, working on a solution for the color problem, and we believe that we know how to solve it.

AO: Critics insist that $100 million was spent researching golden rice, but others claim that this figure was total Rockefeller Foundation spending on rice research over 10 years to hundreds of scientists. Can you clarify this?

Potrykus: The total cost for golden rice development was $2.6 million, spent over 10 years in the lab of Peter Beyer and myself. These funds were from the Rockefeller Foundation, the Swiss Federation, the National Science Foundation, and the European Union. The investment was approximately one-fourth of 1% of the money spent on traditional interventions. Compared to the $100 million plus Greenpeace spends per year, this was a very small investment.

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Chapter 21
Animals in Agriculture: Beef, Milk, and Eggs

Gary Varner

Abstract Interactive exercise for class discussion of ethical issues associated with production of beef, milk and eggs.

Keywords Animals • Agriculture • Ethics • Animal rights • Interactive exercise

Part I: Ethical Views About Animals

The literature on the moral standing of animals is complex and vast. To oversimply, there are three major ethical theories: animal welfare, human dominion, and animal rights. Please read carefully the descriptions of these theories in Table 21.1. Then answer the two questions at the bottom of the page.

Questions

1. For those in the *human dominion* camp:
   Dominionists deny that animals are conscious. How do you think they could defend this view on scientific grounds?
2. For those in the *animal welfare* and *animal rights* camps:
   What do you think is the moral status of non-sentient animals for welfarists and rightists?
   Which kinds of animals are conscious of things like pain, and how do you know?

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Table 21.1 Representative views on the moral status of animals[1]

	Summary Characterization	Associated attitudes	Typical underlying philosophical basis
1. Animal welfare	We are stewards of animals. Their lives and experiences have intrinsic value, but it is up to us to decide how to maximize value in the aggregate by using animals in various ways.	Various traditional uses of animals are permitted, as long as they serve non-trivial ends and are conducted in ways that eliminate unnecessary animal suffering. For example: • Medical research • Humane animal slaughter • Hunting, at least to prevent wildlife overpopulation	1. We have a moral obligation to balance benefits and harms. 2. If an animal can suffer pain, then we have an obligation to balance this harm against the benefits of any human use of the animal. 3. So we should continue to use animals when the benefits to us outweigh the costs to them, but in doing so, we should eliminate unnecessary animal suffering.
2. Human dominion	We have dominion over animals. That is, they have value only as means to our ends.	Everything under animal welfare is permitted, plus things like: • Cockfighting, circuses, rodeos, and bullfights • Confined exotic animal hunting • Injuring animals for movies	1. Animals have no moral standing, because they lack consciousness, including consciousness of pain. 2. So it doesn't matter, morally speaking, how we treat them; no treatment of animals can be judged immoral except in virtue of its indirect effects on humans.
3. Animal rights	Animals have moral rights. And when individuals have moral rights, we cannot treat them as means to our ends.	Many or most traditional uses of animals are opposed, including everything listed as permissible under either of the above views, plus such things as: • Consuming animal by-products (like milk and eggs) • Captive breeding programs for endangered species • Keeping pets	1. If you have rights, then we cannot justify harming you just because the benefits to us outweigh the harms to you. 2. Some non-human animals have mental lives similar to those of some humans (if only very small children). 3. So if we recognize rights for all humans (including very small children) then we should recognize rights for those animals. 4. And so, for those animals, we cannot justify harming them just because the benefits to us outweigh the harms to them.

[1]The first draft of this summary was prepared by Gary L. Comstock and based on Varner (1998–1999).

Part II: Animal Agricultural Practices[1]

Read the following three cases. Using information from Part I, answer the questions.

1. Beef

Approximately 30 million cattle are slaughtered yearly in the United States. When it comes to the slaughter procedure itself, the large-scale, state-of-the-art facilities capable of slaughtering as many as 400–600 animals per hour are, perhaps contrary to popular belief, the most humane, at least if operated properly. The races approaching the stunning chute can be designed to look just like those through which cattle have passed previously for routine veterinary care, experienced handlers can move animals along without prodding, cattle do not "smell blood in the chutes," and "stunning" is a misnomer for what happens in the kill chute, since a properly placed shot with a "stun gun" obliterates the animal's brain, making it impossible to regain consciousness.

Questions

1. What would a person thinking from the animal welfare perspective say about this practice? Why?
2. What would a person thinking from the human dominion say about this practice? Why?
3. What would a person thinking from the animal rights say about this practice? Why?
4. In your own opinion, is this method of slaughter morally permissible? Should it be the legally required method?

2. Milk cows

On average in the US, milking cows spend between 3 and 4 years in production, after which they are slaughtered for relatively low-grade beef. Dairy farmers maintain high productivity by breeding cows to calve about yearly. The calves are removed from their mothers immediately or within days, with most of the female calves becoming replacement milk cows and many of the male calves being raised for veal. Statistics indicate that about one seventh of the cattle slaughtered yearly in the U.S. come from dairy operations.

Questions

1. What would a person thinking from the animal welfare perspective say about this practice? Why?
2. What would a person thinking from the human dominion perspective say about this practice? Why?
3. What would a person thinking from the animal rights perspective say about this practice? Why?
4. In your own opinion, is this production system morally permissible?

[1] The three cases originally appeared in Varner (1996) and are based on information in Rollin (1995) and in Varner (1994).

3. Laying hens

Today over 90% of laying hens in the U.S. live caged in intensive production facilities, which increased the average yield per hen from 70 in 1933 to around 275 today. In such facilities, birds cannot forage, flap their wings, dust-bathe, nest, establish dominance hierarchies, or even preen themselves in natural ways; culling of injured birds is economically inefficient, and the entire population of a battery operation is slaughtered and replaced periodically (every 12–15 months on state of the art operations).

Poultry are still exempt from federal humane slaughter legislation and by comparison to state of the art cattle slaughter facilities, poultry slaughter is still a relatively indelicate affair, with fully conscious birds hung from their legs on conveyor belts before being stunned and beheaded.

Questions

1. What would a person thinking from the animal welfare perspective say about this practice? Why?
2. What would a person thinking from the human dominion perspective say about this practice? Why?
3. What would a person thinking from the animal rights perspective say about this practice? Why?
4. In your own opinion, is this production system morally permissible?

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Chapter 22
Animals in Research: Enviropigs

Robert Streiffer and Sara Gavrell Ortiz

Abstract A cooperative learning ethics case study for guiding discussions of ethical concerns about the genetic modification of farm animals.

Keywords Genetic engineering • Animal ethics • GM food • Agricultural biotechnology • Environmental ethics

Introduction

Manure from farm animals is an important fertilizer for crops, but manure from intensive hog farms is a serious environmental problem in large part because of the high quantities of phosphorus it contains. Researchers at the University of Guelph have developed transgenic pigs, Enviropigs, whose manure contains up to 75% less phosphorus than their non-transgenic counterparts.

Proponents claim that Enviropigs will provide substantial benefits for the environment, consumers, and pork producers while critics allege that they will encourage unsustainable intensive pork production and pose significant food safety and environmental risks.

In this case study, you are to imagine that one of the primary funders of the research, Agriculture and Agri-Food Canada (AAFC), is deciding whether to renew its funding. In response to increased public sensitivity to the use of genetic engineering in agriculture and recent news coverage of the Enviropigs, the agency will convene a meeting with various stakeholders. AAFC arbitrators will hear testimony from the groups and make their decision based on whether the Enviropig project conforms to the agency's mission of providing "information, research and technology, and policies and programs to achieve security of the food system, health of the environment and innovation for growth" (Agriculture and Agri-Food

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Canada 2009b) and satisfies the new Agricultural Policy Framework (APF), which is "composed of five elements: food safety and food quality, environment, science and innovation, renewal, and business risk management" (Agriculture and Agri-Food Canada 2009a).

The Format

Prior to the in-class exercise, the students should be organized into small groups representing the adjudicating group (the AAFC panel) and the three stakeholder groups, the University of Guelph Scientists (U of G), the Friends of the Earth (FOE), and the Organic Consumers Association (OCA). All students should read the instructions and the two readings for all the groups. The students in the stakeholder groups should read the readings for their particular group as well. For the in-class exercise, students will begin with time in small groups to discuss how to best present their group's case to the AAFC panel. Each stakeholder group will then present their case, with U of G getting slightly more time than FOE and OCA. After each presentation, there is time for questions and answers between the AAFC panel and the presenting group. In the two longer formats, after all of the presentations are done, each stakeholder group will lead a question and answer period with another stakeholder group of their choosing, challenging the other group's position. Then the AAFC panel will adjourn and deliberate. They will then return to present and justify their decision by drawing on those groups that supported their decision and indicating how they would respond to those groups that opposed their decision. The class will then step back and discuss what they thought of the exercise (Table 22.1).

Table 22.1 Exercise Timeline

Class time available	50 min	75 min	90 min
Time allotted	43 min	65 min	79 min
Stakeholder group deliberations	10 min	20 min	25 min
U of G presentation	3 min	4 min	5 min
AAFC and U of G Q & A	2 min	2 min	2 min
FOE presentation	2 min	2 min	3 min
AAFC and FOE Q & A	2 min	2 min	2 min
OCA presentation	2 min	2 min	3 min
AAFC and OCA Q & A	2 min	2 min	2 min
U of G Q & A	0 min	2 min	4 min
FOE Q & A	0 min	2 min	4 min
OCA Q & A	0 min	2 min	4 min
AAFC deliberations	10 min	10 min	10 min
AAFC presentation	5 min	5 min	5 min
Reflection and discussion	5 min	10 min	10 min

Instructions

Instructions for the AAFC Panel: You must decide whether to renew funding for the Enviropig project, to be decided by the extent to which the project is consistent with Canada's Agricultural Policy Framework (APF). Use the stakeholder deliberation time to decide what facts you need to make a good decision and what moral questions need to be answered. After you hear testimony from each group, you should ask them any questions you think remain unanswered. After all the presentations, you will have time to deliberate. Select a representative to present and justify your decision.

General Instructions for all Stakeholder Groups: Drawing from your readings, develop arguments for your position within the general framework specified in the instructions below for your group. Generate moral and/or scientific reasons supporting your position. Plan to include both factual statements ("Enviropigs produce less phosphorus in their manure") and moral principles ("The AAFC should endorse projects that will help reduce environmental harm"). Formulate a strategy for briefly presenting your position to the AAFC panel in a persuasive manner, and prepare to answer questions about your position. Choose someone to speak for your group.

Instructions for University of Guelph Scientists: As developers of the Enviropigs, you will argue that the AAFC should continue funding the Enviropig project because Enviropigs will be as safe as other pork products, benefit consumers by giving them price savings, help pig farmers be economically competitive, and reduce the environmental impact of intensive hog farms.

Instructions for Friends of the Earth: The FOE is dedicated to protecting the environment and promoting sustainable agriculture. You will argue that the AAFC should not renew funding because Enviropigs, like many other products of genetic engineering, pose unjustified risks to the environment.

Instructions for Organic Consumers Association: The OCA deals with crucial issues of food safety, industrial agriculture, genetic engineering, corporate accountability, and environmental sustainability. You will argue against funding the Enviropig project on the grounds that Enviropigs, like many other genetically engineered products, have unjustified food safety risks and go against consumer preferences.

All Groups: Background on Enviropigs[1]

Pigs have a dietary requirement for phosphorus, but standard plant-based feed contains only plant phytate, which pigs are unable to digest and which therefore becomes concentrated in their manure. The most common way to provide pigs with sufficient amounts of phosphorus is to add supplemental phosphorus to the pigs'

[1] Adapted from (Streiffer and Rubel 2007).

feed in the form of mineral phosphate. However, supplemental phosphate has the unfortunate side effect of increasing the amount of phosphorus in the pigs' manure. Because the manure is used as fertilizer, this means that supplemental phosphate increases phosphorus in the environment and phosphorus pollution from the manure of intensive hog farms is an enormous environmental problem. Prior to the development of the Enviropig, the most effective mitigation technique was to add phytase to standard feed. The phytase is an enzyme that allows pigs to digest the plant phytate, thus satisfying their nutritional requirements for phosphorus while reducing the amount of phosphorus in their manure by up to 56% compared to conventional feed.

Researchers at the University of Guelph, funded by Ontario Pork, genetically engineered pigs to produce phytase in their salivary glands, using a phytase-producing gene from *E. coli* bacteria and a salivary gland-specific promoter from the mouse. Enviropigs fed standard feed (even without supplemental phytase) do even better than conventional pigs fed feed supplemented with phytase, secreting up to 75% less phosphorus than pigs fed with conventional feed. These pigs are touted as an environmentally friendly application of genetic engineering and, hence, have been dubbed "Enviropigs" by their marketers. Given these facts, there are five features of the Enviropigs that supporters are touting as benefits, four of which are alleged to follow from the first. First, Enviropigs produce less phosphorus in their manure per pig than do conventional pigs using even the most effective alternative methods of phosphorus reduction. Second, hog farms can use Enviropigs to produce less overall phosphorus pollution than other hog farms, even those using the most effective alternative methods. Third, hog farms that are currently limited in size by the environmental limits on phosphorus pollution can capitalize on the Enviropigs' reduced phosphorus emissions per pig and increase the size of their operation. Fourth, Enviropigs will benefit farmers in developing countries because raising Enviropigs is more affordable than adding phytase to their feed or purchasing low-phytate feed. Fifth, because Enviropigs can extract more useful phosphorus from their feed, the use of Enviropigs will reduce the need for collecting phosphorus from the natural environment.

All Groups: Background on Agriculture and Agri-Food Canada (Agriculture and Agri-Food Canada 2003)

Food Safety and Quality: Canada's agriculture and agri-food sector enjoys a global reputation for consistently delivering safe, high-quality food. Many players in the industry are already moving to adopt systems that will offer documented evidence of safety and quality to meet consumer demands. The [Agricultural Policy Framework (APF)] APF will help industry develop these systems to trace their products through the entire food chain to consumers and expand food safety and quality monitoring at the production level. The food safety surveillance and information systems that governments currently have in place would be strengthened.

Environment: Environmental stewardship is key to both the industry's long-term sustainability and its profitability. The industry is well aware of this and is already taking action to manage known environmental risks. The APF sets out areas where governments can provide help, including better information and research on the links between agriculture and the environment, the development of best management practices, and stepped-up action on environmental priorities on farms through agri-environmental scans and environmental farm plans.

Science and Innovation: Advances in science and technology have long been part of the success of Canada's agriculture and agri-food sector and one of the goals of the APF is to make the sector the world leader in innovation. The APF emphasizes the coordination of research and innovation efforts across governments, the sector and private research institutions to achieve maximum return on investments in the key areas of food safety, the environment and innovative production.

