Biology and Political Science

Robert H. Blank and
Samuel M. Hines, Jr

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Rapid advances in the life sciences, especially molecular biology and neuroscience, combined with research in ethnology and related areas are altering our understanding of human nature and behaviour. They also raise challenging social and political issues that necessitate a re-evaluation of existing social values and structures. However despite the vast implications of this new knowledge of the biological foundations of human behaviour, mainstream political science has largely dismissed and, in some cases, overtly rejected the relevance of biology for political behaviour and institutions.

This book redresses the balance. It demonstrates the increasing convergence of interest of some social scientists in the theories, research and findings of the life sciences in building a more interdisciplinary approach to the study of politics. It discusses the development of biopolitics as an academic perspective within political science, reviews the growing literature in biopolitics, and presents a coherent view of biopolitics as a framework for structuring inquiry across the current subfields of political science.

Biology and Political Science argues for a shift in the prevailing environmental paradigm - which ignores biology and assumes the empty organism - to an interactive paradigm that provides a balance between biology and culture. It calls for a more human-centred political science that appreciates the contributions of evolutionary theory, ethology, neurobiology and molecular biology in the study of political behaviour and political institutions. The authors believe that this shift in paradigm and methodology will return political science to its roots and encourage a more inclusive, interdisciplinary study of politics. This book will be a valuable new perspective for all those working in political science, social sciences, life sciences and the history of science.

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Joanna Swabe

3 Transnational Environmental Policy
The ozone layer
Reiner Grundmann

4 Biology and Political Science
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This book is dedicated to the memory of
Thomas C. Wiegele, Professor of Political Science

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Contents

Illustrations

Table

Figures

Preface

This volume is the product of a collaboration between the two authors that grows out of their common experience in holding fellowships at Northern Illinois University in the early 1980s at the Center for Biopolitical Research under the direction of Thomas Weigele. Each of us had the opportunity while post-doctoral fellows to pursue our respective interests in the relationship of the life sciences to politics, public policy and the discipline of political science. Though our research interests varied, we both have become increasingly convinced of the importance of extending the theories and facts being generated by research in the life sciences into our understanding of politics and to the formulation of public policies that are needed in response to developments in the life sciences. Over the last two decades we have worked with others to help build the Association for Politics and the Life Sciences into an organisation that furthers understanding between the social and behavioural sciences - political science in particular - and the life sciences.

One of us, Sam Hines, would especially like to thank the College of Charleston for its substantial support of this research in the form of sabbatical leaves, research grants and an environment conducive to pursuing research that was outside the mainstream. I would also like to thank my parents, Sam and Rachel Hines, for their encouragement and support throughout my undergraduate and graduate programmes. Without their encouragement of my intellectual interests, this book would have never been written. I also want to acknowledge the support of my wife, Laura, whose confidence in my abilities was essential to the task of writing this volume.

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We both want to acknowledge the influence that Dr. Thomas Wiegele had on our research and careers. Without Tom's commitment to biopolitics we would not have been likely to cultivate our interest in the life sciences. And without his leadership there might never have been an Association for Politics

and the Life Sciences, an association that has sustained others and us as we have pursued the intellectual goal of creating a more human-centred political science. We dedicate this book to his own scholarship and intellectual leadership and to his memory.

1 Biology and politics

Introduction

On Tuesday, 27 June 2000, newspapers and the electronic media around the world announced that the genetic code of human life has been cracked by molecular biologists. Francis Collins, director of the National Human Genome Research Institute in the United States is quoted on the front page of the *New York Times* as saying: 'This is a milestone in biology unlike any other'. Unquestionably, this scientific breakthrough has profound implications for mankind's war against disease. However, there are also profound worries on the part of some observers that this new knowledge may be a sort of Pandora's box. Ironically, and despite the obvious implications of this research for our understanding of human behaviour, we are still far from realising the fundamental importance to the social sciences of the interaction of genes, physiology, consciousness and cognition, and of the vast potential of the life sciences to provide at least a cornerstone in a foundation for the social and behavioural sciences.

That there is an increasing convergence of interest among social scientists in the theories, research and findings of their scholarly counterparts in the life sciences is by now commonplace. This increased level of interest manifests itself among social scientists interested in explaining human social behaviour and the functions and operations of social institutions, as well as among those interested in public policy issues including the environment, health and the economy. The prefix *bio* is being placed before politics, economics and sociology with ever greater frequency in scholarly publications and the recent emergence of evolutionary psychology completes the representation of the social sciences in an interdisciplinary biosocial science groundswell (see Corning, 1983; Wright, 1994; Walsh, 1995; and others). Anthropology (especially physical anthropology) and geography have long been sensitive to the life sciences. Psychologists, long dominated by proponents of Skinnerian behaviourism, have always been more attuned to biology, but their interest in neurophysiology and psychobiology is increasing significantly and has been in evidence ever since the revival of cognitive studies which began in the 1950s.

In this book, we will discuss the development of biopolitics as an academic

perspective within the discipline of political science, review the literature of biopolitics as represented by the leading proponents of the perspective, and present a coherent view of biopolitics as a framework or perspective that structures inquiry. Although 'biopolitics' has become established as a shorthand for this perspective, we shall argue that what biopolitics offers the discipline of political science, which is unique compared to other frameworks or perspectives, is a new *naturalism* that purports to carry the discipline beyond the sterile separation of facts and values and challenges the discipline to move decisively beyond the limitations of modernism with its emphasis on disembodied rationalism. We seek to demonstrate the value of a life sciences perspective for the study of all aspects of politics.

Biopolitics as a paradigm

The title of this book is both a reflection of and a tribute to the significant body of scholarly work that has been produced by a variety of political scientists since the late 1960s: a body of work which, we shall argue, effectively presents a paradigm in political science that challenges the discipline by advocating the naturalistic study of politics (see Hines, 1982a). As such, this paradigm derives directly from the tradition of inquiry in political theory that is traceable back to Aristotle, most particularly his conceptualisation of man as *zoon politikon* - the political animal (Wahlke, 1979, n.7 and Arnhart, 1988 and 1992). As Roger Masters has argued, the insights of the contemporary life sciences require that we re-examine the ancients' view of science and recognise that some of the pre-modern notions they held are actually more consistent with most contemporary thinking than the mechanistic, dualistic modern positivistic science associated with Descartes, Copernicus, Newton and pre-relativity physics (Masters, 1993).

However, the most important theoretical source for this paradigm is contemporary neo-Darwinian evolutionary theory. In addition, ethology and the newly emergent disciplines of behavioural ethology and neurobiology have much to contribute to a fully developed naturalism in political science. Finally, the new naturalism in political science is also indebted to developments in contemporary physics and to chaos theory (Masters, 1993; Schubert, 1989, especially ch. 19). Thus, the new naturalism reflects our evolving understanding of the nature of science, the nature of explanation and the nature of causation (see Masters, 1993 *passim*). The significance of these new intellectual developments will become apparent as the elements of the biopolitical paradigm are presented.

This paradigm stresses the powerful connections between biology, and the life sciences more generally, and politics. To understand politics, it is necessary that we apply the knowledge generated through the study of the natural world. It is also essential that we recognise that man is a part of - *not apart from* - that natural world. The study of politics thus encompasses the full range of political behaviour among those species that are capable of exhibiting such behaviour. It also includes a wide range of policy issues and areas including the environment, human health, biotechnology, economic development and sustainability, popula-

tion dynamics, and chemical and biological weaponry. Indeed, we will argue that the growing list of significant policy issues which involve nature and human nature loom as of such importance that they must be recognised as at the top of humankind's political agenda. Addressing these policy issues successfully is the key to our survival as a species.

This paradigm points toward the evolutionary history of the human species as a source of knowledge and reflects the continuity that exists from early hominids and man's closest primate relatives to the present. As Harold Lasswell, one of the most interdisciplinary of twentieth-century social scientists, observed in the first issue of *Comparative Politics,* we must take a very long historical perspective if we are to understand fully the roots and origins of human political behaviour and the products of that behaviour, political institutions and processes (Lasswell, 1968). Glendon Schubert has made this point dramatically:

> Biological theory implies the rejection of the presumption that our political theory as a species began 2,500 years ago in Athens or (alternatively) as described in 'naturalistic' fables (whether optimistic like that of Rousseau or pessimistic like that of Hobbes) .... The roots of political behavior go back not thousands but millions of years; and political man did not spring ... from the forehead of Socrates - as our teaching of the wellsprings of political philosophy might lead innocents to infer. The implications of contemporary research in physical anthropology, archeology, paleontology, and related sciences are going to jack political philosophy off its classical assumptions - once political scientists become better educated in, and start facing up to the facts of biological life including their own life history as a species.
>
> (Schubert, 1976: 164-5)

Proponents of a political science that is informed by the life sciences are consistent in advocating the application of the knowledge and methods of the life sciences to the study of politics, but they are not advocates of a narrow, positivistic philosophy of social science and certainly not advocates of a simplistic, reductionistic science. Rather, they seek to understand the biological bases of behaviour and to comprehend the theoretical basis of political theory as an enterprise that is both empirical and normative in its scope.

Proponents of this paradigm are also committed to the interdisciplinary study of politics. The greatest challenge posed by this paradigm is the requirement that practitioners of political science, as a discipline, must of necessity include the theory, methods and findings of the life sciences within their framework. Arguably, proponents of this paradigm would assert that some of the most important insights into political behaviour are to be found outside of the mainstream of political science. John Wahlke, in his presidential address to the American Political Science Association, reflected this point of view when he challenged the profession to move beyond a 'pre-behavioral' study of politics to a 'more genuinely behavioral political science' (Wahlke, 1979: 30).

Proponents of this paradigm are keenly aware that social scientists in general, and political scientists in particular, are not inclined to embrace this new naturalism. As Masters notes:

> Most social scientists, when encountering the evolutionary perspective on human affairs, have ignored it or tried to suppress it, using the anonymity of peer review to oppose the publication of scholarly work they neither understand nor respect. My contention is that the social sciences in general, and political science more specifically, need a new paradigm.
>
> (Masters, 1993: 143)

Like other social sciences, political science has been dominated over the last five decades by a 'profound anti evolutionary bias' (Philips, 1999: 535). As noted earlier, the only recent president of the American Political Science Association (APSA) to call for a more biologically oriented paradigm was Wahlke in 1978. Moreover, in 1989 Wahlke chaired the Political Science Major Task Force, which explored a core programme of courses essential for training a political scientist. One of the Task Force's findings was that A "new" evolutionary biology has revolutionised thinking about the formation of social aggregates by primates and hominid ancestors of modern mankind' (Wahlke, 1991a:52). In light of this, the members warned that rapid advances in knowledge across a broad range of biobehavioural sciences threatens to make political science obsolete if it does not impart such knowledge to its students.

The swift and hostile reaction to this recommendation demonstrated the intensity of opposition to biobehavioural initiatives. In the same issues of *PS* that carried the Task Force report, Warren Miller argued that biology is 'largely irrelevant to the center of gravity of political science'. For Miller, the link between biology and the social sciences is 'scarcely visible' and studying biological processes 'quite peripheral to the interests and needs' of social scientists (1991: 9).

It should be noted that political science has not always been hesitant to break new ground, particularly in its relationship to biology. In fact, there seems to have been a progressive narrowing of the field since its formative period in the earlier decades of this century. A reading of the presidential addresses and articles of the 'founders' of the American Political Science Association demonstrates a clear interest in the interdisciplinary goals of the discipline, especially as it related to the life sciences. The following quotations illustrate this early concern. William Bennett Munro, in his 1927 presidential address to the American Political Science Association argued that:

> Our immediate goal, therefore, should be to release political science from the old metaphysical and juristic concepts upon which it has traditionally been based ... *It is to the natural sciences that we may most profitably turn, in this*

> *hour of transition,* for suggestions as to the reconstruction of our postulates and methods.
>
> (Munro, 1928: 7, emphasis added)

Perhaps the clearest statement of the special reciprocal relationship between the natural sciences and the social sciences comes from Charles Merriam in his 1925 APSA presidential address:

> Still more serious for the student of politics is the integration of social science with the results of what is called natural science - the reunion of the natural and the 'non-natural' sciences for more and more it appears that the last word in human behavior is to be scientific; more and more clearly it becomes evident that the social and political implications of natural science are of fundamental importance. It even seems at times that this is more evident to the natural scientists than to the social scientists, who at times concede the impossibility of more scientific social control of human conduct.
>
> (Merriam, 1926: 15)

Little can be added today to strengthen what Merriam said seventy-five years ago. Within the context of the emerging biotechnological revolution, his observations are as relevant now as they were then. The opportunities that Merriam foresaw for political science have increased dramatically and so have the penalties for failure to respond.

Is biopolitics a paradigm?

If we accept the strict Kuhnian usage of the concept of paradigm, then it is fair to say that biopolitics does not yet constitute a paradigm, for Kuhn has argued that the social sciences are 'preparadigmatic', in as much as they do not have an established theoretical framework complete with all of the components associated with traditionally understood paradigms in the disciplines of the physical sciences. However, to the extent that evolutionary theory is a paradigm in the life sciences, then biopolitics may be said to possess something closer to a paradigm than some other theoretical frameworks extant in the social sciences (Hines, 1982a, 1982b).

We hasten to add, however, that among biologists, there is still disagreement as to what constitutes an agreed upon theory of evolution. For example, there are still important disagreements among leading theorists of evolutionary biology as exemplified in the quarrel over the status of the concept of 'punctuated equilibrium' in the theory of evolution (see Somit and Peterson, 1992; Dennett, 1995; Eldridge, 1996). Nor have biologists come to an agreement as to the status of Wilson's 'Sociobiology'. Thus, in fairness, it must be said that evolutionary biology cannot function for biopolitics in the same way that 'economic man' functions for rational choice theory or that Skinnerian behaviourism

functions for one version of behavioural political science. Nonetheless, we will argue that an evolutionary theory of politics offers a potentially comprehensive paradigm for the study of politics that comprehends systems theory, cybernetics, rational choice theory, socialisation theory, as well as cutting edge developments in evolutionary psychology, psychobiology and neurological science (TenHouten, 1997). Biopolitics also holds the promise of providing a new 'naturalistic' framework for political philosophy (see Masters, 1989; Arnhart, 1998). We shall revisit this topic in our concluding chapter.