University of Guelph Scientists: "Sensational Science or Science Fiction?" (Wooley and Vowles 2000)

Besides saving producers the cost of readily digested phosphorus supplements, animals able to digest the element in their regular diet will excrete up to 50% less phosphorus. Farmers use high-phosphorus pig manure for fertilizer, but the substance washes into lakes and streams, where it promotes the growth of algae.

Professors Cecil Forsberg, Microbiology, and John Phillips, Molecular Biology and Genetics, along with graduate student Serguei Golovan constructed a fusion transgene for use in making transgenic pigs by splicing the promoter-enhancer region from a mouse salivary gland protein gene together with the protein-coding region from a bacterial gene specifying the enzyme phytase. This composite gene, which was designed to direct the secretion of phytase into the saliva of pigs, was first tested in a mouse model: the transgene was inserted into one-celled mouse embryos and the embryos then transferred into surrogate mothers. Offspring were then tested for the presence of phytase in their saliva.

With successful expression of the transgene in the saliva of transgenic mice, they then repeated the process with one-celled pig embryos which were then transferred into surrogate sows. Piglets born beginning last summer are producing phytase in their saliva. This allows them to digest phosphorus in their normal feed, thereby avoiding the need for costly phosphorus feed supplements. More hazardous phosphorus in their manure is greatly reduced, making them much more environmentally friendly.

Phillips and Forsberg emphasize that the real test will come this spring when the first offspring from the Enviropigs will be born. If these offspring carry the transgene from their parents, then the research team will put their novel herd of Enviropigs through a series of exhaustive tests to determine just how successful the pigs are at recovering phosphorus from their feed, and any possible side effects to the genetic modification.

The agricultural industry seems to have embraced GE technology. The U.S. Department of Agriculture estimates that half of the country's last soybean crop and one-third of its corn crop used genetically engineered seed. In Ontario, farmers used transgenic seed on 35% of corn, 20% of soybeans and 60% of canola grown last year.

Across Canada, growers now have access to more than 30 varieties of transgenic crops, including corn, canola, soybeans, potatoes, cotton, flax, wheat and tomatoes.

Biotech opposition: … polls suggest consumers have only a marginal understanding of the concept of biotechnology, and Prof. Larry Milligan, vice-president (research), says much of the current media coverage adds to that misunderstanding. GMO (genetically modified organism) has become the accepted acronym for genetic engineering, when the literal meaning is quite different, he says.

Opposing GM foods would include virtually everything on the dinner table, as Surgeoner pointed out, but Milligan says most consumer concerns are more likely focused on the transfer of genetic material in the laboratory, specifically between different species. "We all agree that people must trust what they eat," says Surgeoner. "Clearly, the process of modifying genetic material to improve foods must be subject to strict regulatory oversight."

He believes that's already being done in Canada and says the country's food supply "has an enviable reputation for safety and reliability based on a regulatory system for the assessment and approval of all foods marketed in Canada, including those produced through biotechnology."

Skeptics have capitalized on widespread public ignorance about the science and regulation of so-called GMOs, calling them "Frankenfoods" and conjuring up images of mad scientists running amok in laboratories. This couldn't be further from the truth, says Wildeman.

"It's important to understand that researchers do not randomly transfer genes about which they know nothing. There is a great amount of basic research conducted on a specific gene before it can be selected for transference."

Prof. Larry Erickson, Plant Agriculture, says activist organizations like Greenpeace have stirred up fears over the imponderables, such as what might happen in crossing species barriers and mixing, say, viral DNA with alfalfa genes. He and his colleagues, however, point out that the mixing of DNA even across species is routine and often benign. "The human genome consists of a high proportion of copies of viral DNA," says Prof. John Phillips, Molecular Biology and Genetics. Pointing, for example, to lengthy and apparently meaningless stretches of the human genetic code that incorporate portions of DNA from retroviruses that have co-existed with humans since time immemorial, he says: "There's a mistaken perception that the genomes of individual species are pure and pristine." …

Food-safety guarantees: According to Guelph faculty, two questions are central to the debate over genetically engineered foods: Is there a risk in eating them and, perhaps as important, do people think there's a risk in eating them? "No one's saying this food is absolutely risk-free," says Surgeoner. "You can't guarantee zero risk with anything."

He notes that today's number-one health risk from food is posed not by genetic engineering but by overeating. Number two is food-borne illnesses resulting from natural pathogens such as E. coli, salmonella and listeria. Says Prof. Doug Powell, Plant Agriculture: "Several million Canadians are sickened and a couple of hundred are killed each year from food- and water-borne illness. Not one has ever been linked with genetic engineering. While vigilance is warranted with any new technology, the excessive concern about genetically engineered foods trivializes efforts of farmers, processors, distributors and consumers to enhance the safety of the food supply."

Adds Prof. Karen Finlay, Consumer Studies: "People use herbal remedies without questioning them, despite the fact they undergo no testing. People assume that because they're health-oriented, they've been tested. They haven't. They're assumed to be somehow safe because they're 'natural'." …

Powell points to the need to inform consumers about the regulations and practices that govern biotechnology and food safety. "There is one country in the world that has a mandatory safety assessment of new and novel foods – whether derived through genetic engineering, mutagenesis breeding, new enzymes, whatever – rightly focusing on the safety of the end product rather than how that end product was derived. It is Canada. Others should follow suit."…

Health Canada and the Canadian Food Inspection Agency (CFIA) are both involved in assessing the safety of new food products, guided by the premise that genetically engineered foods are substantially equivalent to traditionally bred organisms and lend themselves to well-defined risk-assessment methods and principles. As the CFIA points out, regulators frequently have more knowledge about GMOs than about naturally grown foods.

The result? "We have not seen a single food-safety outbreak attributable to any genetically modified food that has passed through Canada's regulatory system," says Surgeoner. "That covers GM corn, canola, soybeans – the products approved since 1994."

University of Guelph Scientists: "The Enviropig Will Reach The Meat Counter, But When?" (Forsberg 2002)

Dear editor:

In the December 4th issue Tom Van Dusen asked where does the Enviropig fit in to help the pork producer satisfy the proposed Nutrient Management Act, and still remain profitable?

To provide a refresher, manure from pigs and poultry is enriched in phosphorus, the major pollutant in areas of pork and poultry production. The Enviropig is designed to secrete in its saliva the enzyme phytase. This endows the pigs with the capability to utilize practically all of the phosphorus present in cereal grains.

This has two primary benefits: there is no need to add either supplemental phosphate or phytase enzyme to the diet, and second, the phosphorus content of the manure

will be reduced by 60–80%, which will allow manure to be spread on land at the same or greater rate than before and still meet stringent nutrient management requirements. Trials are in progress to determine whether the Enviropig manure has less odor.

Initial testing has documented that the transgenic phytase pigs are as healthy and grow as rapidly as other pigs. If the transgenic pigs appear healthy, why are they not in the food chain? Because of strict Canadian legislation including the Canadian Environmental Protection Act, the Novel Foods Act and the Health of Animals Act, which we fully support, and will necessitate extensive studies to document that the pigs have no deleterious effect on the environment, that they are healthy, and produce safe pork over an extended period of time.

Has industry shown interest in the Enviropig? Despite the tide of interest from the press, government and individuals throughout the world, no major player has come forward to sponsor the last hurdle for the Enviropig. However, we have had discussions with several swine breeders in Canada and with scientists in China who are keen to import the Enviropig.

There are good reasons for this wait and see attitude; first, there is the matter of cost, taking the first transgenic pig through the regulator process will be an expensive and uncharted course, and second, the Enviropig is a GMO, and at least one major player in the pork industry is concerned that being associated with research and development on genetically modified pigs may leave the impression that their breeding stock is genetically modified, a factor which could have financial consequences.…

A factor that has been discounted is the flexibility of consumers when it comes to price shopping. Knowing that the pigs had been thoroughly tested, and if enviropork is a few cents cheaper than conventional pork, many consumers will go for the cheaper product. Some may even buy it because the Enviropig leaves a significantly smaller footprint in the environment.

The bottom line is yes the Enviropig is “hogtied in red tape”, however, be patient, its time will come, perhaps sooner than we expect.

Friends of the Earth: FOE Mission Statement (Friends of the Earth n.d.)

Friends of the Earth International is a worldwide federation of national environmental organizations. This federation aims to:

- Protect the earth against further deterioration and repair damage inflicted upon the environment by human activities and negligence;
- Preserve the earth’s ecological, cultural and ethnic diversity; …
- Promote environmentally sustainable development on the local, national, regional and global levels.

Friends of the Earth: "The Next Pig Thing" (Vestel 2001)

At this point, while researchers and pig farmers have extolled the environmental benefit Enviropigs present, most of the leading environmental groups aren't following suit. While the hogs' virtues may be attractive to the green groups, their modified genes represent a vice too significant to overlook.

The crux of the debate centers around the manure pigs produce. Modern pig farming often involves raising thousands of swine in a single facility – which can in turn generate thousands of tons of manure every year. That manure is then spread in fields or stored in "lagoons." The contaminants in the manure can spread from either fields or lagoons into water sources. In 1995, for instance, an eight-acre hog-waste lagoon in North Carolina burst, spilling 22 million gallons of manure into a nearby river and killing enormous numbers of fish. Concentrations of manure rank "among the greatest threats to our nation's waters and drinking water supplies," according to a recent Environmental Protection Agency study.

The Enviropig, developed at the University of Guelph in Ontario and introduced to the world in August, has been modified so that their manure contains up to 75% less phosphorus than the average swine. Several substances in pig manure cause environmental damage, but phosphorus is one of the major culprits. The presence of phosphorus in waterways can cause fish kills, biodiversity loss and foster the growth of toxic organisms, according to the EPA. …

"The environmental barriers are the largest in terms of growing as an industry," says Clare Schlegel, chairman of Ontario Pork, which represents 4,400 hog farmers in the province and has been a primary funder of the Enviropig research. "[Pork producers] are being looked at as polluters – this is one technology to show that we do care."

Environmentalists aren't buying it. The Sierra Club, which has made lobbying for controls on pig manure pollution a centerpiece of its clean water campaign, calls the Enviropig a load of hogwash.

"This is just another quick fix," says Laurel Hopwood, chair of Sierra Club's genetic engineering committee. "The way to reconcile [the problem] is to stop factory farming." Greenpeace and other environmental groups have echoed the Sierra Club message, arguing that the only real solution is moving away from massive industrial-style hog-growing and instead raising fewer pigs in bigger outdoor spaces.

Other technical fixes also exist. Pigs don't digest most of the phosphorus in their grain-based diet, so it ends up in their manure. A new breed of corn, developed by a USDA researcher, reduces phosphorus in manure by up to 50%. A widely practiced strategy of adding the enzyme phytase to feed can also reduce phosphorus content by 56%.

"There are a lot of sustainable agriculture programs that offer real benefits to food security and to the environment that take far less resources than the biotech solutions being proposed," says Michael Khoo of the Union of Concerned Scientists. …

[F]or virtually all major environmental groups, the matter boils down to the fact that they oppose the introduction of genetically-engineered organisms into the environment.

"The GMO issue is a deal breaker," says Melanie Shepherdson Flynn, an attorney with the National Resource Defense Council's Clean Water Project. "It's an extreme solution without knowing what the result will be."

Friends of the Earth: "Enviropigs Will Not Help Environment" (*Minnesota Daily* 2001)

In the near future, a side of bacon might be more than just pig. It will probably contain some mouse and a little bit of an E. coli bacterium too. The reason: Canadian scientists genetically designed a pig by injecting genes from an E. coli bacterium and a mouse into a single-cell pig embryo. And this new combination is in demand. These transgenic pigs excrete manure containing 50–75% less phosphorus – a chemical the EPA says is a major threat to our nation's water and drinking supply. The pigs, trademarked Enviropigs, will be the first genetically modified farm animals to reach the market anywhere in the world, their creators at Ontario's University of Guelph believe. Microbiologist Cecil Forsberg, involved in the project, said the Enviropig is "for sure, the first modified farm animal engineered to solve an environmental problem."

Lilian Schaer, a spokeswoman for Ontario Pork – a marketing group that represents 4,500 pig producers and has financially supported the genetic research, agrees. "A pig that produces less phosphorus would be a dream pig from just about everyone's point of view," she said.

These pigs, however, have nothing to do with cleaning up the environment and everything to do with increasing profits.

In 1950 the average hog sales per farm were about 31. Now 105 farms raising more than 50,000 pigs each account for 40% of the US hog industry, according to the Minneapolis based Institute for Agriculture and Trade Policy. And the only thing keeping these farms from getting larger is their inability to dispose of large quantities of manure in a manner adhering to the Clean Water Act. But now that the phosphorus levels can be lowered, don't expect these large farms to sit back and applaud themselves for being more environmentally conscious. Instead they will increase their farms' sizes until the hazardous effects of the manure again straddle the regulatory limits set forth by the Clean Water Act.

Although this might lower the price of pork, it does nothing to address the current environmental issues and in fact only compounds many of them. … The large hog farms emit greenhouse gasses and nitrogen gas, which can radically change the surrounding ecosystem. The increased number of Enviropigs will exacerbate these problems.

Friends of the Earth: "The Price We Pay for Corporate Hogs" (Halverson 2000)

B. Building Sewerless Cities

… At one time, crop and livestock production were complementary enterprises on farms. Most of the nutrients originating from the soils of a given area were returned to that same area. Animals' living quarters were bedded with hay or straw and, when soiled, the bedding was removed to a manure heap where it composted, killing most of the pathogens that may have been present in the manure. Under such conditions, environmental problems arising from animal production activities, when they sometimes occurred, were minimal and relatively easily solved by improving management or taking other, relatively low-cost, remedial measures.

Environmental problems were exacerbated when specialization separated livestock production from the land and the availability of cheap, mineral fertilizers made it possible to produce crops without manure nutrients. Today, most farm animals are concentrated in large holdings on small acreages and are raised under intensive conditions resembling manufacturing processes. Animal feeds generally come from areas far away from the industrialized livestock farm. Manures from these "animal factories" may be handled as wastes or surpluses to be disposed of, rather than as valuable soil amendments, and may be applied to the land in quantities far exceeding the nutrient needs of crops. Quantities of liquid waste can be enormous. At a single site in Missouri, one hog factory produces fecal waste equivalent to that of a city of 360,000 people.

Earthen manure storage basins have leaked manure onto cropland and into streams, killing the life in them. Some leaks were found to be deliberate; others were unintentional – minor accidents or widespread catastrophes. Either way, it seems clear that the liquid manure storage technology is fundamentally unsafe.

Besides the plant nutrients nitrogen, phosphorus, and potassium, liquid manure also contains bacterial and viral pathogens, parasites, weed seeds, heavy metals, and even antibiotics, disinfectants, and insecticides, when these are present on the farm. In 1988, an expert panel convened by the World Health Organization identified liquid manure spreading as a critical pathway by which salmonellae and other pathogens are transferred to the natural environment.