Historical development of biopolitics

As a discipline, then, political science has not been particularly sensitive to the contributions of the life sciences to our understanding of political life or public policy. The major contending theories or frameworks for the study of politics have not yet incorporated the biological dimensions that are here demonstrated to be essential to a full understanding of political phenomena. Indeed, the major theories, including rational choice with its rational, self-interested economic man as the centrepiece of the edifice, and political socialisation grounded in Skinnerian behaviourist psychology are in some important ways antithetical to a life sciences approach with its interactional model of behaviour - genotype plus environment equals behaviour.

The challenge to the dominant theories in political science is quite clear. A life-science-based political science requires the study of real behaviour, not merely attitudes and opinions, and it refuses to accept the truncated account of human nature that an 'economic man' model relies upon for explanation. To be sure, sociobiological theory subsumes rational choice and extends the calculation of self-interest to include genetic self-interest, but ultimately explanation requires evidence of enhanced survival potential if we are to understand why some political strategies are more successful than others over time. It is not merely a coincidence that the dominant perspectives enshrine the enlightenment ideal of the rational actor making individual choices and are therefore consistent with political ideologies that exalt the autonomous individual. In contrast, a biosocial science including political science, sociology, anthropology and psychology will also deal with the problematic nature of co-operation and altruism. The work of Peter Corning is particularly instructive in this regard. The more individualistic model, however, ignores the complexity of collective action and the policy implications of our behaviour based on an understanding of the complex interactions between genes, bodies and the environment. The behaviour of the *political animal* and the implications of our policy choices can only be understood accurately and comprehensively in the context of a more sophisticated life science based biopolitics. These issues will be dealt with in detail in chapter 2.

The term biopolitics was first used by Morley Roberts in 1938 (Roberts, 1938). The first political scientist to use the term in print was Lynton Caldwell in 1964 (Caldwell, 1964 and 1987). In 1975, at a conference in Paris sponsored by the International Political Science Association, a group of political and social

scientists gathered to present papers that later were published in a volume edited by Albert Somit entitled *Biology and Politics* (1976). One of the more interesting features of the development of biopolitics has been the extent to which it has been an international phenomenon. Among the earliest conferences to sponsor panels on biopolitics was the International Political Science Association. An entire issue of the *International Political Science Review* was devoted to articles on biopolitics and the Biology and Politics section of the publication, *Social Science Information,* has been edited by one of the founders of biopolitics, Roger D. Masters, since its inception. A most important vehicle for publishing biopolitics-based research is the series of volumes (now at least seven), *Research in Biopolitics,* edited by Albert Somit and Steven Peterson and published by JAI Press.

Organisationally, the Center for Biopolitics was established at Northern Illinois University by Thomas Wiegele in 1980. Wiegele was able to secure funding from the Scaife Foundation to bring several post-doctoral faculty members to the Center as visiting scholars during the early 1980s. Fellows included Joseph Losco, Donna Baird, James Schubert, Robert Blank and Samuel Hines. The Center published a newsletter and produced regular bibliographies for several years. In 1982, the Center published the first issue of the journal, *Politics and the Life Sciences* and formally founded the Association for Politics and the Life Sciences. That journal has been published continuously ever since and is currently published by Beechtree Publishers in England under the sponsorship of the Association for Politics and the Life Sciences.

In 1986, the Center was transformed into the Program for Biosocial Research at Northern Illinois University. In June 1990, *Biopolitics and Mainstream Political Science: A Master Bibliography* was published by the Program. Although the Program in Biosocial Science no longer exists as an administrative unit, Northern Illinois University continues to offer a track in its masters and doctoral program in political science in biopolitics.

The Association for Politics and the Life Sciences (APLS) became an organised section of the American Political Science Association (APSA) in 1985. It was active in organising biopolitics panels for a decade, but in 1995 lost its status as an organised section when the minimum number requirement was raised by the APSA. The changing membership of APLS, of which over half were drawn from other disciplines by the mid-1990s, meant that many members were uninterested in paying full APSA membership fees to attend APLS panels. As a result in 1998, the association under the leadership of Gary Johnson began hosting its own annual meeting to be held separate from APSA but in the same city and time as APSA to enable members to attend both. The full programme for each of these meetings can be found at the APLS website (http://www.aplsnet.org).

Despite this impressive history in organisation of a biopolitics field, or perhaps somewhat because of its success in forging an interdisciplinary association, by the standard of the criterion of 'intellectual impact in the discipline' of political science biopolitics cannot be viewed as successful, according to Somit and Peterson (1998: 569). In their excellent review article of biopolitics after three decades, they reluctantly came to the conclusion that with few exceptions,

primarily international relations, biopolitical research has not had an appreciable impact on political science. As measured by a 'near total absence' in the mainstream journals of articles or reviews of biopolitical research or ideas and little mention in the major textbooks, there is little evidence of a successful transition from the active interdisciplinary agenda to political science. Interestingly, Somit and Peterson note that the picture is different if we focus instead on the application of biological concepts to the study of politics by those outside the discipline. Here there is considerable activity especially by non-political science trained members of APLS.

The failure to move from organisational success to recognition in mainstream political science has many reasons, including the intransigence of the discipline to a biological paradigm of behaviour, to lack of an impressive institutional base (Somit and Peterson, 1998: 569). Another contributing factor might be timing. Although much of the early work in biopolitics was aimed at inculcating a biopolitical perspective in political science and efforts were made to publish in mainstream journals, especially the *American Political Science Review,* the unresponsiveness of these journals to biopolitics articles forced those persons writing in biopolitics to seek more hospitable outlets for their work. Also, given the hostile or indifferent reaction to their appeals for a more sympathetic hearing for biopolitics, emphasis in the biopolitics literature shifted toward more substantive work and less for making a case for a more biologically-oriented discipline. In other words, political scientists in biopolitics gave up trying to convince the uninitiated and focused on the interdisciplinary work at hand. Establishment of its own journal and an independent annual meeting, though signs of maturation and strength organisationally, has the effect of further isolating biopolitics and making it even less visible to the discipline of political science.

We feel that the case for a more biologically oriented political science is better in 2000 than it was in 1970 because of all the groundwork done over this generation by scholars in biopolitics. Furthermore, the evidence coming from the biological sciences, especially genetics and neuroscience, makes it increasingly unlikely that informed, intelligent observers can continue to dismiss biological concepts and variables in the study of political phenomena in all sub-fields of political science. In other words, the timing now should be more conducive to success in making the case for a more biologically oriented political science. It is hoped that a book titled *Biology and Political Science* will strike a positive chord in political scientists from many areas to consider integrating biopolitical findings in their teaching and encourage more biologically sensitive research across the discipline. We are not naive enough to believe this will be accomplished fully or with alacrity, but welcome any moves in that direction. To that end we make what we hope is a persuasive case to a sceptical discipline.

Biology, health and behaviour

The genetic links to behaviour are increasingly apparent, largely the result of genetic research under the human genome project. Although applications are yet

limited, genetic diagnosis capabilities will provide us with an array of predictive tests, of varying reliability and preciseness, for susceptibilities of many personality and behavioural traits. Moreover, in the next decade gene therapy will likely emerge for many of these traits. As a result of this new genetic knowledge, and its applications in testing, diagnosis and therapy, the linkages between the genome and behaviour are again becoming matters of heated controversy. Issues of regulatory policy, discrimination, privacy and the potential for eugenics abound. And the debate within the medical profession will only become more intense and will be closely tied to national health care policy issues as well as funding for scientific research. Political scientists are currently ill-equipped to engage in these profoundly serious debates (see White, 1992; Blank, 1999).

The more we understand the functioning of the brain, the more we are led to the conclusion that what our individual brains permit limits us as individuals. This is not to be interpreted as suggesting that our brains determine behaviour, but rather that they mediate genetic and environmental influences. The brain affects or mediates every action and thought of both political leaders and citizens. Our capacity for enjoyment, suffering and behaviour is inscribed in neurons and synapses. As a result our interpretation of the world, including the political and social dimensions, and our responses to it depend on the internal organisation of the brain. Therefore, in order to make sense of human behaviour we, by necessity, must understand the organisation and functioning of the system that controls or modulates it, the central nervous system.

The findings of the life sciences, then, require a model, which acknowledges that the brain has a major role in explaining behaviour. As noted by Changeux:

> The development of the neurosciences has brought another way of looking at behavior ... The neuronal content of the black box can no longer be ignored. On the contrary, all forms of behavior mobilise distinct sets of nerve cells, and it is at their level that the final explanation of behavior must be sought.
>
> (Changeux, 1997: 97)

Although it is debatable as to whether we will ever be able to describe a particular behaviour in terms of specific neuronal activity, it is crucial that these neural dimensions be an integral part of any respectable paradigm of behaviour. To ignore the role of the brain is no longer possible in light of what we now know even in the rather primitive stages of neuroscience.

The rapid development of cognitive science along with behavioural genetics has already led to significant alterations in psychological theories of abnormal behaviour. 'Perhaps the greatest source of optimism and excitement in the field of abnormal psychology in the last twenty-five years has been the tremendous advance in the study of the biological bases of behavior' (Bootzin *et al.,* 1993: 88).

This enthusiasm, however, has not generally extended to the social sciences, particularly political science. The newly emerging field of evolutionary

psychology may help to provide the connecting link between the biological bases of behaviour and the larger process of evolution in the study of political, social, cultural and economic behaviour (for some examples of social scientists other than political scientists who are advocates of biosocial science see Fox, 1989; Walsh, 1995; Eibl-Eibesfeldt, 1989; Wright, 1994; de Waal, 1982, 1989, 1996; Maryanski and Turner, 1992. For sources in bioeconomics, see a series of papers by Corning 1995, 1996a,b,c).

Also largely neglected by political scientists has been the impact of health status on political behaviour. How do disability and chronic illness, for instance, affect political attitudes, interest and participation? Even the normal process of ageing can be a very significant individual and group variable in certain contexts (see studies cited later by Wiegele, Schubert, and Hines on age, age structure and political decision-making). Peterson and others have found that health and illness might shape political activity, but most political analysis continues to focus exclusively on the same socioeconomic variables introduced in *The American Voter* in the 1960s. Although more research has been done on the effects of ageing on political behaviour, the health factor is seldom emphasised. Studies by Robins and Rothschild (1981, 1988) on health, stress and leadership behaviour are the exceptions to the rule. In addition to examining the relationship between health and political behaviour, research is necessary to analyse the policy implications. For example, how might an individual's health status influence his or her position on health policy issues such as managed care and rationing?

A related area is the impact of illness on political decision-making. Here again there has been increased interest among a few political scientists and life scientists who have found troubling patterns that have ramifications for all levels of political leadership. In chapter 5 we will describe what has been posited about disability and presidential decision-making and about the effect of drugs and alcohol on political decisions. This has significant importance not only in domestic politics but also for international politics (for example, Boris Yeltsin as President of Russia).

The life sciences and public policy

The implications of the life sciences for public policy are substantial in two distinct ways: the content of public policy and the process of policy making (see Caldwell, 1987, for an overview). Many of the most contentious policy issues currently are at their base biological, and this prevalence is bound to increase in the twenty-first century. From issues surrounding genetic and reproductive engineering and rapid advances in neuroscience, to concerns about the ecological system, including biodiversity, global warming and the like, to population control and abortion, and to medical technology and the ageing population, the life sciences are at an increasingly central place in the public policy agenda. To date political scientists have found themselves largely left out of the debate over these issues. Their absence from national commissions and other policy forums, as compared to ethicists, sociologists, and especially scientists, is striking. In large

part this reflects the lack of training and appreciation of life science perspectives by political scientists, some of whom joined the discipline to escape science and mathematics.

This marginalisation of political science from the critical policy issues of the day means that the crucial political perspectives that it could offer are offered instead by life scientists, who are themselves poorly trained to appreciate the nuances of the policy process. Students with interests in the policies related to these important issues find themselves drawn to interdisciplinary programmes in public health, environmental studies and health administration rather than to political science departments, which offer them little in the way of coverage of these topics. Also, programmes in policy sciences and policy studies (foreshadowed by Lasswell, 1925), often anchored in economics, not political science, have eclipsed political science in speaking to these issues.

This raises a second problem faced in contemporary policy analysis: the question of how the policy process works. The heightened understanding of the role of human biology in decision-making must be better integrated into policy analysis and into our models of the policy process. For instance, Graham Allison's introduction of the organisational process and governmental (bureaucratic) politics models as alternatives or supplements to the rational actor model was a significant improvement of our understanding of political decision-making. However, three decades later it is just as important that our heightened knowledge of the biology of human behaviour and the evolutionary bases of organisational behaviour be incorporated into more inclusive models of policy making. As in the study of political behaviour, the context of policy making must be recast in light of new findings in the neuroscience, genetic and evolutionary spheres. For too long political science has ignored the evidence from the life sciences as it affects policy content and process, despite the warnings of the discipline's founders that biology must have a central place. This imbalance must be redressed by the development of a new paradigm that gives full appreciation to human biology.

A life science paradigm of political behaviour

The dominant model for the study of political behaviour is a traditional social science model (see Figure 1.1) that emphasises the influence of environmental variables on decision-making. In this model, the emphasis is clearly on the 'nurture' (read political socialisation) of the decision maker and the dynamics of groups in decision-making. As Glendon Schubert pointed out some time ago, this social psychology approach is simply not complete enough (Schubert, 1976: 165). A more robust model that is interactional at its core is required. Minimally, the interactional model reflects the combined effects of genotype and environment on the organism with the result being the phenotypic expression of those influences. Versions of such a life science interactional model are offered by Glendon Schubert (1976, see Figure 1.2) and Roger Masters (1989, see Figure 1.3).