… [O]ptions exist for safer, more environmentally-friendly hog production using pastures (outdoor production) and deep-bedding (indoor production) that are within the financial range of independent family farmers. Being more management-intensive than capital-intensive, these other options, if mandated, could also allow independent family farmers to compete with larger operations on a playing field that favors hands on husbandry and management over capital.

C. Part of the Pig Really Does Fly

… Neighbors of hog factories report not being able to go outdoors or let their children play outdoors due to odors from nearby hog factories. Some report lining their windows and fireplaces with plastic to keep the stench from coming into their homes.

Animal factories need not be large to create a problem. Increasingly, to save on labor and because the technology is almost exclusively recommended by the industry and land grant universities, smaller farmers have adopted liquid manure handling systems and create the same detrimental effects, albeit on a smaller scale. Recent studies have shown that dusts and gases responsible for hog factory odors are having serious respiratory impacts on nearby residents.

As much as 70–80% of the nitrogen in a liquid manure storage facility changes from liquid to ammonia gas and escapes into the atmosphere. The gaseous ammonia returns to earth, precipitated from the atmosphere by rain. Nitrogen-enriched rainfall contributes to excessive algae growth and can damage or alter natural habitats, for instance, causing nitrogen-loving plants to replace the existing flora in a given area. Methane is a significant greenhouse gas that is emitted by liquid manure storage.

The most significant contribution to the reduction in greenhouse gasses that farms can make is to change manure management. The change can go in two directions: away from liquid manure and open lagoon storage toward more costly and complex management systems, such as electricity generation from methane, or toward ecologically sound and less complex management systems, such as manure handling incorporating straw or other natural bedding and composting. The latter direction is least costly for small livestock farms and not only reduces greenhouse gases, but replenishes the soil carbon.

Organic Consumers Association (OCA): Background on OCA (Organic Consumers Association n.d.)

The OCA is a grassroots non-profit public interest organization which deals with crucial issues of food safety, industrial agriculture, genetic engineering, corporate accountability, and environmental sustainability. We are the only organization in the US focused exclusively on representing the views and interests of the nation's estimated ten million organic consumers….

Our web site, research, and media team are considered by reporters and radio talk show hosts to be among some of the nation's top experts on food safety and organic food. Our media team provides background information, interviews, and story ideas to TV and radio producers and journalists on a daily basis--from national TV networks to the alternative press. Our field organizers provide advice and coaching to grassroots activists across the nation and coordinate our network of 10,000 volunteers.

Organic Consumers Association: "Hazards of Genetically Engineered Foods and Crops" (Cummins n.d.)

GE is a revolutionary new technology that is still in its early experimental stages of development. This technology has the power to break down the natural genetic barriers – not only between species – but between humans, animals, and plants.

Randomly inserting together the genes of non-related species-utilizing viruses, antibiotic-resistant genes, and bacteria as vectors, markers, and promoters-permanently alters their genetic codes.

The gene-altered organisms that are created pass these genetic changes onto their offspring through heredity. Gene engineers all over the world are now snipping, inserting, recombining, rearranging, editing, and programming genetic material. Animal genes and even human genes are randomly inserted into the chromosomes of plants, fish, and animals, creating heretofore unimaginable transgenic life forms. For the first time in history, transnational biotechnology corporations are becoming the architects and "owners" of life.

With little or no regulatory restraints, labeling requirements, or scientific protocol, bio-engineers have begun creating hundreds of new GE "Frankenfoods" and crops. The research is done with little concern for the human and environmental hazards and the negative socioeconomic impacts on the world's several billion farmers and rural villagers.

An increasing number of scientists are warning that current gene-splicing techniques are crude, inexact, and unpredictable-and therefore inherently dangerous. Yet, pro-biotech governments and regulatory agencies, led by the US, maintain that GE foods and crops are "substantially equivalent" to conventional foods, and therefore require neither mandatory labeling nor pre-market safety-testing.

GE food and fiber products are inherently unpredictable and dangerous—for humans, for animals, the environment, and for the future of sustainable and organic agriculture. As Dr. Michael Antoniou, a British molecular scientist points out, gene-splicing has already resulted in the "unexpected production of toxic substances… in genetically engineered bacteria, yeast, plants, and animals with the problem remaining undetected until a major health hazard has arisen". The hazards of GE foods and crops fall into three categories: human health hazards, environmental hazards, and socio-economic hazards. A brief look at the already-proven and likely hazards of GE products provides a convincing argument for why we need a global moratorium on all GE foods and crops.

A. Toxins and Poisons

GE products clearly have the potential to be toxic and a threat to human health. In 1989, a genetically engineered brand of L-tryptophan, a common dietary supplement, killed 37 Americans. More than 5,000 others were permanently disabled or afflicted with a potentially fatal and painful blood disorder, eosinophilia myalgia syndrome (EMS), before it was recalled by the Food and Drug Administration (FDA). The manufacturer, Showa Denko, Japan's third largest chemical company, had for the first time in 1988–1989 used GE bacteria to produce the over-the-counter supplement. It is believed that the bacteria somehow became contaminated during the recombinant DNA process. Showa Denko has paid out over $2 billion in damages to EMS victims.

In 1999, front-page stories in the British press revealed Rowett Institute scientist Dr. Arpad Pusztai's explosive research findings that GE potatoes are poisonous to mammals. These potatoes were spliced with DNA from the snowdrop plant and a commonly used viral promoter, the Cauliflower Mosaic Virus (CaMv).

GE snowdrop potatoes were found to be significantly different in chemical composition from regular potatoes, and when fed to lab rats, damaged their vital organs and immune systems. The damage to the rats' stomach linings apparently was a severe viral infection caused by the CaMv viral promoter apparently giving the rats a severe viral infection. Most alarming of all, the CaMv viral promoter is spliced into nearly all GE foods and crops.

Dr. Pusztai's path breaking research work unfortunately remains incomplete. Government funding was cut off and he was fired after he spoke to the media. More and more scientists around the world are warning that genetic manipulation can increase the levels of natural plant toxins or allergens in foods (or create entirely new toxins) in unexpected ways by switching on genes that produce poisons. Since regulatory agencies do not currently require the kind of thorough chemical and feeding tests that Dr. Pusztai was conducting, consumers have now become involuntary guinea pigs in a vast genetic experiment. Dr. Pusztai warns, "Think of William Tell shooting an arrow at a target. Now put a blind-fold on the man doing the shooting and that's the reality of the genetic engineer doing a gene insertion".

B. Food Allergies

In 1996, a major GE food disaster was narrowly averted when Nebraska researchers learned that a Brazil nut gene spliced into soybeans could induce potentially fatal allergies in people sensitive to Brazil nuts. Animal tests of these Brazil nut-spliced soybeans had turned up negative. People with food allergies (which currently afflicts 8% of all American children), whose symptoms can range from mild unpleasantness to sudden death, may likely be harmed by exposure to foreign proteins spliced into common food products. Since humans have never before eaten most of the foreign proteins now being gene-spliced into foods, stringent pre-market safety-testing (including long-term animal feeding and volunteer human feeding studies) is necessary in order to prevent a future public health disaster.

Mandatory labeling is also necessary so that those suffering from food allergies can avoid hazardous GE foods and so that public health officials can trace allergens back to their source when GE-induced food allergies break out.

In fall 2001, public interest groups, including Friends of the Earth and the Organic Consumers Association, revealed that lab tests indicated that an illegal and likely allergenic variety of GE, Bt-spliced corn called StarLink, had been detected in Kraft Taco Bell shells, as well as many other brand name products. The StarLink controversy generated massive media coverage and resulted in the recall of hundreds of millions of dollars of food products and seeds.

C. Damage to Food Quality and Nutrition

A 1999 study by Dr. Marc Lappe published in the Journal of Medicinal Food found that concentrations of beneficial phytoestrogen compounds thought to protect against heart disease and cancer were lower in GE soybeans than in traditional strains. These and other studies, including Dr. Pusztai's, indicate that GE food will likely result in foods lower in quality and nutrition. For example, the milk from cows injected with rBGH contains higher levels of pus, bacteria, and fat.

Organic Consumers Association: "Enviropig Studies Search for Effects of Meat on Humans" (D'Amato 2001)

Scientists have, according to this story, made a genetically engineered pig, but no one has quite figured out how to test that pig to make sure it's safe to eat.

The new "enviropigs" – those genetically modified porkers who carry an extra gene that causes them to have less phosphorus in their manure – will be the first animals to be tested under Health Canada's guidelines for genetically modified foods.

These pigs, being raised at the University of Guelph, hold the promise of being environmentally friendly. The extra gene causes bodily changes that help them digest the phosphorus in their feed instead of excreting it, which means cleaner, more drinkable lakes, rivers and streams.

But the pigs' arrival also brings science to uncharted waters. Guelph microbiologist Cecil Forsberg, who helped create the pigs, was cited as saying that technology is moving "faster than a slim government agency can move," and it's not clear, for example, how to test the pork to ensure it's safe.

The story says that Forsberg is working with federal government scientists to develop a policy to test genetically modified meat and that currently, a policy exists only for plants, which are biologically less complex. The extra gene causes production of the enzyme phytase, which lets the pig digest phosphorus in its feed. Trace amounts of phytase have been found elsewhere in the pig's body. There's a chance that humans might have allergic reactions to it, and also to the E. coli bacteria and mouse genes that were used to make the extra gene. But it's difficult to test for allergic reactions, especially on a substance that hasn't caused a reaction in humans before. You can't test on mice or rats because their immune systems are so different from humans.

All these questions are part of what concerns other scientists, who say there isn't enough testing on genetically modified foods, and we can't be sure they're safe.

Hugh Lehman, a retired philosophy professor from the University of Guelph, was quoted as saying, "To me, it's very risky. Very small chemical differences can have profound implications. If it's anything people are going to eat, there should be extensive and rigorous testing," The story says that Lehman was among a group of high-ranking scientists who publicly warned earlier this year that our existing food supply could be contaminated by genetically engineered crops that haven't been tested rigorously enough.

In a recent interview, Lehman quoted the work of a Scottish scientist [Arpad Pusztai] who noticed abnormalities in rats that were fed genetically engineered potatoes. But Doug Powell, a University of Guelph professor of plant agriculture who is scientific director of the Centre for Safe Food in Guelph, was quoted as saying that research "has been largely repudiated" by other academics and that genetically engineered foods are subjected to much higher safety requirements and testing than new foods that are developed by traditional breeding practices.

Meanwhile, Forsberg said the new enviropigs appear to be physically normal, and he believes they'll be declared safe to eat within 5 years.

Organic Consumers Association: "Poll on Attitudes on Genetically Engineered Foods" (Council of Canada 2000)

Environics Research Group was commissioned by The Council of Canadians to conduct a national poll on consumer attitudes to genetically engineered foods. The telephone poll, which surveyed 902 Canadians between December 22, 1999 and January 16, 2000, is accurate within 3.3 percentage points, 19 times out of 20.

The following questions were asked of people who said they were somewhat or very familiar with "genetically engineered" or "genetically modified" foods:

Q 1. Do you strongly agree, somewhat agree, somewhat disagree or strongly disagree with each of the following statements:

a. I worry about the safety of genetically engineered foods
48% Strongly agree
27% Somewhat agree
75% TOTAL AGREE
13% Somewhat disagree
11% Strongly disagree
24% TOTAL DISAGREE

b. Genetically engineered foods should always be labeled as such.
87% Strongly agree
8% Somewhat agree
95% TOTAL AGREE
2% Somewhat disagree
2% Strongly disagree
4% TOTAL DISAGREE

c. Consumers should be able to buy food that is not genetically engineered.
80% Strongly agree
15% Somewhat agree
95% TOTAL AGREE
3% Somewhat disagree
1% Strongly disagree
4% TOTAL DISAGREE

d. I would prefer to buy non-genetically engineered foods, even if they were slightly more expensive.
45% Strongly agree
26% Somewhat agree
71% TOTAL AGREE
15% Somewhat disagree
11% Strongly disagree
26% TOTAL DISAGREE

Q 2. How confident are you in the federal government's ability to protect the safety and health of Canadians when it comes to genetically engineered food? Are you…?

11% Very confident
33% Somewhat confident
44% TOTAL CONFIDENT
33% Not very confident
23% Not at all confident
56% TOTAL NOT CONFIDENT

Q 3. Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree that Canada should be able to refuse to import genetically engineered foods from other countries if there are concerns about health or environmental safety?

84% Strongly agree
10% Somewhat agree
94% TOTAL AGREE
2% Somewhat disagree
4% Strongly disagree
6% TOTAL DISAGREE

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Chapter 23
Climate Change: Coastal Dead Zones*

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Abstract Many of the anticipated changes (increased streamflow, warmer temperatures, calmer summer winds, and increased depth due to sea-level rise) associated with global climate change would move the Chesapeake Bay ecosystem in the direction of worsening hypoxia (harmful oxygen depletion).

Keywords Climate change • Estuaries • Eutrophication • Hypoxia • Chesapeake Bay

Introduction

Climate change is likely to significantly complicate the achievement of environmental management objectives that presently command public attention and significant commitment of resources. This is particularly the case for coastal environments that are subject to numerous societal uses and pressures from human activities but also to concerted efforts to restore their ecological health and productivity. The Chesapeake Bay is a global model for such large-scale ecosystem restoration.

The Chesapeake Bay is the United States' largest and best-studied estuary. The bay is more than 190 miles long and its tidal waters cover more than 4,200 square miles. Its 64,000-square-mile watershed extends over six states and the District of Columbia and includes a population of approximately 16 million people.

*Excerpted from the full report, "Regional Impacts of Climate Change: Four Case Studies in the United States," Prepared for the Pew Center on Global Climate Change, December 2007. Retrieved 4 June 2009 from http://www.pewclimate.org/docUploads/Regional-Impacts-Chesapeake.pdf.

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The Chesapeake is situated along the transition between warm-temperate and cool-temperate regions and is influenced both by freshwater runoff and by the Atlantic Ocean. Consequently, the Chesapeake ecosystem has experienced substantial climatic variability over 4,000 years in its present geographic configuration.

Humans had begun altering the Chesapeake Bay ecosystem even before the arrival of Europeans; however, pervasive human effects became obvious only during the late twentieth century. In particular, eutrophication – the increase in organic matter loading due principally to inputs of nitrogen and phosphorus nutrients – has been recognized as the chief cause of degradation of the ecosystem and, consequently, has been the central focus of restoration efforts (Boesch et al. 2001; Kemp et al. 2005).

Eutrophication has manifold consequences in coastal ecosystems, including increased production of phytoplankton, including harmful or noxious algal blooms; decreased water clarity, resulting in loss of seagrasses; altered food chains; and severe depletion of dissolved oxygen in the water column (Cloern 2001). Particularly during the summer, dissolved oxygen can fall to very low levels in denser bottom waters that are isolated from the warmer surface waters (the source of oxygen replenishment). Depletion of dissolved oxygen (hypoxia) to levels that exclude fish, crustaceans, and mollusks, or even the complete absence of oxygen (anoxia), is a phenomenon that has increased in coastal waters around the world (Diaz and Rosenberg 1995). Commonly referred to as "dead zones," these expanding hypoxic regions have attracted wide attention from the public and policy-makers (Dybas 2005).

In the late 1980s, a concerted effort to reduce nutrient pollution in the Chesapeake Bay was initiated through the multistate–federal Chesapeake Bay Program. The present goal of the program is to reduce nutrient inputs sufficiently to restore water quality, including healthy dissolved oxygen conditions, by 2010. While the cost to society of the degradation of the Chesapeake Bay ecosystem is difficult to quantify fully, it is estimated that the cost of restoration, largely driven by stringent requirements to reduce hypoxia, exceeds $15 billion (Chesapeake Bay Watershed Blue Ribbon Finance Panel 2004). Despite already substantial public and private expenditures, reports of record-sized hypoxic zones in 2003 and 2005 raised public concerns about whether progress is really being made. Hypoxia in the Chesapeake Bay, and in most other regions experiencing this phenomenon, is greatly affected by climate, as well as by nutrient inputs from human activities. Indeed, climatic conditions, including some combination of high river inflows, warm temperatures, and relatively calm summer winds, were major factors in the extensive hypoxia that occurred in 2003 and 2005.

This case study examines how both climate variability and potential climate change can affect hypoxia in the Chesapeake Bay and can present additional challenges to ongoing ecosystem restoration. We use past observations to elucidate the multiple influences of climate on hypoxia and its consequences to the ecosystem. Using this empirical basis, we project how climate change during the rest of the twenty-first century is likely to affect hypoxia, and how climate change will challenge the achievement of restoration goals.

Climate Variability and Hypoxia

Recent variations in the climate of the Chesapeake Bay watershed have included a dry period in the 1960s, a wet period in the 1970s, and a period of unusually large inter-annual variability over the past 25 years (Boesch et al. 2001). Multi-year climate cycles such as the El Niño-Southern Oscillation and the North Atlantic Oscillation influence these regional climate variations (Austin 2002), as do more localized weather patterns and storms. Variations in precipitation and temperature affect the amount and timing of fresh water flowing into the Chesapeake Bay from the Susquehanna, Potomac, James, and other rivers. These inflows influence hypoxia in the bay by delivering nutrients that stimulate biological production and contribute to the density stratification of the estuarine waters (Hagy et al. 2004). Winds also play a role by forcing denser ocean waters into the bay or by vertically mixing the water column in the estuary. For example, the volume of hypoxic water during the summer of 2005 was particularly large in part because summer winds were weaker than normal, allowing bay waters to remain strongly stratified.

Hypoxia thus has both natural and human causes and has occurred at some level in the Chesapeake Bay for more than 2,500 years (Cooper and Brush 1993). However, hypoxia in the bottom waters of the mainstem bay has become more frequent, widespread, and severe since the 1960s (Hagy et al. 2004). The natural factors that make the bay susceptible to oxygen depletion include its deep central channel, which acts as a basin to contain the dense, low-oxygen waters; the bay's high ratio of watershed area to volume, leading to large nutrient exports from the watershed into a limited volume of receiving water; and high variability of freshwater flow (Kemp et al. 2005). Anthropogenic causes are largely related to the greatly increased nutrient loading that has occurred since the mid-twentieth century (Boynton et al. 1995; Harding and Perry 1997). The higher nutrient levels increase phytoplankton biomass, particularly in the spring. The increase in impervious surface area on the landscape (e.g., from roads and other development) and other land use changes may also affect the volume and timing of freshwater runoff (Jennings and Jarnagin 2002; Jones et al. 2001). Because nutrient loading to the bay is closely tied to freshwater input, the interaction between climate and anthropogenic nutrient loading will be particularly important in determining future hypoxic events in the Chesapeake.

Freshwater flow into the Chesapeake Bay is typically greatest during the spring. This spring freshet – a freshwater pulse resulting partly from snowmelt – delivers sediment and nutrients that act in concert to control the timing, position, and magnitude of a spring phytoplankton bloom – light limitation controls phytoplankton in the upper estuary (closer to the Susquehanna River) and nutrient stimulation enhances it in the middle to lower estuary (closer to the ocean) (Harding 1994). The freshet is, to a large degree, controlled by the winter weather (Miller et al. 2006). Drier than normal winters mean very little precipitation is stored in the form of snow in the upper watershed, resulting in less spring runoff. Conversely, wet winters that have high frequencies of storm events result in more snow stored in the

watershed and later released to the estuary as snowmelt runoff in the spring (Najjar 1999). The organic matter produced during the spring bloom is retained particularly in the middle reaches of the bay, as the estuarine circulation produces a net return flow of bottom waters (Boicourt 1993). The settling material is eventually decomposed in the bottom layer by microbes that consume oxygen in proportion to available organic matter and thus cause hypoxic conditions in waters deeper than about 30 ft (Kemp et al. 1992). Because fresh water is less dense than salt water, the freshet also increases water-column stratification, preventing the resupply of oxygen from the surface.

The resulting hypoxia affects the cycling of nutrients and other materials in the ecosystem, causes stress and mortality in biota, and changes interactions between predators and their prey, thus impairing normal ecosystem function (Breitburg et al. 1997). Small zooplankton swim upward to avoid low oxygen. They may also be subject to increased predation by jellyfish, which are more tolerant of low oxygen than are other predators. Changes in zooplankton biomass and behavior may reduce key prey for larval fish that use the estuary as a nursery. Benthic (bottom dwelling) organisms are especially vulnerable to hypoxia, as they are unable to flee low-oxygen conditions (Diaz and Rosenberg 1995). Other animals alter their customary behavior – for example, blue crabs (*Callinectes sapidus*) may alter their migration routes to lower-bay spawning areas. Striped bass (*Morone saxatilis*) experience severe habitat restriction and physiological stress in summer as they try to avoid both the high temperatures of surface waters and low oxygen of bottom waters (Coutant 1985). Therefore, by driving hypoxia, nutrient pollution – as modulated by climate variability – affects commercially and recreationally important fisheries in the Chesapeake Bay (Houde and Rutherford 1993).

Changes in nutrient inputs, combined with variability in freshwater flow, have produced large inter-annual variability in the spatial extent and volume of hypoxic water in the Chesapeake Bay, as revealed by records extending from the 1950s (Hagy et al. 2004). Understanding these highly variable records provides insights into possible ecosystem responses to future climate change. A wetter climate would likely result in enhanced phytoplankton production that extends farther down the bay, providing more organic matter to fuel summer hypoxia. A drier climate would likely be characterized by smaller input of nutrients, reduced phytoplankton production, and blooms confined to the upper estuary. The location, timing, and magnitude of the spring bloom, and its subsequent degradation, all combine to affect the severity of summer hypoxia.

Modeling of Future Climate Change and Ecosystem Consequences

Projecting the ecosystem response to potential climate change requires an understanding of how precipitation, river runoff, sea level, temperature, and wind will vary and interact with biological processes in the future. These multiple drivers and

Table 23.1 The influence of multiple climate drivers on the extent and severity of hypoxia in the Chesapeake Bay

Climate driver	Direct effect	Secondary effect	Influence on Hypoxia
Increased temperature	More evapotranspiration	Decreased streamflow	+
		Land-use and cover changes	±
	Less snow cover	More nitrogen retention	–
	Warmer bay temperature	Stronger bay stratification	+
		Higher metabolic rates	+
More precipitation	More streamflow	Stronger bay stratification	+
		More nutrient loading	+
	More extreme rainfall	Greater erosion of soil P	+
Less precipitation	Less streamflow	Weaker bay stratification	–
		Less nutrient loading	–
Higher sea level	Greater bay depth/volume	Stronger bay stratification	+
		Greater bottom water volume	–
		Less hydraulic mixing	+
	Less tidal marsh	Diminished nutrient trapping	+
Weaker summer wind	Less water column mixing	More persistent stratification	+
Stronger summer wind	More water column mixing	Less persistent stratification	–

their relationship to hypoxia can vary considerably (Table 23.1). Effects of some drivers are relatively direct; for example, increased runoff would likely exacerbate hypoxia. For more complex drivers, it is sometimes difficult to predict the direction, much less the magnitude, of their effect on hypoxia. For example, warmer temperatures could expand agricultural production, increasing nutrient runoff, causing increased algal blooms and greater hypoxia. Conversely, reduced soil moisture during the summer could force abandonment of some crops or increase the use of irrigation. Such complex interactions occur on spatial and temporal scales smaller and shorter than can be resolved by the global climate simulation models used to forecast climate changes. Furthermore, necessary simplifications as well as incompletely understood physical feedbacks contribute to uncertainties in the models used to project future climate variability and change. However, newer models are producing results that are increasingly consistent with observations of recent climate trends (DeGaetano and Allen 2002), inspiring greater confidence in model results, especially regarding temperature projections.

Assessments of climate change impacts in the Mid-Atlantic region, conducted as part of the U.S. National Assessment of Consequences of Climate Variability and Change (Fisher et al. 2000), relied on an earlier generation of coupled ocean-atmosphere general circulation models, specifically the then-available versions of models from the U.K. Hadley and Canadian climate centers. Using these models

(Najjar et al. 2000) projected that spring streamflow in the Susquehanna River could change by +12% to –4% by 2030 and +4% to –25% by 2095. Based on the 2030 projections, they estimated that average hypoxic volume in the Chesapeake Bay could increase as much as 31% or decrease by 10%. Earlier (Najjar 1999) used geographically downscaled projections from a version of the GENESIS general circulation model to project an increase in streamflow down the Susquehanna River of 24 ± 13% under a doubling of atmospheric carbon dioxide (CO_2).

The newest generation of climate models has improved both spatial resolution and large-scale heat balances. These models no longer require adjustments to match observations as did earlier models (Bader 2004). On average, the latest models project an increase in annual precipitation for the East Coast of the U.S., but with regional uncertainty (Christensen et al. 2007). Although applying newer models to project streamflow is beyond the scope of this brief review, it is instructive to examine whether the newer models might change or sharpen earlier projections for future streamflow. A recent high-resolution model covering the continental United States projects only small differences in the degree of change within the Chesapeake Bay watershed for current-generation and earlier models (Diffenbaugh et al. 2005). Thus we examined results for the generalized Chesapeake region from the U.S. Community Climate System Model (CCSM3) and a newer version of the U.K. Hadley Centre for Climate Prediction and Research model (HadCM3) for a range of possible greenhouse gas forcing scenarios.

The projected changes in average monthly precipitation for the Chesapeake Bay region by the end of the twenty-first century are shown in Fig. 23.1 for two scenarios used in Intergovernmental Panel on Climate Change (IPCC) assessments: the A1B

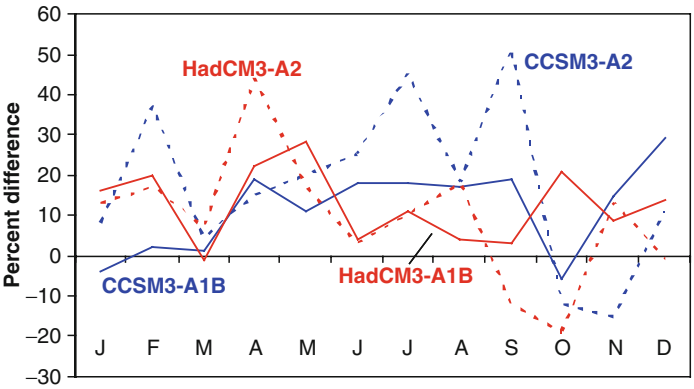

Fig. 23.1 Projections of the changes in average precipitation (by month) for the Chesapeake Bay region by the end of the twenty-first century, based on two different climate models (HadCM3 and CCSM3) run under identical forcing scenarios: the IPCC scenarios A1B (reversing the growth of greenhouse gases by mid century) shown as *solid lines* and A2 (unrestrained growth in greenhouse gas concentrations throughout the century) as *dashed lines*

(reversing the growth of greenhouse gases by mid century) and A2 (unrestrained growth in greenhouse concentrations throughout the century). In general, the two models agreed in their projection of more precipitation during most of the year, except during fall, when some modeled scenarios projected decreased precipitation. As would be expected, the more rapidly warming A2 scenario produced wider ranges in precipitation, with increases greater than 30% in some months and decreases greater than 10% in the fall. One should bear in mind that in a warmer world, increased losses due to evapotranspiration would be expected to moderate the effects of increased precipitation on streamflow, particularly during the summer. Presently, two-thirds of all precipitation returns to the atmosphere via the combined effects of surface evaporation and plant-mediated soil drying (Neff et al. 2000).

Although these results await detailed hydrologic modeling, their implications for inflows to the Chesapeake Bay can be summarized as (1) increased inflows during winter, due to increased precipitation and less storage as snow; (2) somewhat increased runoff during spring, but without a pronounced freshet from snowmelt, (3) inflows during summer generally similar to the present; and (4) possibly decreased streamflow during fall. In general, moderate increases (in the range of 10–15%) in delivery of fresh water and, potentially, nutrients from nonpoint sources should be expected. Previous results (Najjar et al. 2000) suggest a wider range of possible changes in precipitation and inflows (because of the inclusion of a Canadian Climate Centre model that produced hotter and drier projections). The newer models are more in agreement with the other model they used as well as with the fine-scale model of (Diffenbaugh et al. 2005), which also found modest increases in average rainfall and in extreme rainfall frequency in the Chesapeake watershed for both the A2 and A1B scenarios. Similar projections also appear in a more recent assessment for the northeastern U.S. (Hayhoe et al. 2007).

There is generally a greater degree of confidence in projections of temperature than of precipitation. Both the CCSM3 and HadCM3 models project greater warming of air temperature for the Chesapeake Bay region (3–4.5°C by the end of the century based on the A1B and A2 scenarios) than for the global averages for those models. Both models predict the greatest warming to occur during summer, with maximum increases ranging from 3.5°C to 6.5°C and an increase in extremely warm days, clustered in the summer months, under conditions of modest winds. The timing of this warming is significant not only because it would increase evapotranspiration and decrease soil moisture, but also because it would result in warmer water temperatures in the bay during the time that hypoxia is most prominent.