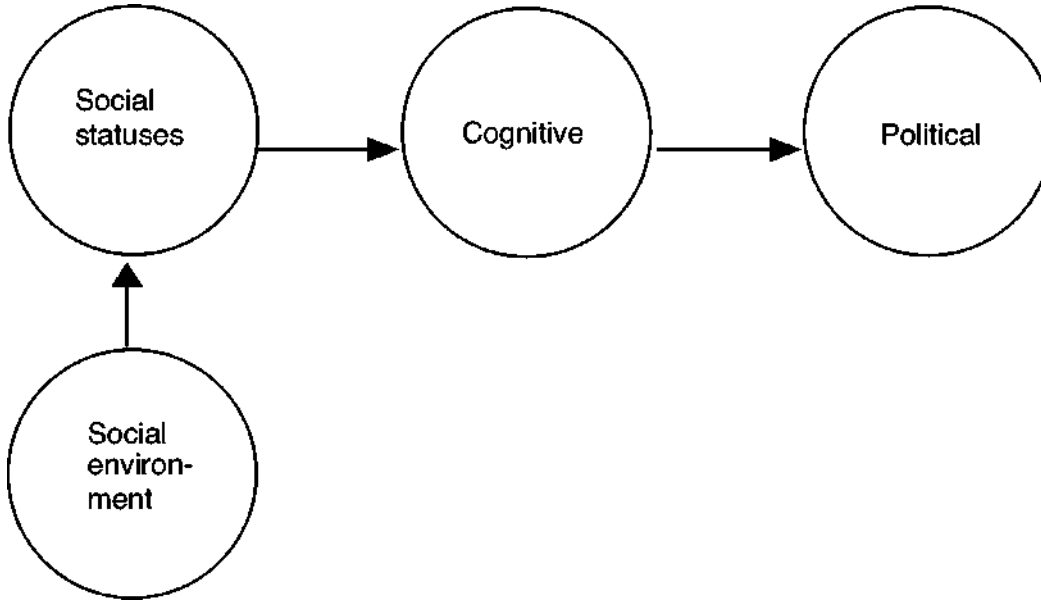


Figure 1.1 The social science paradigm of political behaviour
Somve: Schubert (1976: 177)

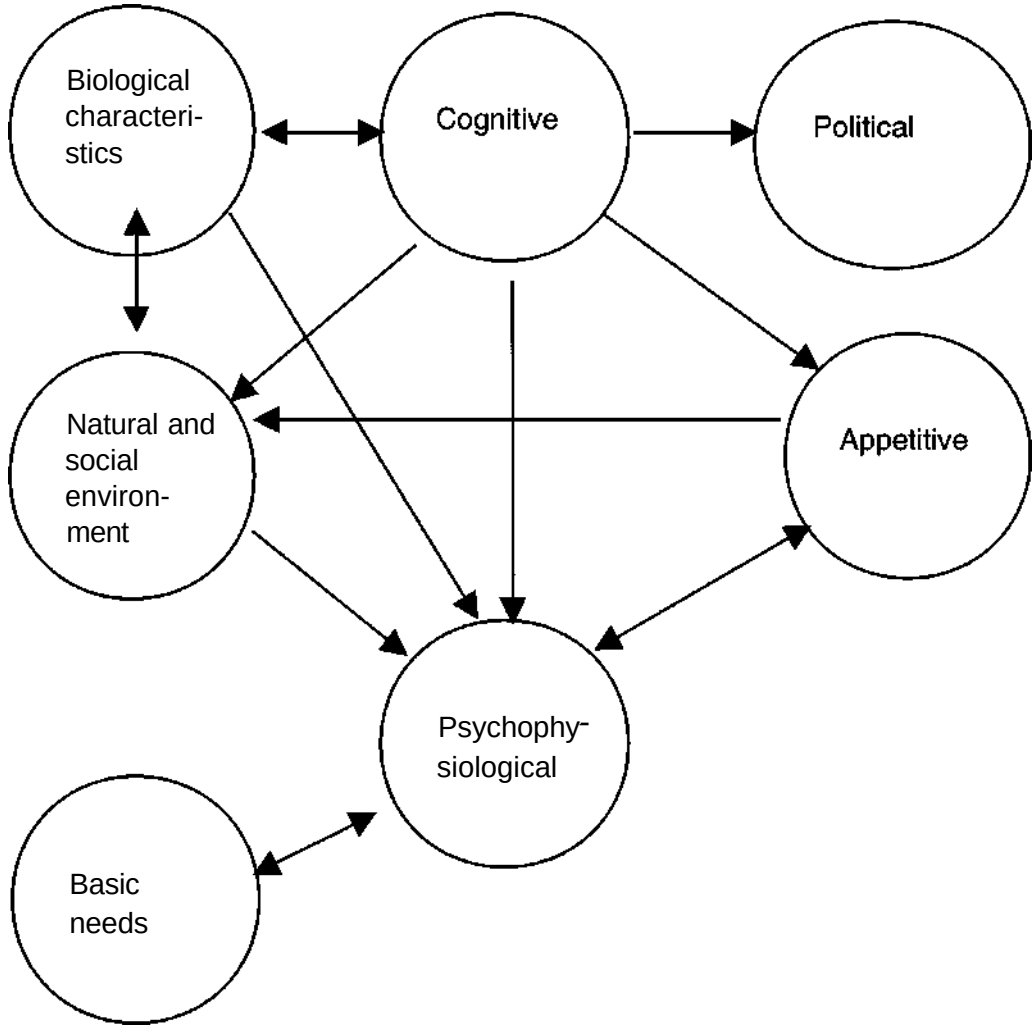


Figure 1.2 A life-science paradigm of political behaviour
Somve: Schubert (1976: 179)

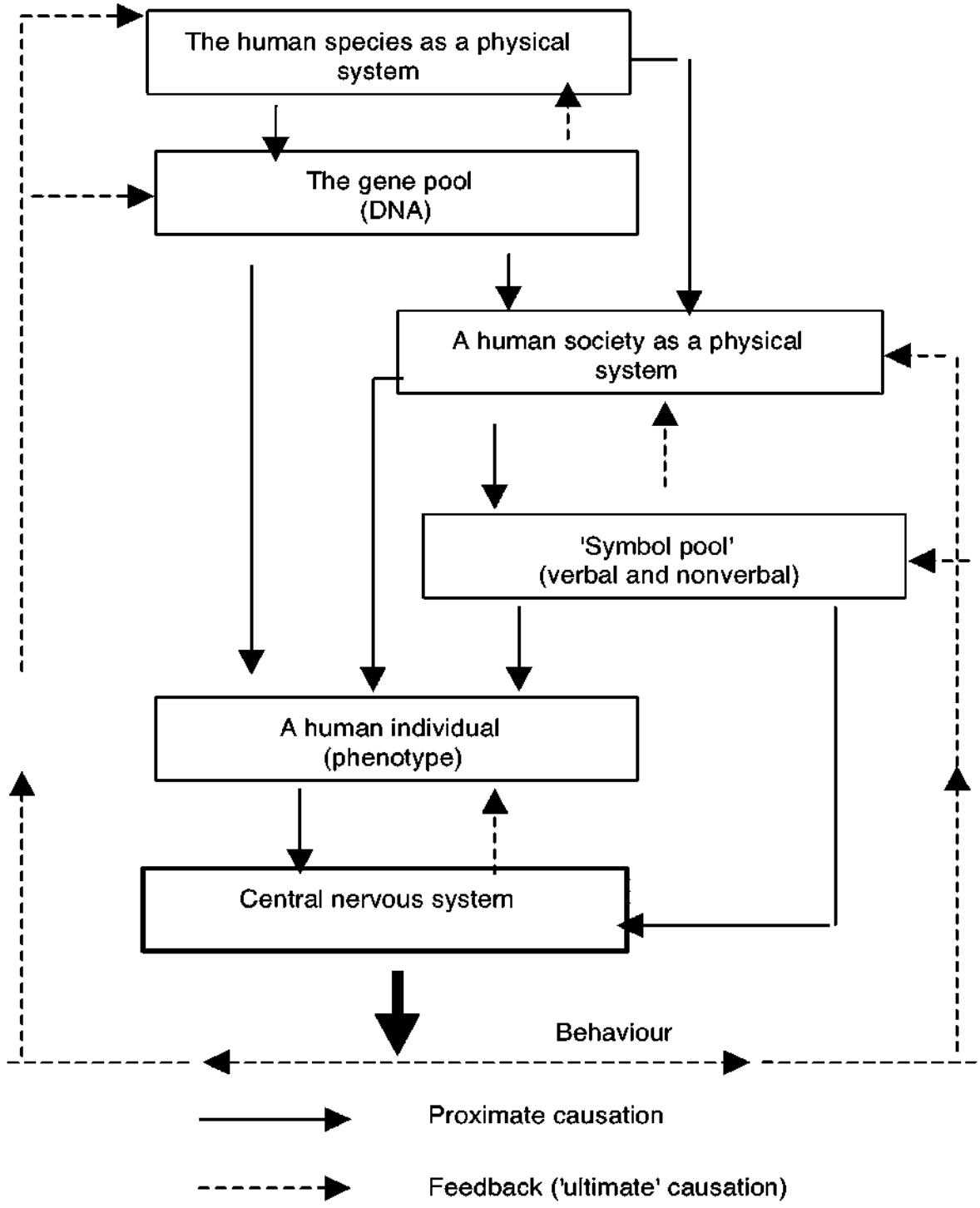


Figure 1.3 An interactional model of political behaviour
Souive: Masters (1989: 134)

The older model, which still seems to dominate mainstream political science focuses on proximate causal linkages, ignoring completely the level of ultimate causation, which is essentially an evolutionary explanation that takes into account all levels of analysis. Although this admittedly more complex interactive approach demands much more of the researcher, it is necessary if what constitutes a full explanation is even to be understood, much less applied.

Practitioners of the life sciences well understand the problem of deciding on the level of analysis at which the research is focused. The social sciences have divided their interests - for example, with psychology and sociology - between the level of the individual and the level of the emergent group. When one considers the important differences between studying whole systems (such as societies) as compared to an individual decision maker (such as a political official), one can quickly appreciate the importance of levels of analysis. For the practitioner of biopolitics, it is certainly legitimate to isolate one level for purposes of analysis, but one must acknowledge that it is also legitimate to study phenomena at an altogether different level (for example, more reduced or more complex) than that chosen for a particular study. This is precisely the reason why a biopolitical approach has the potential to incorporate in a meaningful and linked way the many disparate types of research associated with the study of politics (such as political systems, group processes, elites both collectively and individually, policy arenas and small group dynamics).

The careful exploration of the effect of genetic variables on behaviour is among the most controversial aspects of applying the interactional model. But it is equally challenging to embrace the insights of ecology and to contextualise properly the phenomena that are being studied. The interactional model invites collaborative and multi-methodological strategies of research. We will explore the implications of this interactional model in several of the chapters that follow as we focus upon political behaviour and political evolution.

Organisation of the book

Chapter 2 analyses the vast implications of biopolitics for political theory and the need to re-evaluate basic assumptions of the prevailing political science paradigm. It reviews the contributions of the major figures in the development of biopolitical theory. Chapter 3 extends this analysis to comparative politics and international relations, one area where some attention has been directed toward biology.

One of the major problems to be faced in adopting a more biology-based approach to political science centres on methodological problems inherent in a more holistic paradigm. Chapter 4 discusses these problems but shows that they are surmountable. It addresses the issue of level of analysis at length and discusses the dangers of the dependence on any single methodology such as the prevailing method of survey research to explain behaviour.

Chapter 5 focuses attention on the biological bases of behaviour. It first summarises the current state of knowledge concerning the genetic and neurological bases of human behaviour. It then discusses in detail the findings of biopolitical research over the last several decades on the impact of health and nutrition on political behaviour. It also describes research on the biological foundations of elite behaviour and leadership.

Chapter 6 analyses recent biopolitical research on policy making and on the evolutionary bases of bureaucracy and problems that accompany political struc-

tures. It also describes the wide range of biopolicy issues facing individuals and society and the challenges they create for traditional policy-making institutions. This chapter also examines some central policy concerns raised in new knowledge of the biological contributions to aggression, criminality, addiction, sex-typical roles and sexual orientation and its impact on conventional notions of free will and individual responsibility. Chapter 7 expands this discussion to an analysis of environmental and population policy and argues that unless we pay closer attention to these global trends species survival will be held in the balance.

In the concluding chapter, the case again is made for a paradigm shift toward an interactive model. It concludes that rather than lead to biological determinism, which is often argued by opponents of biopolitics, this inclusive paradigm allows us to counter deterministic protestations more effectively than by denying any biological influences at all. The chapter concludes by calling for a human-centred political science in which the now 'empty organism' is given life and the 'black box' at the centre of contemporary environmental models comes into the light.

2 Biopolitical theory

> Assessing contemporary human existence as a biological phenomenon is not only permissible but mandatory. Anyone rejecting this approach fails to recognize the significance of our existence and thus the extent of human responsibility.
>
> Pierre Bertaux (1963), cited in Eibl-Eibesfeldt (1989: xii)

Introduction

from the appearance of the first works that were avowedly 'biopolitical', proponents have been advocating the need for a theoretical 'paradigm shift' in political science from traditional and behavioural approaches to a life science based, evolutionary framework or paradigm. But the suggested strategies for achieving this goal have varied, as have the core problems and preferred methods. Some have advocated the use of evolutionary theory and general systems theory, the intellectual forebear of David Easton's (1965a) systems theory, in their quest for a general theory of political change as a foundation on which to build their framework. Others, seeking an explanation for social co-operation in the face of self-interested behaviour, have been drawn to sociobiological theory. Still others who are focused on specific types of political behaviour are most concerned with the extension of the behavioural paradigm to take fully into account the human body and the brain, specifically, in the shaping of that political behaviour. Yet another group of biopolitics scholars have drawn heavily upon the work of ethologists and are seeking fruitful comparisons among and between primates, again as part of a strategy for expanding upon the behavioural research programme. However, it must be said that even when not fully articulated, all of these theorists are lagging as a backdrop the theory of evolution, albeit updated and contemporary, to be sure, but historically indebted to the original work of Charles Darwin and to the modern evolutionary synthesis.