Greater and earlier warming of the bay would have multiple effects on hypoxia. First, higher temperatures would reduce the amount of oxygen that can be dissolved in the water, leading to lower overall oxygen content that would be depleted by respiration of biota. Observations from past years with similar freshwater discharges suggest progressively earlier onset of hypoxia when the deep-water column warms early (Hagy et al. 2004). Second, warmer summertime air temperatures would enhance the stratification (and thereby reduce the exchange) between the warmer surface waters and cooler deep waters. Third, both photosynthesis

and respiration are temperature-dependent processes and thus the rates of production, decomposition, and nutrient cycling would likely increase under warmer conditions. Although as much as 70% of the variance in the extent of hypoxia is explained by springtime runoff, a significant fraction of the remaining variability is due to whether summertime weather conditions are conducive either to stratification or to wind mixing and oxygenation of the water column. Thus, increased summertime temperatures, especially if coincident with reduced winds, would lead to more persistent stratification and the expansion of hypoxia into shallower areas of the bay.

Chesapeake Bay hypoxia may also respond to accelerated sea-level rise resulting from global warming. Locally experienced sea-level rise is also partially due to land subsidence resulting from the post-glacial rebound of regions to the north, as well as other local effects such as groundwater withdrawal. Coupling regional subsidence with IPCC Third Assessment projections of global sea-level rise (Wood et al. 2002) projected an increase of relative sea levels for the Chesapeake Bay region of 38–87 cm (15–34 in.) by the last decade in the twenty-first century. Assuming a central estimate of approximately 60 cm (24 in.), this increase is twice the locally observed rise in sea level during the twentieth century and would increase the volume of the bay by 9%, unless counteracted by the increased infilling of the bay with sediment (Cronin et al. 2003).

Sea-level rise would have two potentially competing effects on the volume and duration of hypoxic conditions. As the depth of the Chesapeake Bay increases, the proportional volume of ocean waters filling the bay would also increase without compensatory increases in freshwater flow. This would allow salty bottom waters to penetrate farther up the bay, thus increasing stratification and hypoxia. Assuming that the depth of the discontinuity between the less dense surface water and the denser water below would remain the same, it would also increase the volume of bottom water from which oxygen would have to be depleted to generate hypoxia. Changes in the circulation in the bay could occur, as increasing water depth reduces the effect of the sill that lies off Rappahannock Spit in the lower Bay. This hydraulic control point currently enhances vertical mixing (Chao and Paluszkiewicz 1991). Reduction in mixing would further isolate the salty bottom water from the upper layer and reinforce stratification over a broader region of the bay.

Although some clues to the changes in hypoxia that might occur under climate change can be gleaned from the responses to inter-annual variations discussed earlier, the Chesapeake Bay ecosystem is physically and biologically complex and therefore somewhat unpredictable. Prolonged shifts in climate and its variability, or in the biota inhabiting the bay, may have unprecedented effects that drive the ecosystem to a new state. Such a change in state may have already occurred during the late twentieth century – Hagy et al. (2004) could ascribe only part of the increases in hypoxic volume to enhanced nutrient loading, suggesting that some reduction in the resilience of the ecosystem over time, such as a further reduction in filter feeders (e.g., oysters), may have occurred.

Management Implications

Although the Chesapeake 2000 Agreement (Chesapeake Bay Program 1999) expanded the multiple objectives of the Chesapeake Bay Program, the program's central focus remains alleviating hypoxia and other undesirable effects of eutrophication through the significant reduction of nutrient inputs. New nutrient reduction goals for 2010 were based on inverse computer models, essentially "back calculations" that predict the nutrient load reductions necessary to return water quality to levels needed to support living resources. These water quality objectives were determined based on known biological requirements for oxygen and light in various depth zones along the bay and its major tributaries. The Chesapeake Bay Program has estimated that on a bay-wide basis, reductions of 48% and 53% are required for nitrogen and phosphorus, respectively (derived from a 1985 baseline load (Koroncai et al. 2003)). The most demanding requirement for these new targets is the load reductions needed to reduce hypoxia in the central trough of the bay to levels more typical of the mid-twentieth century.

Estimates of nutrient inputs to the bay indicate that some reduction has been achieved, but confidence in these estimates is low. Watershed models have been used to track estimated load reductions based on the management actions taken and assumptions about their effectiveness. However, the representation of such virtual accounting as a measure of progress has been sharply criticized in recent report (Government Accountability Office 2005), which emphasized the need for real-world measurements and integrated assessments of progress. One such measure of progress is the change in loadings of nutrients from the major rivers discharging to the bay. However, the results of such monitoring are also difficult to evaluate, in large part because of the climatic variability that affects the amount and timing of freshwater discharges. Flow-adjustment techniques used to compare concentrations over time show statistically significant downward trends in nutrient concentrations for many of the major rivers, including the Susquehanna (Langland et al. 2004), but these results often do not match well with watershed model projections. Because climatic variations also affect the processes creating, maintaining, and dissipating hypoxia in the bay itself, these watershed and estuarine processes conspire to create variability that has made it difficult to see much improvement in hypoxia in the bay at present (Chesapeake Bay Program 2006).

Climate change is likely to affect hypoxia in myriad ways, sometimes with opposing results. In addition to changes to the physical drivers of freshwater discharge, temperature, water depth, and winds, processes in the watershed that govern the delivery of nutrients and sediment are likely to change. Climate-influenced changes in forests, land uses, and agricultural practices will surely occur. Reduction in snow cover could result in less runoff of atmospherically deposited nitrogen during snow melt and more retention within forests. Increases in extreme rainfall events may cause more phosphorus delivery as a result of soil erosion. Other important changes in the estuary itself include the probable reduction in tidal wetlands (which serve as important nutrient traps) due to sea-level rise.

While we lack the full understanding needed to integrate all of these factors into a reliable projection of future hypoxic conditions in the Chesapeake Bay, many of the anticipated changes (increased streamflow, warmer temperatures, calmer summer winds, and increased depth due to sea-level rise) would move the ecosystem in the direction of worsening hypoxia. This conclusion is consistent with the simulations of hypoxia in the Gulf of Mexico performed under climate change scenarios (Justić et al. 2003). If the bay does face these anticipated changes, nutrient loads would have to be reduced further – beyond current targets – to meet the water quality objectives needed to support living resources. Given the long lag times, both in terms of implementation of nutrient control strategies and in ecosystem response, it is not too early to begin assessing the implications of climate change on management objectives for hypoxia and for Chesapeake Bay restoration in general. At a minimum, the linked watershed and estuarine models used to determine nutrient load reduction targets should be run using reasonable assumptions for a range of mid-twenty-first century streamflows, temperatures, and estuarine volume. This update would provide an estimate of the sensitivity of management objectives related to the alleviation of hypoxia to climate change.

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Chapter 24
Nanotechnology: Nanotechnology and Human Enhancement*

Deb Bennett-Woods

Abstract A journey into the future of medicine and the ethical concerns raised by the use of techniques of nanotechnology, biotechnology, and cognitive science for the purpose of human enhancement.

Keywords Nanotechnology • Biotechnology • Information technology • Cognitive science • Medicine • Human enhancement

The Context Described: Evolution of the Human Person

> The most exciting breakthroughs of the twenty-first century will not occur because of technology but because of an expanding concept of what it means to be human. (Naisbitt and Aburdene 1990)

The traditional goal of medical therapy has been to simply treat an existing disease or injury, as opposed to treatment for purposes of enhancements that are intended to go beyond the boundaries of normal human functioning and health. However, emerging technologies are blurring the line between the two (Ebbesen and Jensen 2006). For all practical purposes, nearly any technology that can restore function will likely be able to enhance function as well. Commonly referred to as

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NBIC (nanotechnology, biotechnology, information technology and cognitive science), the convergence of these technological capacities provides the basis for manipulating pretty much every aspect of human functioning (Roco 2003). With the prospect of such powerful technologies at hand, it seems only logical and inevitable that the enhancement of basic human capabilities and life extension would follow at some point.

Is there a practical or ethical difference between injecting nano-enhanced red blood cells and placing a patient on oxygen, or a respirator, or providing a medication that enhances oxygen intake? Why replace red blood cells with an exact replica when it might be possible to create a technologically superior artificial cell capable of carrying enough oxygen to allow you to survive an extended loss of cardiac or respiratory function?

Likewise, if medical advances such as human organ transplants are acceptable, why shouldn't we develop nano-engineered organs to overcome the scarcity of human organs?

If it is possible to create neural implants that preserve memory in a brain damaged by Alzheimer's disease, why not also provide enhanced capacity for general information storage and computational speed? Why stop at repairing a gene when you can select for or engineer genetic enhancements prior to birth? (Bennett-Woods 2007).

The recent history of medicine gives some indication of how readily such enhancements are likely to be embraced. Assisted reproduction, cardio-pulmonary resuscitation and advanced life support have all been considered to have crossed a moral line when first introduced, yet all have become standards of care in the years since. Despite persistent objections of some faith and cultural traditions, thousands of babies are born each year by in vitro fertilization techniques. We maintain the lives of severely premature neonates and dying elders long past the point at which they would be physiologically capable of functioning on their own. And, although we do have some qualms about these abilities, the technologies themselves are generally portrayed in the media as examples of the "miracles" of modern medicine.

Human beings have an innate appreciation of and drive for perfection. In few places is this more evident than the extraordinary increase in elective cosmetic surgeries or the rising use of genetic screening to detect abnormalities and terminate pregnancies on that basis. Writers such as Hughes (2004), Naam (2005), and Bailey (2005) strongly advocate human performance enhancement as a means of liberating us from the narrow evolutionary boundaries set by genetics (Naisbitt and Aburdene 1990). Others, such as Fukuyama (2002) and McKibben (2003), are critical of pursuing these powerful technologies too quickly or at all, envisioning a widening gulf of social disparities or the loss of human identity and values (Bennett-Woods 2007). The popular culture resides somewhere in between, as we find ourselves torn between the popular media images of Frankenstein on one hand and mutant superheroes on the other. Our ongoing fascination with human enhancement seems related to the same general fascination we have with horror films. They entertain precisely because of their power to frighten and horrify us

(Bennett-Woods 2007). At the same time, they stimulate our natural curiosity and imagination while also satisfying our desire for novelty and adventure.

Encouraged in large part by the ELSI initiative of the Human Genome Project, much scholarly attention has been paid to the possibility of human enhancement and radical life extension. For example, while not focused on nanotechnology per say, *Beyond Therapy: Biotechnology and the Pursuit of Happiness*, produced by the President's Council on Bioethics in 2003, addressed the issue of human performance enhancement broadly. The report strikes a cautionary note on proceeding too quickly with biotechnologies intended to enhance human performance and extend the human lifespan. It warns against a "dangerous utopianism" that neglects the nature and limits of human happiness (President's Council on Bioethics 2003).

Human performance enhancement is generally at least mentioned in passing in virtually all of the major reports from the NNI, NSF and others that include medical applications (Roco and Bainbridge 2003a), as well as in counterpart reports such as from the European Technology Platform on NanoMedicine (2006). For example, an NSF/DOC sponsored report from 2002 strikes a far more optimistic chord than the President's Commission by stating that the long-term implications of human performance enhancement include improvements in:

- Societal productivity, in terms of well-being as well as economic growth
- Security from natural and human-generated disasters
- Individual and group performance and communication
- Life-long learning, graceful aging, and a healthy life
- Coherent technological developments and their integration with human activities
- Human evolution, including individual and cultural evolution (Roco and Bainbridge 2003a)

The overall tone of contributors to these various NIH and NSF- sponsored reports is relentlessly positive in the area of human performance enhancement.

To date there are no widely embraced guidelines or standards for research and development that is either intended to result in human enhancement capabilities or likely to do so incidentally.

The highly visible, morally controversial, and conflicted depictions of these particular applications of nanotechnologies results in a difficult context to describe. There are little or no facts and figures on which to base an analysis, no regulatory precedents, no good historical analogies and no societal consensus. In fact, it is likely there is not much genuine social awareness of the issues at hand. Advocates of nanotechnology tend to downplay concerns about radical human enhancement as either too far out in time to concern us now, or simply more fiction than science. Critics of nanotechnology focus on the same concerns in a way that often appears intent upon overshadowing the broader societal dialogue. Neither approach is wise, nor will either stimulate the thoughtful dialogue that needs to happen if we are to make informed choices about technologies as they are developed. We are treading new ground as we re-imagine the foundational assumptions of medicine, health and, ultimately, human identity and meaning.

Clarifying the Purpose

Examining the ethical issues raised by nanotechnology and human performance enhancement is fundamentally an exercise in imagining the whole of the future human enterprise. We are a technological society that places great value on science, innovation and progress. We are proud of our technological accomplishments and share a well-established faith in the ability of technology to solve problems and enhance our lives. Nowhere is this truer or better deserved than in medicine; however such beliefs are not without challenge. Nanotechnology raises legitimate concerns and novel challenges as well as novel opportunities.

The first challenge is to ask what goals we are attempting to achieve in our search for scientific knowledge and its resulting technologies. Are we obligated to use knowledge once it has been acquired and for what ends? How and why should we approach this unprecedented opportunity to manipulate life, death and our experience of everything in between?

The second challenge becomes one of whether or not to set limits on these technologies and, if so, what limits to set and how to enforce them. Does our human inclination toward discovery and manipulation of our environment make it natural, inevitable and desirable that we use all knowledge and technology? How can we prevent our scientific and technological capabilities from simply outpacing our ability to assess and respond to the deep impact on human culture and society? If we set the limits too tightly, might we fail to realize a new and beneficial level of human achievement, self-actualization and transcendence? On the other hand, if we fail to set limits will we initiate a form of technological determinism in which too much power is too easily used without the full appreciation of how to use it well? (Bennett-Woods 2007). What criteria can be used to assess the benefits and harms for a state of existence for which we have no precedent?

The third challenge involves the extent to which we can and should prepare for changes to the definition of human health, the goals of medicine and perhaps even the definition of a human person (Bennett-Woods 2007). How do we define or re-define health in the face of radical human enhancement technologies? Should genetic, sensory, mechanical and cognitive enhancements be valued differently? In other words, are some enhancements fundamentally more or less acceptable than others? (Bennett-Woods 2007). How can we mediate deep-seated cultural assumptions about social class, political power, market-driven economics, and traditional values of fairness and due process when responding to these inherently disruptive technologies? For example, how can we avoid a tyranny of the enhanced if past forms of intolerance and inequity based on race, gender, age and culture are simply transferred over to those for whom enhancements are not available? (Bennett-Woods 2007).

Framing the Ethical Questions

The President's Council report cited earlier identifies the same basic ethical concerns discussed regarding medicine in the prior chapter of this book. They include issues of safety and bodily harm (health), unfairness, equality of access and liberty

(freedom and coercion) (President's Council on Bioethics 2003). These lead to ethical questions similar to those posed about nanomedicine; however, they are also different insofar as we have crossed the line from compassionate therapy and restoration of normal functioning to fundamental changes in human abilities and the unprecedented capacity for biological self-design.

- Should persons be able to pursue human enhancement on the basis of personal autonomy and liberty? Will the compulsory nature of new technologies limit autonomous choice?
- Will persons who choose not to pursue human enhancement become a vulnerable population in need of protection?
- Do the utilitarian benefits of human enhancement outweigh the costs or harms?
- Once available, do we have a duty of fidelity to provide enhancement technologies to all members of the community?
- If not, how do we minimize the social, economic and political inequities likely to accrue to those who do not have access?

In addition to these questions, the prospect of human enhancement and life extension also poses deeper and more complex questions.

- What is the essence of a human person?
- How much of a human person can be manipulated, replaced or enhanced beyond its natural function before it becomes something more or less than human?
- Will the application of performance enhancing technologies before birth and in early childhood be inherently oppressive and a violation of individual human identity?
- Will human performance enhancement alter the purpose and meaning of suffering, striving and achievement?

The Principle of Respect for Communities Applied

The principle of respect for communities requires that we act in ways that respect the ability of communities to act as autonomous, self-governing agents. However, human enhancement may alter key elements of our self-identity and, by extension, our communal identity. It may change the nature of our relationships with each other and the world. Any consideration of communal autonomy must also start with individual autonomy.

The Human Person

At the core of the discussion is the definition of the *human person*, an overtly complex concept whose understanding has been severely fragmented by differing perspectives. The biological sciences view the human person in narrowly biological terms and boundaries. The social sciences have a somewhat expanded view of the

person that incorporates self-awareness and the social nature of persons. Religion and philosophy assert yet a deeper meaning and purpose to the concept of a human person. Among these various perspectives, the boundaries of the human person are already highly disputed. As evidenced by ongoing debate on topics such as abortion, stem cell research and end of life care, we do not agree on when the moral status of a person starts and when it ends. We also don't agree on what the limits of our obligations are to a person; however, these ongoing cultural debates regarding the moral and legal status of human embryos and other entities at the margins of human functioning will ultimately frame the questions and responses needed to evaluate the meaning of human agency and identity in the face of radical life extension and performance enhancements.

What makes a human being human? What makes a human person a person? Many would argue these two concepts are not the same thing, with the human being narrowly defined by gross biological and physiological characteristics such as human DNA. The concept of a human person is often argued to incorporate higher order capacities such as consciousness, reasoning, self-motivated activity, communication, and self-concept (Warren 1973), or at least the potential for these capacities. In the case of issues such as abortion or treatment for patients in permanent vegetative states, the argument is whether there is a point at which such capacities exist at such a low level as to disqualify an entity from being a person in the moral sense. However, what about the possibility of capacities of consciousness, reasoning, or communication that go well beyond what any current human person holds. Human cognitive enhancement may introduce entirely new capacities for creative thought or reasoning we can't really imagine on this side of it. This raises the intriguing question of whether there are aspects of human functioning, perhaps general intelligence, memory, or emotional capacity, that are so central to human identity that they should not be subject to alteration or manipulation. What percentage of the human body can be replaced or enhanced with artificial or bioengineered components before the entity in question is something more or less than human?

Ultimately, despite the efforts of philosophers, bioethicists and theologians to construct complex definitions and rationales to answer these questions, the average citizen is somewhat more likely to draw on popular culture and personal experience. The audience was most relieved when the Star Trek character of Data, the android, was saved from being disassembled by his "Creator" thanks to the aggressive defense of Captain Picard on his assertion that rational beings have a right to autonomous choice. (The Measure of a Man. Star Trek Next Generation Season 2: Episode 9.) Throughout the series, fans cheered on his emerging "personhood" as he struggled to understand and experience human emotion. Perhaps someday, the pioneers of human enhancement technologies will be in the position of cheering on the rest of humanity as we adopt the new technologies in order to "catch-up" and realize our newly imagined human potential.

The question of boundaries is already quite fuzzy. We are all acquainted with people who have cochlear implants, pacemakers or artificial limbs. Our experience is that they are fundamentally still the same persons, and would likely remain so even if their technology performed a bit above the human norm. The widespread

acceptance of cell phones and other wireless technology has more than paved the way for the simple convenience of miniaturized, implantable communication devices that allow for hands-free operation and cannot be easily lost or stolen. Once widely available in the marketplace, can other forms of neuroenhancement be far behind? To what extent will distinguishing traits and abilities become commodities to be purchased in place of gifts to be developed, and how will this affect the symbolic notion of individual human identity?

The Human Person in Community

Bringing us back to the notion of communal autonomy, what, if anything, might constitute the line in the sand that we collectively are unwilling to cross in our definition of persons among us? Perhaps even more importantly, how exactly will we come to some manner of consensus on these questions? The principle of respect for communities rests on the shared values and ongoing dialog of members of a community. It assumes that communities have a moral right to be self-determining, to make autonomous choices about their own best interests. However, autonomous choices require information and the ability to weigh the likely consequences of our choices. How can we weigh a current existence against one for which we may have little practical insight? How are communities likely to react to an altered conception of human identity? Will human performance enhancement make communities more or less homogenous? Naam suggests that we won't all choose the same enhancements but will continue to express our individuality through the technological enhancements and abilities we choose to adopt (Naam 2005). Will the choice to literally evolve in different directions ultimately build community? Perhaps it will simply fragment and cluster along different lines than it is currently. At the other end of possibilities, an aggressive focus on the evolution of individuals, according to their own preferences, may render the concept of community, as we know it, obsolete. New models of society may emerge that allow us to share space and resources without socially constructed boundaries that currently define where one community starts and another ends. This potential impact on how we live in or out of community may be the single greatest challenge we face in the future.

The Principle of the Common Good Applied

The principle of the common good calls us to act in ways that respect shared values and promote the common good of communities. The common good is defined, in part, by our collective consensus on the conditions under which human beings thrive. These conditions include the social goods we value, the goals toward which we strive and the expectations associated with our communal roles. Proponents of human performance enhancement see tremendous opportunity to overcome

current problems and bring us closer to the ideals of the common good. Roco and Bainbridge propose a passionate defense of the pursuit of human enhancement.

> At this unique moment in the history of technical achievement, improvement of human performance becomes possible. Caught in the grip of social, political, and economic conflicts, the world hovers between optimism and pessimism. NBIC convergence can give us the means to deal successfully with these challenges by substantially enhancing human mental, physical, and social abilities. (Roco and Bainbridge 2003b)

They go on to conclude,

> The twenty-first century could end in world peace, universal prosperity, and evolution to a higher level of compassion and accomplishment. It is hard to find the right metaphor to see a century into the future, but it may be that humanity would become like a single, distributed and interconnected "brain" based in new core pathways of society. This will be an enhancement to the productivity and independence of individuals, giving them greater opportunities to achieve personal goals. (Roco and Bainbridge 2003b)

Of course, one man's future utopia is another man's dystopia. Returning to Star Trek for comparison, what these authors describe is uncomfortably close to the Borg, a cybernetically enhanced race who uses their collective intelligence to wander the galaxy assimilating other cultures and destroying those that resist (Who? Star Trek Next Generation and Season 29: Episode 16). Humans have not always used their power wisely, peacefully or with compassion. Serving a common good is not just a matter of consequences, but also a matter of intention. What might the intended goals be of human enhancement and what social goods would we expect to realize in our pursuit of a common good?

Health as an Expanded Social Good

The concept of health has long been deemed a societal good associated with a high level of normal human functioning. According to the World Health Organization (McKibben 2003), *health* can be defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organization 1948). However, human performance enhancement promises a state of existence that may far exceed a high level of normal functioning. Does the enhanced human simply become the new normal in light of a radically expanded biological potential?

How will we come to define society's best interests in light of potential human enhancement and life extension? The Preamble of the World Health Organization Constitution also specifies that "the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition" (World Health Organization 1948) What is the highest attainable standard of health? What interests of society are served if we adopt the assumption that we should provide whatever biotechnical enhancements are available to achieve each individual's

personal definition of health and well-being? Perhaps more importantly, what interests of society might we have to sacrifice in order to provide health per this expanded definition.

Other Communal Goals and Social Goods

Of course, society could reject the cost burden of providing enhancement to all members while still leaving the door open for those who wish to pursue it on the basis of personal liberty, another highly valued societal good. Other pressing societal goals such as developing an educated citizenry and providing other basic services may compete to limit support for the routine provision of enhancement technologies. However, this denial of communal responsibility does not necessarily constitute a rejection of the technologies themselves. It simply places them within the scope of the open market, yet another valued social good.

The current fashion of seeking a wide range of cosmetic surgeries solely for the purpose of perceived attractiveness is supported by a general agreement that consenting adults with the ability to pay should be able to seek such services as a matter of personal autonomy and their individual definition of what constitutes optimal physical, mental and social well-being. This same vein of thought could just as easily be used to justify the use of pharmaceuticals engineered to manipulate mood, enhance cognitive abilities or increase physical endurance. On the other hand, our liberty interests may also be compromised by the open market availability of enhancement technologies. If my ability to acquire and hold a job depends on how well I compete with my cognitively enhanced colleagues, then the technology takes on a compulsory character than may well undermine personal liberty and other freedoms we hold in high esteem.

Societal Roles

Modern society depends on a complex web of individuals filling various roles within the society, and working together to achieve the common good. Let's consider the role of the physician (as well as other health care providers), commonly associated with the societal goods of medicine and health. As the applied definition of health itself expands, then so does the acceptability of and demand for enhancement technologies. In fact, at the point at which enhancement technologies begin to give individuals an edge in the job market or other social spheres, it will become harder to claim that such services do not fall into the category of basic health care. Current conceptions of elective treatment may be subject to revision by societal consensus and a demand to include enhancement as a routine form of primary care.

In medicine, the *standard of care* is both a legal and clinical term for the actions any prudent physician or other health care provider would take in a given situation.

Just as other successful advances in life saving technology are eventually established as the standard of care in those specific life-threatening situations, radical prevention and enhancement strategies may become the standard of care in primary and acute care settings, reflecting both acceptance by patients and providers of altered expectations in the outcomes of health care encounters.

In response, it is not hard to imagine the traditional role of physician as healer expanding to physician as designer and enhancer. The plethora of current, reality-based television shows that chronicle "extreme makeovers" in the form of radical cosmetic surgeries, gastric bypass, and other interventions portray physicians as saviors, altering the lives and very identities of their patients. Embedded at the center of life and death struggles, the health professions have always been imbued with a certain heroic quality. However, if human enhancement technologies come to be viewed as compulsory, driven largely by the goals of the marketplace, physicians as designers and enhancers may come to be seen in a much less heroic light. Will these new arenas of practice remain consistent with the altruistic identity of healer or will they eventually come to be seen as manipulative, oppressive and exploitive? The potential disintegration of roles underlying critical social goods may prove a greater harm than is currently being anticipated.

The Principle of Social Justice Applied

The principle of social justice requires that we act in ways that maximize the just distribution of benefits and burdens within and among communities. In the same way that the uneven distribution of nanomedicine may exacerbate existing societal disparities, human enhancement could take such disparities further yet on both a national and global scale. Social justice calls us to look within and beyond our own community borders and consider our interests in light of those of all other communities. This spectrum also includes communities of the future in the form of future generations.

Tyranny of the Enhanced

How will enhancements come to be valued? Will society become stratified on the basis of enhancement levels in much the same way it has traditionally been stratified on the basis of race, gender or class? Will the enhanced come to see themselves as entitled to a dominant social position by virtue of their parents' good upfront design choices (Fukuyama 2002). Critics of enhancement generally see it as radically upending any hope of a level playing field for those members of society that currently do not have access to basic needs, let alone advanced technologies that would allow them to compete fairly in the open marketplace.

A particularly intriguing question is raised by the emphasis on this research in the military. The military is currently a primary investor in human enhancement technologies (see Chapter 7 of Bennett-Woods, D. (2008). *Nanotechnology: Ethics and Society*). This fact raises the interesting question of what will happen to "future warriors"

coming out of the military? Will they be accepted and perhaps even sought out for their interesting spectrum of abilities? Will they be relegated to law enforcement and other jobs that make use of their specific warrior capabilities? Will they be feared, subject to an underlying mistrust of their power and the potential for that power to be turned against the larger society. Will they be tempted to use their capabilities toward criminal ends? Will they pose a public threat or simply be treated like they do?

Tyranny of the Elders

What are the implications of a longer life span? Death is a normal, albeit often unwelcome, part of nature. Death, among other things, imbues the human life span with meaning. It is the final milestone in a human life and we live our lives with that inevitability clearly ahead of us. We surround it with ritual and mark it with accomplishments large and small. We also resist it and such resistance meets its epitome in the field of anti-aging medicine, which is directly associated with many of the projected advances in nano-enabled biotechnology.

Proponents of anti-aging medicine generally predict that the human life span will increase to between 120 and 150 years within the next 50 years (Mykytyn 2006). Citing a Freedonia Group Study in 2005, Mykytyn points out that the anti-aging marketplace represents a $20 billion expenditure by consumers. However, the cost of expanded life spans goes well beyond the pocketbook of the individual consumer. It represents a prioritization of research dollars and investment away from other targeted research. It means higher costs, over longer periods of time, of social programs such as Medicare and Social Security.

Perhaps most importantly, it represents a potentially huge societal cost as people live twice as long, consume twice as many resources, and simply take up "space", both literally and figuratively. In China's mandate for one child families, we do have a modern precedent of what to do with too many people. Restrictions on reproductive autonomy would seem inevitable, as more and more resources are consumed by fewer and fewer people. The trend toward accumulation of great wealth by a relatively small number individuals may increase as less wealth is distributed across the generations. Retirement before the age of 100 will be unlikely for most people, leaving little room in the job market for nearly two entire generations.

On the positive side, increased life span may be the answer to decreasing fertility rates across the globe. If the population is aging anyway, wouldn't it make sense to help them age gracefully and productively? Elders living longer could be an economic engine and a fount of valued wisdom and stability as we rapidly work our way into the future.

Assessing Options for Action

Too much is at stake to believe that human performance enhancement can simply be stopped in its tracks. The line between therapy and enhancement is too fine and the natural human disposition is to compete effectively. Efforts to ban human

enhancement technologies will largely fail, driving research and development activities underground or into friendlier territory.

Khushf (2003) suggests that our best option is to set aside any current societal consensus on what we think the goals of community and human thriving should be based on what they have been in the past, and "seek to form a new consensus, asking how enhancement should be understood, and what forms such enhancement should and should not take" (Khushf 2003). He contends that the possibility of something "genuinely new" is absent from current dialogues that tend to fall on the extremes of support and non-support for human enhancement technologies. In essence, our only real option may be to stimulate dialog on a broad scale that is at least as creative and strategic about the societal goals we wish to achieve as scientists, engineers and entrepreneurs are being about the science itself.