What is perhaps surprising, but indisputable, is the fact that the study of politics was from the beginning in ancient Greece informed by contemporary knowledge of human nature. Indeed, it could be argued that all political theories have a theory of human nature, even if that theory is that there is no 'human nature' but only a malleable organism shaped by its environment - shall we say, a *tabula rasa!* One of the best sources for putting the relationship between

political and social science and the life sciences in perspective is W.J.M. Mackenzie's *Politics and Social Science.* Mackenzie (1967: 24; see also Mackenzie, 1979) says that 'one can hardly begin to discuss politics without a reference to the question "What is man?", the starting point of so much political argument from the time of Plato, indeed from the time of Homer and of his contemporaries in Palestine, China and India.' And one cannot ask that question today and expect an informed response without taking into consideration contemporary biology and the life sciences more broadly. However, that is precisely what political science has done, by and large. We have ignored what the life sciences have to say about human nature and human behaviour. Rather than seek more complex, robust and more powerful explanations, we have settled too often for more manageable research designs that arbitrarily assigned all explanatory power to the environment and ignored the genotype and the body (physiology) as independent variables in relation to human behaviour. The limitations of a political science that relies too heavily on survey research methods and aggregate data analysis are becoming more obvious, even as its proponents laud its significance for understanding political behaviour.

In a glowing report on the contributions of survey research to political science, Henry Brody argues that surveys are 'powerful collectors and accurate magnifiers of information' (2000:47). Survey methodology can assess the causes and impacts of events just like the experimental method in physics, biology and psychology and represent the 'gold standard' for measuring opinions, according to Brody. As measured by range of applicability, linkage to theory, conceptual richness, capacity for confirming theory and policy relevance, Brody concludes that survey research scores high. Despite its costs, he concludes that survey research is 'extraordinarily cost-effective in producing some of the most exciting and important research on politics' *(ibid.:* 48). The answer to any existing gaps that exist for Brody is training more people in scientific [read survey] methods and more funding for more and increasingly sophisticated surveys. Although surveys have produced vast amounts of data and are at the base of most contemporary knowledge of political behaviour, it is striking that nowhere in his article does Brody question the fundamental problems of survey research raised by a biological perspective.

Despite over five decades of almost exclusive use in the study of political behaviour, opinions elicited by survey research are still not proven reliable indicators of actual behaviour. Survey research relies upon verbal report and offers little guidance to the emotional effect or intensity of feeling underlying the response. Key variables such as efficacy, trust, alienation and so forth, are assumed to be broad mental images that can be verbalised by all respondents if only the right questions are asked and the appropriate scales constructed. Neuroscience research (discussed in chapter 5), however, demonstrates that much human action is unconscious (or at least not clearly conscious) and that we are thus unlikely to be able to verbalise much of our behaviour. This is especially the case for deep-seated and highly emotional responses such as fear, hatred and aggression.

Therefore, although words express ideas overtly, they are embedded in a continual interplay of neural, hormonal, biochemical and other physiological activity that make them, at best, weak approximations of deeper impulses. Motor responses from the nervous system that react to cognitive and affective ideation act simultaneously with activity of the autonomic nervous system and the glandular and hormonal systems. As such, much of our emotional state and our physical readiness to act are a direct expression of the neurophysiological system. Importantly, while the functioning of these systems is not accessible to conscious, introspective analysis, they can be observed through a wide array of psychophysiological activity, such as sweating palms, release of adrenalin into the bloodstream, rise or fall in heart rate, increase or decrease in blood pressure, slower or more rapid respiration, and so forth (Wahlke, 1979: 198). Survey research alone with its dependence on verbal response overlooks this vast range of critical indicators.

These shortcomings of survey research do not negate its usefulness. Indeed, Peterson (1996; see also Peterson, 1990) has noted that survey research that includes measures of biological variables can be a useful component of biopolitical research. However verbal responses must be supplemented with inclusion of psychological measures to facilitate a more reliable measure of attitudes and thus a closer approximation of behaviour. By observing physiological responses in different situations to different stimuli at the same time as observing verbal behaviour in interview situations, we should be able to reveal more about the internal state of the respondent. Although few studies of political behaviour have done this, a variety of physiological indicators have been used in isolated studies. Among the indicators used have been heart rate, eye blink rate, galvanic skin response, blood pressure, uric acid level and reaction time. The contributions that this approach can make to the study of political behaviour will be discussed throughout the following chapters, especially chapter 5.

Despite these obvious limitations, the case for biopolitics or biosocial science more inclusively has not been as convincing as it apparently needs to be. For example, recent handbooks of the discipline of political science completely ignore biopolitics and have all but forgotten the extent to which systems language (via David Easton, in particular) underlies much of the vocabulary of political science and owes its origins to the biology of living systems. It is particularly disturbing to find a chapter on political behaviour by Miller (1996), which purports to review both old and new contributions, that only discusses survey research and voting behaviour studies. Even the chapter by Dunleavy (1996) which covers institutional and experiential approaches shows complete ignorance of the biobehavioural research that is being carried out by proponents of biopolitics. Interestingly, Dunleavy (1996: 278) does cite the biopolitical researcher Vanhanen's (1984) study of the evolution of democracies (see chapter 3), but only to make an aside about voting participation in America. This omission is glaring, particularly since many of the empirically based biobehavioural studies have appeared in mainstream political science journals, as illustrated by citations to works by J. Schubert, Roger Masters *et al.,* and numerous other authors whose

works are reviewed in Somit and Peterson (1994, 1995 and 1996). Of course many of these studies of political behaviour are found in the journal *Politics and the Life Sciences* which, despite being in all major citation indexes seems to have escaped the attention of the mainstream figures of behavioural political science.

Competing theories of politics have been more successful than biopolitics for various reasons. Somit and Peterson (1999) have made this point effectively in their comparison of the relative success of rational choice theory and biopolitics in political science. They conclude that the success of rational choice theory was predictable because it

> fitted comfortably into political science's 'political behavior is learned behavior' paradigm; it did not raise doubts about a considerable body of research (and researchers) in that discipline; its origins in economics endowed it with impressive scientific credentials ab initio; and graduate training at highly and less-prestigious institutions alike was quickly forthcoming.
>
> (Somit and Peterson, 1999: 43)

Like them, we hope to demonstrate that '[biopolitical theories promise a more profound explanation than rational choice theories because they allow researchers to explain what rational choice theories must simply take as a given - the tendency of humans to make decisions in light of their perception of their own self-interest' (Somit and Peterson, 1999: 40). Unlike rational choice theorists who must make a priori claims about human nature - we are economic men and women - biopolitical theorists can call upon an extensive body of ethological, sociobiological and evolutionary theory and evidence to support a view of human nature that comprehends self-interested behaviour and co-operative, social behaviour as well. An explanation frequently offered for this neglect of biopolitics research is that it may be due to the taint of social Darwinism and the eugenics movement in America on that body of scholarly work in politics that stretches from Herbert Spencer to Charles Merriam (see Drysek and Schlosberg, 1995).

In a recent volume *Political Science in History,* Drysek and Schlosberg (1995) offer an insightful discussion of the relationship of biology to political science. After noting the long-standing reliance on biological metaphor in political thought, they focus upon the impact of Darwinian evolutionary theory on the discipline. They note that the impact of the sub-field of biopolitics has not been significant, but that it parallels the proliferation of numerous sub-fields that sustain their proponents but have difficulty attracting more followers. The social sciences in general also reflect this tendency. Their principal conclusion is that despite offering promise, biopolitics remains plagued by the ideological debates over the 'best regime' and the problems of relativism and reductionism.