Finding Common Ground

Did human beings stop developing once they hit the top of the evolutionary ladder, or have we always been in a process of unfolding human potential? The rapid advance and sheer complexity of human society and culture is testament to a certain ongoing level of evolutionary change within the species. In fact, there is a contemporary tendency to refer generally and metaphorically to emerging technologies as leading to the next step in human evolution. Some commentators even predict the emergence of a new species of human beings. Technology advocate Ramez Naam posits this evolutionary process as inevitable, labeling modern humans a "phase shift" in biology.

> We are not the end point of evolution – there is no such thing. We are just an intermediate step on one branch of the tree of life. But from this point on, we can choose the directions in which we can grow and change. We can choose new states that benefit us and benefit our children, rather than benefiting our genes. (Naam 2005)

The prospect of achieving a higher order of human potential is tremendously appealing in the current face of daunting problems in all realms of human society. Freedom from physical and mental infirmities, coupled with expanded abilities to pursue the activities and interests that inspire and enlighten us, may liberate much needed levels of human energy, creativity and potential. Assuming that an enhanced existence will also lead to a more enlightened perspective opens the door to utopian views of a future in which the highest human ideals can finally be realized on a broad scale. In evolutionary terms, our survival may depend on our ability to adapt to a higher level of functioning in a new and more demanding environment. In the face of accelerating pace, increased complexity and a high order of uncertainty, human performance enhancement may be the key to our continued evolutionary success.

Others have a much dimmer view of efforts to exceed our natural human boundaries, one that is equally compelling. Striving for perfection holds great meaning until the achievement of perfection is a result of technological intervention

rather than personal effort. Thinking faster and thinking well are not the same thing. Enhancement implies power and power can be abused. The prospect of a lifetime that lasts 150 years or more may simply result in an extended childhood and adolescence as we try to figure out what to do with all that time. The normal human milestones that mark the progression of a human life may become skewed. The pressure to make a difference and to leave a legacy may kick in much later or burn out much sooner. Wonder, curiosity, joy, sorrow and all the other emotions that shape human character may dissipate into a technology induced absence of human affect and, ultimately, human meaning.

As with so many other issues raised in this book, reality is not likely to reside primarily at one end or the other. There is much precedent for the abuse of power by dominant forces in the social order. Common ground will require assurances and safeguards that can forestall a tyranny of the enhanced, particularly during the early stages of availability when access is likely to be limited to an already privileged few.

There is also reason to be concerned that human nature requires the trials and tribulations of life to stimulate personal growth and to nurture wisdom and insight. On the other hand, technology has long shaped human experience and identity, enabling an extraordinary flourishing over a relatively short time frame in the scope of human evolution. It will continue to do so in any form. Technologies that enable human enhancement and life extension will represent the same two-edged sword of all previous technologies. Finding common ground will require that we acknowledge both the potential for benefit and for harm.

In order to attend to the various ethical questions raised, common ground must strive for the following:

- Respect for the essential dignity of the human person, however it comes to be defined.
- Support for the flourishing of all human communities
- Dynamic, ongoing, representative dialog that continuously refines the definition of common good
- Commitment to social justice, including just treatment of future generations
- Clarity and transparency of intention and goals
- Ongoing assessment of societal impacts
- Collective willingness to change paths quickly in the face of untoward or unwelcome outcomes.

Pragmatic Considerations

In many ways this chapter is intended to be a cautionary tale. In essence, all nanoroads lead to human performance enhancement and life extension. Advancements in nanoscience and nanomaterial development and manufacturing will lay the foundation for all nanotechnology applications include those involved in nanotechnology.

For example, applications involving intimate human-machine interfaces may well have their origins in the information technology and telecommunications industries. The military is aggressively pursuing a whole range of enhancement technologies in their pursuit of the Future Force Warrior. As with prior military technologies, these will eventually make their way into medicine and other industries in the form of consumer services and goods that enhance human "survivability" and "superiority" in essentially the same spirit they are intended to enhance soldier survivability and superiority (aka lethality and fightability in military jargon) on the battlefield. Along a slightly different vein, continued environmental degradation of air and water or failure to address emerging environmental threats such as climate change may render human enhancement a requirement if the species is to survive into the future. Finally, there is no reason to expect that medical advances that restore function won't also be used to enhance it. Sports doping is an obvious example of the use of medical tools for non-medical ends and the difficulty in preventing it from happening. A failure to begin to develop a holistic and systems oriented vision of science and technology will increasingly allow science and technology to define the human good with increasingly less input from the actual humans.

The complexity and relative messiness of society at large places us at a serious disadvantage when trying to decide how to move forward in the face of rapid pace and uncertainty. Nonetheless, move forward we will. The true pragmatists have little choice but to roll up their collective sleeves and try to find the wisdom to guide the speed and direction with which these technologies ultimately alter the human condition. To do so ethically requires, at a minimum, that human enhancement technologies are welcomed or marginalized in order to respect the essence and will of the larger community and the best of our human values and aspirations. The values of liberty, knowledge, compassion, curiosity and human striving must be carefully weighed against the human tendencies to also act in narrowly self-serving ways and to abuse power once they have it.

In addition, these technologies must serve a common good, requiring that we engage in a careful differentiation of the benefits from the harms and that we consciously work to minimize the harms that are inevitable. Finally, pragmatism dictates that we seek a form of social justice so that the proposed nano-divide does not further fragment our increasingly interdependent human community.

Questions for Thought

1. Is there a morally significant difference between repairing and enhancing basic human abilities? Doesn't all technology enhance human performance to some extent? Better nutrition increased our height and average IQ. Sanitation and antibiotics increased our life span. Why shouldn't we develop technologies that allow us to think faster, see and hear better, be more physically fit or extend our life span by another 50 years?

2. Propose a system in which human enhancement and life extension technologies could be made available that would meet the requirements of true informed consent (voluntary and competent), minimize the potential harms or abuse of the technologies, and ensure a measure of social justice.

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Appendix A: Exercises

EXERCISE 1.A

One way to improve your ability to analyze arguments is to study them methodically. The following exercise will help you to identify premises, discover unstated assumptions, and imagine ways to defend conclusions with which you may not agree.

Your instructor may wish to copy this page, handing out one copy to each student at the beginning of the exercise. Each student then answers the first question. When finished, pass your paper to the person on your right, per instructions. (Note to instructor: You may have to be creative in finding a way to link all students together across your classroom's rows and spaces.)

Write and Pass

Assume that Emily's case has no unusual excusing conditions. Under normal circumstances, most people think it is wrong to cheat. However, our reasons for this conclusion may vary. Some think cheating is a violation of duties to one's fellow students, or the teacher, or, perhaps, the institution. Others may think cheating has bad consequences, such as the tarnishing of the reputation of Emily or her teacher, or a decline in respect for Emily's institution were the institution widely believed to condone cheating. Others think cheating is wrong for all these reasons and others.

1. Assuming that Emily's case has no unusual excusing conditions, do you think it would be morally wrong for Emily to cheat? Answer yes or no and provide one reason to defend your answer. Using at least one complete sentence, write your answer here:

   _____

Pass this paper to the person on your right.

2. Provide one good reason that supports the claim stated in (1).

   _____

Pass this paper to the person on your right.

3. Together, the two preceding statements form an argument (that is, a claim and a reason to support the claim). Every argument makes certain assumptions. (For example, from the claim that "All scientists are smart," it follows that "Lewontin is smart," but only if one assumes that Lewontin is a scientist.)

4. List one assumption made in this argument.

_____

Pass this paper back *to the person on your left.* Allow him or her to review what you have written on it. Finally, pass this paper back to its original owner. Do you agree with the way your argument was developed? With the assumptions identified in it?

EXERCISE 1.B

DISCUSSION QUESTIONS

Imagine you are Emily. Should you hand in the sheet of paper with Doug's name on it? Write out answers to the following questions.

1. **Issues and points of conflict**: What exactly is the issue that Emily must decide? What values are in conflict? List as many as you can think of.
2. **Interested parties**: Who are the stakeholders, that is, humans who might be affected by Emily's decision? List as many as you can think of.
3. **Potential consequences**: What things (for example, relationships, reputations. social groups, cultural institutions) might be affected by Emily's decision? List as many as you can think of.
4. **Obligations**: What duties does Emily owe to people? List as many as you can think of.

How would you respond to the following questions that Emily is asking herself?

1. Don't different cultures have different ways of doing things?
2. Who is to say what's right and wrong?
3. What's the relationship between ethics and the law?
4. What's the relationship between ethics and religion?
5. Is ethics, unlike science, completely subjective? Are there any right and wrong answers in ethics? If not, why do most people think cheating is ethically wrong? If there are, then why do many people think that no method exists to determine the right answers?

EXERCISE 1.C

SHOCK TREATMENT FOR NAIVE RELATIVISM (OR THREE THINGS EVERY-ONE EVERYWHERE ABSOLUTELY POSITIVELY SHOULD NOT DO EVER)

List three actions that you believe are clearly ethically wrong. You must describe the actions in such a way that no one in your classroom will disagree with you.

If you think this will be a difficult assignment, you're right, but only if you describe the actions too generally or ambiguously. To avoid trouble, describe

actions in very specific terms. If you say *cheating,* or *killing,* or *abusive behavior* is clearly ethically wrong, someone is sure to be able to find a convincing counterexample.

So describe the three actions in careful detail, staying away from obviously hot issues where disagreement is likely to occur. Avoid abortion, euthanasia, gay rights, genetically modified foods, and animal rights. A safe bet is to choose an outrageous action and define it so narrowly that everyone will see at a glance why it is immoral. Give your actors names, describe their motives, explain the consequences of their actions, and rule out all exceptions that might make the action morally acceptable. Here's an example to get you started:

> It is wrong for Emily to write Doug's name on work she has done in order to prevent Doug from failing the assignment unless she has promised her instructor that she will appear to cheat in order to help the instructor carry out an experiment.

Here is a template you might want to use in stating the actions:

> It is morally wrong for *name* to *particular action* in order to *objective* because of *motive* unless *exceptions.*

Following this strategy should help you to articulate at least three actions that are clearly ethically wrong. When finished, write three actions that are dearly ethically right. Here are some more examples.

> It is morally wrong for *Dirk Smith* to *pour gasoline on his niece* and light a match *in order to kill her* unless she is a Buddhist and has asked him to help her immolate herself as a protest against an unjust war that has killed all other family members.

1. _____
2. _____
3. _____

It is morally right for *Dirk Smith* to *help his niece obtain information about relatives* lost in the war *in order to save them from harm* unless by doing so he will jeopardize their safety.

1. _____
2. _____
3. _____

Appendix B: Notes for Instructors

CHAPTER 1: ETHICS

Emily the student

The ethical problem embodied in Emily's case is a problem of conflict or conscience for an individual. Our teaching objectives in it are to help students articulate what is wrong with cheating, and help them realize that there is a broad range of judgments they share about what is morally right and wrong. Salient features are that, all other things being equal, cheating is morally wrong and students think that it is wrong. They think it is wrong for anyone in a situation similar to Emily's in all of the relevant details. They are, therefore, moral objectivists. Ironically, however, many of these same students think of themselves as naive relativists, and they will deny that there are any particular moral judgments universally shared across times and cultures. The main objective in discussing this case is to help them begin to overcome their naïve relativism and to acknowledge the fact that there are many particular moral judgments on which we all agree.

"Write and Pass" is a pedagogical exercise to help students gain clarity about their own views; to learn how to compose an argument; and to gain confidence in their innate ability to examine the assumptions of arguments.

Suggestion: Use Exercise 1.A, "Write and Pass," in Appendix A, immediately after the students read "Case 1: Emily the Student."

"Discussion Questions" is a graded exercise intended to help students identify ethical issues and points of conflict; use their moral imaginations to recognize potentially interested parties; learn to envision potential consequences; and to articulate obligations.

Suggestion: Use the "Discussion Questions" exercise after the students do the "Write and Pass." Following are some notes for grading the exercise.

Evaluation Checklist[1]

[1] Based on a form developed by Muriel J. Bebeau et al., *Moral Reasoning in Scientific Research* (Poynter Center for the Study of Ethics and American Institutions, Indiana University, 1995).

1. **Issues and points of conflict** (5 points total)
   1 correct answer earns 3 *points.*
   2 correct answers earns 4 *points.*
   3 correct answers earns 5 *points.*
   Emily's duty to be honest v. her duty to look out for her friend, Doug ____
   Emily's duty to respect her fellow students v. her desire to help Doug ____
   Emily's duty to treat Dr. Wright with respect v. to pursue her own interests ____
   Subtotal ____

2. **Interested parties** (3 points total: 1-2 = 1, 3-4 = 2, 5+ = 3)
   Emily ____
   Emily's family ____
   Doug ____
   Dr. Wright ____
   Other students in the class ____
   Other students at the university ____
   The university itself ____
   The general community ____
   Subtotal ____

3. **Potential consequences** (4 points total: 1-2 = 1, 3-4 = 2, 5-7 = 3, 8+ = 4)
   To Emily's reputation ____
   To Emily's career ____
   To Emily's relationship with Doug ____
   To Emily's relationship with Dr. Wright ____
   To Emily's family ____
   To other students in the class ____
   To the university ____
   To future students ____
   Subtotal ____

4. **Obligations** (5 points total: 1= 1, 2 = 2, 3 = 3, 4 = 4, 5+ = 5)
   To be honest ____
   To obey the university's rules ____
   To respect Doug, to respect herself ____
   To respect Dr. Wright ____
   To do no harm ____
   To act in a way that she could approve of other students acting ____
   To consider her own needs and interests ____
   Subtotal ____
   Total ____
   16 - 17 = A
   14 - 15 = B
   11 - 13 = C
   9 - 12 = D

CHAPTER 2: RELIGION

Rich the atheist

The ethical problem embodied in Rich's case is a problem of conflict or conscience for an individual. Our teaching objectives in it are to help students articulate their views about the relevance of religious beliefs to ethics, to help them realize that there is at least one ethical theory that is deeply religious, and to raise questions for them about the acceptability of that theory. Salient features are that, all other things being equal, religious beliefs ought to be a topic for discussion in university classrooms; and, yet, we live in a pluralistic democratic society in which religion can be a conversation-stopper.

Postscript to Chapter 2:

Dealing with religion in secular life science ethics discussions

Science instructors may experience some uneasiness in dealing with students' religious convictions during a discussion of ethics at a secular institution. Here are some tips.

1. Acknowledge the validity of religious convictions.

Religion has been and continues to be an important source of many peoples' ethical values, concepts, and ideals. No matter what culture we study, religious communities have been the repositories and incubators of moral values and principles. Even if we think that religion is to be abhorred for the values it has taught, we should begin by honoring the religious student's perspective. We can do this by acknowledging the historical role of religion in teaching values.

We might respond by saying: "Good point. Matters of faith and God and religious instruction play a central role in forming our values, don't they? Thanks for reminding us not to overlook religion as we think through this issue."

Then we must go on to point out that there are difficult problems in bringing religion into secular ethics conversations. Such as:

2. Appeals to religion can be used to stop rather than encourage conversation.

"Abortion is wrong because it says so in the New Testament (or Hebrew Bible or Qu'ran or Upanishads)." "Euthanasia is wrong because God (or the mu'azzin or Pope or rabbi) opposes it."

When someone tries to use a religious appeal to end a conversation, we can point out that this is a *faulty* appeal to authority. However, we must be careful to explain the reasons. Suppose the authority is scripture, tradition, the head of the church, or the deity. Appeals to these authorities are faulty *not* because scripture, tradition, and God are necessarily faulty authorities. They are faulty appeals because *the structure of the argument* is faulty. The appeals beg the question of whether the authorities are incorruptible and infallible. What if someone appeals to the authority of Charles Manson or Adolph Hitler? Participants in ethics conversations must, at the very least, remain free to ask whether the authority is reliable, and free to pursue questions in this area.

3. **Ask the student why he or she thinks God (or the Bible) would command something.**

The best way to convert religious appeals from conversation stoppers to conversation starters is to ask students to think about God's *reasons* for doing something. "Religion is important in these conversations. Now, let's try to figure out *why* God would make it wrong to have an abortion or engage in homosexual behavior." This will help religious students to begin to figure out the philosophical grounds of their values.

What if a student balks at this point, refuses to entertain the question, protesting that it would be impious or dangerous to inquire into God's motives? There is every reason to answer such students straightforwardly. They have articulated an issue that lurks in the minds of many less outspoken students.

4. **Ask whether there is unanimity about issues of morality *within* the student's tradition.**

All traditions, even fundamentalist traditions, are at least mildly pluralistic. There is always a Mr. Jones who sits in the back pew and, while he is in all other respects a member in good standing of the congregation, is fondly known to all for his contrary opinions. Ask your student to identify such a person. For example: "Is there anyone in your tradition who holds a different view of the morality of abortion?" Assign them the task of asking their Mr. Jones about his views, and have them carefully write down his reasons for diverging from the tradition's teachings.

If the student continues to refuse to name any dissenters, you may be dealing with one of two kinds of student. It is important to figure out which kind. The first type is good-willed but misinformed. Such students genuinely don't know that there are dissenters in their tradition. They may need your help to identify contrary-minded individuals the student can trust.

The second kind is more difficult. These students' lack of information is compounded by the fear that modern science is going to destroy their faith. There is no guaranteed method for dealing with this student, but I suggest the following.

5. **Assign the student the task of having their spiritual mentor (pastor or priest) help them find literature written by people in their tradition that fairly represents ethical views conflicting with theirs.**

The problem with the fearful student is that they do not trust their university instructor, probably not always without good reason, with what seem to them spiritual questions. Try to get these students in touch with someone they trust. When these students find such a mentor, the mentor may be able to assist them in realizing they can be simultaneously pious and intellectually active.

6. **If the appeal is to the Bible, ask whether the verse has a wider context, and whether there are any larger, overall, Scriptural themes that seem to be in tension with the verse.**

A strong case can be made that the overall themes of the Hebrew, Christian, and Muslim Scriptures are righteousness, justice, love, compassion, and mercy. Try to draw this point out of other students' comments, but be ready to point it out if no one steps forward.

7. Ask whether there is unanimity about issues of morality *between* religions.

For example: "Does anyone know if Christianity, Buddhism, and Hinduism, have the same view of the Bible (or "God's will" or "duties to animals")?

8. Ask whether the United States should make public policy on the basis of religious revelations given to one religious tradition.

Point out that while students come from various religious traditions, and some from no religious tradition at all, they actually agree about a fairly wide range of values. Mention the long lists of rights and wrongs they "wrote on the walls" during the Shock Treatment for Relativism exercise. Remind them that the best way to make progress in ethics is not to start with values that are specific to their tradition because those values may be very contentious. It is to start from values we agree about, and then work from there toward the thorny questions.

There is also the matter of public policy. Unlike most other nations, the United States does not have a state religion. The country's founders wanted to separate church and state in order to protect the free exercise of religion. People here have the freedom to follow whatever religion suits their conscience. Then you might ask your students the following sorts of questions: "Is this a good way to proceed?" "Does anyone have reasons to support their view about whether we should continue to try to make public policy on non-religious grounds, without privileging the views of any single religion?" "Do you think we should decide policy matters on religious grounds or on grounds that might be shared both by believers *and* atheists?"

9. Suggest that students pursue religious issues in courses devoted to that subject.

This is a natural way to end discussions if you've done #1-#8. Students will appreciate knowing that there are places they can go to pursue the issues further. Many secular campuses offer courses on "Religious Ethics."

10. Summarize the discussion

We can avoid hard feelings simply by bringing closure to the discussion. Here are some ideas: "As we have noted, religion is an important source of ethical values and belongs in rational ethics discussions. But there are problems. First, within a single tradition there are varying interpretations of what God commands. Second, there are varying interpretations of morality among the various religions. Third, in the United States we honor religious liberty by trying to make public policy without privileging the authority of any one religion. How do we address the problems? First, we can ask what reasons God has for commanding something. Second, we can try to identify values that are shared widely across many religious traditions. And third, we can explore these issues in more depth in classes devoted to this topic."

CHAPTER 3: REASONING

Karen the ethicist

The problem embodied in the students' conversation is the problem of knowing how to proceed when thinking about ethics. Our teaching objectives in it are to help

students articulate their doubts about ethical thinking being rigorous or methodical; help them to see some ways in which ethical thinking is rigorous and methodical; and assist them in learning how to think critically and carefully in this area. The emphasis on good arguments and objective criteria can also be used to set the stage for Chapter 4, and to show why 7 ethic s not "just merely" a matter of opinion.

CHAPTER 4: METHOD

Dennis the relativist

The problem embodied in Dennis's case is a problem of ethical theory. Our teaching objectives in it are to help students articulate their worries about the objectivity of ethical judgments, to help them realize that others have these same worries, and to raise questions about whether students must simply accept naïve relativism. Salient features are that questions about the objectivity of ethics are legitimate, concerns about ethics being unscientific are widespread, and yet there are good reasons to think that the skeptical, relativist, challenge can be met.

CHAPTER 5: ENVIRONMENT

Marie the environmentalist

The ethical problem embodied in this case is a problem of deciding on the moral standing of nonhuman entities. The teaching objectives are as follows: to explore the various theories regarding the relative weight to be attached to the moral status of humans, animals, ecosystems, and future generations. The salient facts or features that create the problem are the following: (1) the fact that farmers, individual animals, and ecosystems, and future generations, all have an interest in using natural resources such as water and soil; (2) there may not be enough natural resources to serve all of these interests; and (3) it may be that "natural resources" should not be understood as "resources" at all, but rather as intrinsically valuable things. If it is appropriate, the last point could lead into a more theoretical discussion of the intrinsic/instrumental values: how one would justify the claim that something has intrinsic value, and how the distinction is relevant to moral reasoning.

CHAPTER 6: LAND

Gordon the lawyer

The ethical problem to be embodied in this case is a problem of deciding on a general policy or principle. The teaching objectives are to explore the various theories regarding the relative weight to be attached to the property fights of farmers, con-

sumers, and nonhuman entities, such as bodies of water, soil, or wildlife habitat areas. The salient facts or features that create the problem are (1) the fact that farmers, consumers, and wildlife all need water and soil, and (2) in some areas there is not enough water, soil, and/or habitat to go around.

CHAPTER 7: FARMS

Roy the dairy farmer

The ethical problem embodied in this case is that of deciding on a course of action related to career and family. The teaching objectives are as follows: to articulate the moral virtues and vices traditionally associated with family farming; to discuss the costs and benefits of larger scale industrial agriculture; and to comment on the relevance of religious considerations to these issues.

The salient facts or features that create the problem are (1) the fact that there are many virtues in a way of life spent on a medium sized owner operated dairy farm, and yet (2) such farms are quickly disappearing as the structure of the dairy industry moves increasingly toward a system dominated by a few very large farms.

CHAPTER 8: FOOD

Dhruva the destitute

The ethical problem to be embodied in this case is that of deciding on a general policy or principle. The teaching objectives are to explore the various theories regarding the relative weight to be attached to our duties to provide food aid to those close to us and those far away from us**.** The salient facts or features that create the problem are (1) the fact that many people die of hunger each year, and (2) farmers produce sufficient food each year to feed everyone.

CHAPTER 9: BIOTECHNOLOGY

Dr. Krista the scientist

Additional discussion questions that may be used after students have read the chapter:

1. Would such a product as the Egg Machines ever be made? On what do you base your answer?
2. Can you give a definition of *natural* that implies that Egg Machines are unnatural, but the use of airplanes and selective breeding are not?

3. Do you think there *is* a morally relevant difference between Egg Machines and Tissue Culture? If so, what is it? Or do you think that they should be seen as morally on par, that if one of them is acceptable, then the other must be as well?
4. Do you think that genetic engineering in agriculture would make us more likely to apply genetic engineering to *humans*? Why or why not?
5. Is there something morally bad about always being at the ready to make things out of bits of living nature, or viewing it in terms of *commercial* potential? Why or why not?
6. It was said that the Raw Materials view would encourage the following: Confronted with animal suffering in agricultural contexts, someone with this view would tend to try to change the animals so that they don't feel the suffering, rather than change the conditions, so that the animals aren't under the stress. Is there anything wrong with this? If so, what?
7. It's often said that most Americans don't think that much about where their food comes from, and also that, given the suffering of animals involved, there are further pressures to not think about it, since this is a disturbing thought if focused on consciously. How would Egg Machines and Krista's scenario concerning Tissue Culture affect these tendencies of ours?

CHAPTER 11: ANIMALS IN AGRICULTURE

Misha the cow

The ethical problem embodied in this case is a problem of deciding on a general policy or principle. The teaching objective is to explore the various theories regarding the moral standing of farm animals. The salient facts or features that create the problem are (1) the fact that many farm animal species exhibit complex behaviors and apparently possess reasonably sophisticated mental states, and (2) the moral protections afforded humans of comparable behaviors and states are not afford to farm animals.

CHAPTER 17: FARMS

Lost in the Maize

The ethical problem addressed in this case is a problem of conflict or conscience for an individual. The teaching objective is to give students practice articulating alternative courses of action.
Additional features that one might want to add to the case:

1. GM and OF are close relatives.
2. The genetically modified maize has not been approved for human consumption (only for animal feed).

3. GM´s crop is worth 50 times that of OF´s.

Here follow some notes to help you assist your students in responding to the worksheets.

A. *Question 1. Did GM make the right decision?*
   A) Write your answer here (Yes or No):
   B. *Pass the paper to your neighbor on the left.*
   [Solicit answers and read – tally]
   B) Write down one reason that supports the decision passed to you ('Yes' or 'No'). Important – you have to write about the decision in front of you, not the one you wrote yourself.

C. *Pass your paper to your neighbor on the left.*

[Solicit answers and read out – illustrate different kinds of arguments]

C) Look at the answer and supporting arguments now in front of you. What kind of ethical principle do you think explains the answers to parts A and B? Write down a few words to sum up your thoughts.

[Solicit answers and have students read their answers out loud. Use their answers to Illustrate different principles: legal, moral, ethical, economic justice, religious, ecological justice]

[After discussion, have students pass papers back to original source]

After several sleepless nights, GM reconsiders his decision and decides to tell OF about the possible cross-pollination. … It is also possible the test will show that there has been *no* contamination of OF's organic crop.

[Ask: Are there any factual questions about this part of the case?]

A. *Work in pairs to answer questions 2, 3 and 4. Write down your answers in a few words.*
B. *Question 2. Should OF get his crop tested for the presence of genetically modified maize? Why?*
C. *Question 3. If tests shows that there IS genetically modified material present in OF's corn, should he tell Gerber? Why?*

OF has the tests performed. They show that his crop is completely free of any genetically modified material. He informs the Maize Liberation Front about GM´s crop, knowing full well that they will destroy it.

D. *Question 4. Should OF have informed the Maize Liberation Front, given that he has not suffered any economic harm himself? What ethical principle might justify OF's behavior?*

Topics for discussion

1. Even before planting, what are GM's obligations to OF? Do they extend beyond what is legally required? If GM tells OF, isn't there an assumption that there is something wrong with the genetically modified crop? Yet it was approved.

So his bringing it up would make it seem like he agreed there was a problem, even though he thinks there is none.

2. What does it mean for something to be *free* of any transgenic material? How might contamination occur? Is it possible to detect such contamination, and if so, at what levels? Do very low levels (e.g. does 0.1% represent a threat?) Should levels of contamination be set? What would have to be done to ensure that there is *no* contamination? Compare this case with pesticide residues that are detectable on organic crops.
3. In reality, Gerber would test every batch themselves, so they might discover contamination in their supply. However, testing procedures are patchy and many products labeled as GM-free or organic have been shown to contain some detectable genetically modified material.
4. Insurance might cover OF's losses and GM's liability. In fact, the major re-insurers refuse to insure claims against loss caused by genetically modified crops. A perceived liability can prevent a technology being deployed, whether or not the risk is real. The insurance company is employing the 'precautionary principle', but is this appropriate?
5. What different ways could genetically modified maize 'contaminate' organic maize. How would you ensure that organic maize is absolutely free of any contamination?
6. Some students may cite the precautionary principle. This is a relatively new concept in the legal system, though it has been adopted to some extent in Europe. In addition to actual harm, it covers anything that has the potential to cause harm. How do you apply this principle? Would it preclude deployment of new technologies.

Additional issues that could be added to the case:

– The genetically modified maize has not been approved for human consumption (only for animal feed).
– OF´s crop is worth fifty times that of GM's.
– OF's family has been farming on this site for 200 years. GM has been there for only 5 years.

CHAPTER 18: FOOD

Edible Antibiotics in Food Crop

Teaching objectives:

1. To have the students research and identify the issues, pros and cons
2. To identify the facts or features that create the problem
3. To identify risks, costs, benefits and detriments. Identify who bears risk, who benefits and who pays.

4. To recognize varying levels of certainty in the arguments regarding risks and benefits. To be able to compare use of the precautionary principle to current regulatory methods.
5. To be able to evaluate competing arguments and identify acceptable alternatives and/or compromises.

Author Index

Subject Index

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