In an earlier review of biological ideas in politics, Mackenzie (1979: 36) found five types of objections to a biologically based political science: 'the bad political repute of Social Darwinism; the supposed death of God; the naturalistic fallacy

and the attack on "reductionism" ...; the character of human knowledge (phenomenalism since Kant); the character of the human will' To these Somit and Watts (1994) add the fact that many have a professional stake in the viewpoint that all behaviour is learned and therefore not constrained in any way by biology and by the ethical objections raised about the experimental research required by a biologically based social science. However, as Walsh (1995:15) observes, 'Those who hurl the gauntlet at nineteenth century biology are fighting battles in wars long ago won: What modern chemist quotes Brodie? What modern geologist resurrects Bishop Ussher as a straw man when discussing plate tectonics?' Today's biosocial science researchers bear little or no resemblance to their nineteenth-century predecessors who were relying on far less sophisticated life science research and who were extrapolating at will from Darwin's work to serve ideological purposes in their day.

In her presidential address to the American Sociological Association, Alice Rossi made the point that:

> Researchers in the biological sciences have gone further in incorporating social variables into their research than the social sciences have gone in incorporating physiological variables in theirs, with the ironic consequence that there is more evidence to support the importance of social variables in the biological literature than there is evidence to reject the evidence of physiological variables in the sociological literature.
>
> (Rossi, 1977: 7)

Walsh goes so far as to say that: 'If we do not [incorporate biology] and continue to defer to the biological sciences in the study of human behavior, we may find one day that the rest of the scientific community regards us with the same condescension that is today reserved for "scientific" creationists' (1995: 16). We would do well to heed this warning.

In what follows, we shall provide an overview of contemporary biopolitical theory as formulated by some of the leading theoreticians of biopolitics. As a way of organising our discussion of biopolitical theory, we shall begin with an examination of what one of the authors (Hines, 1982b) defined as a biopolitics 'Credo', following earlier attempts by Easton (1962) and Somit and Tanenhaus (1967) to formulate the behavioural creed.

1 The study of politics must reflect that man is an outcome of evolution. Our past is meaningful for the present and is a result of biological and cultural processes. Our future is conditional and therefore the fundamental problem for our species is survival. (Take time and the problem of survival seriously.)
2 Human behaviour is expressed phenotypically - the result of the interaction of genotype with environment. (Following the interactional paradigm, take genetic endowment and the environment seriously.)

3 Man has evolved into a highly complex organism that interacts with the environment in a purposive and a deterministic way. (Take the body, the brain and human consciousness seriously.)
4 There is more continuity than discontinuity between man and other animals (especially the primates and other mammals: for example, the social carnivores) than is commonly recognised. (Take other species seriously.) Employ the comparative method to study human and animal behaviour with the understanding that animal behaviour studies are, minimally, of heuristic value and that analogous explanations are possible, and homologous explanations may be possible, but are subject to empirical demonstration. The use of analogy (and metaphor) is both legitimate and necessary.
5 Explanation of human behaviour must reflect the levels of organisation manifest in human life (individual, dyad, group, population, species). Recognise the effects of upward and downward causation and the significance of effects as causes. Acknowledge the limitations of a fully reductionist (i.e. physicalist, materialist) account of human behaviour. Employ both deductive and inductive strategies of inquiry. Seek to integrate micro- and macro-level studies. (Take complexity, feedback, synergism, function, emergence and teleonomy seriously.)

A succinct summary of the credo would be: 'Take TIME, GENES, the BODY, CONSCIOUSNESS, other SPECIES, the ENVIRONMENT and SURVIVAL seriously.' This credo takes full account of the contemporary life sciences and their sophisticated and complex understanding of human nature and of the evolution of our species. It reflects the current state of evolutionary theory and of the latest advances in psychobiology and acknowledges the interactive character of genotype and environment in the expression of the phenotype.

The components of biopolitical theory

Biopolitical theory encompasses what we shall refer to as biobehavioural theory and evolutionary theory. The former focuses on the implications of the interactional model of human behaviour (see figure 1.3 in chapter 1 and figure 5.2 and 5.3 in chapter 5) and relies on studies at the level of the individual and small groups. The latter draws upon general systems theory and the evolution of social systems and political subsystems as well as ethology and Sociobiology. The latter includes the study of the biocultural evolution of institutions and structures. In addition, there is an important area of research, which we call 'applied biopolitics' or 'biopolicy' that covers the application of knowledge and theory from biopolitics and a wide variety of disciplines to specific areas of public policy. This usage follows that described by Lynton Caldwell (1964, 1987). In this chapter we shall review biobehavioural and evolutionary biopolitical theory, with special emphasis on the work of Roger Masters and Larry Arnhart, Glendon Schubert, Albert Somit and Steven Peterson, Peter Corning, Tim Hayward and William Ophuls. In chapter 5 we review the substantial body of research on

political behaviour using life science theory and facts. In chapters 6 and 7 we will review the major areas of biopolicy including environment and health.

As we have indicated, there are several distinct strains within biopolitical theory. Some, like Roger Masters, Glendon Schubert and Peter Corning, have attempted to create theoretical frameworks for biopolitics that are comprehensive and fully informed by the full range of contemporary evolutionary theory and contemporary physics. Others, like Albert Somit and Steven Peterson have drawn upon those theorists and on Sociobiology and ethology to challenge assumptions about contemporary democratic theory and practice.

Outside of biopolitics, at least one theorist, William Ophuls (1977, 1997), has drawn extensively on ecological theory to critique modernity and liberal democratic capitalism. His ecological approach, particularly when coupled with that of Hayward (1998), provides a foundation for an ecological theory of politics. We shall deal with their contributions in chapter 7 because their focus is more on a particular political issue, the environment, rather than on the development of broad-based biopolitical theory. Moreover, unlike the other theorists we will discuss, they have not actively associated themselves with the Association for Politics and the Life Sciences and with the biopolitical movement.

Now we shall examine the work of several of these authors in some detail while noting other contributors whose work relates closely to these primary biopolitical theorists. In chapter 3 we will discuss contributions to the study of comparative and international politics. In later chapters dealing with methodology (4), behaviour (5) and biopolicy (6 and 7) we will discuss the work of those persons who have developed biobehavioural theory and applied biopolitics.

Evolutionary biopolitics and human nature

Roger Masters has offered a theory of biopolitics that reflects the full range of insights from the life sciences. In his *The Nature of Politics,* he updates the tradition of Western political thought with the latest findings of the life sciences, observing that '(t)he great thinkers of the past always took into consideration the science of their time, just as empirical science inevitably raises moral and philosophical questions' (Masters 1989: 5). Masters shows the important ways in which the findings of the life sciences contribute to our ability to answer the perennial questions of political theory: the nature of man, the origins and purposes of politics and the state, the nature of political obligation and the problem of creating and maintaining political order. Drawing upon strains of political philosophy that began with Plato and Aristotle, particularly the latter, who challenged the Sophists' position that society rests on contract or convention, Masters seeks to provide a contemporary, sophisticated theory of human nature that demonstrates the Aristotelian idea that man is by nature a political animal. Political order is thus naturally based upon both human nature and nurture and political leaders seek solutions to the problem of maintaining order and survival through institutional structures and political processes that are adaptations to particular ecological settings.

Masters begins with a detailed examination of what the study of animal behaviour and sociology can reveal about human nature and the nature of social competition and co-operation. Research in ethology and Sociobiology (for example, the works of Eibl-Eibesfeldt; Barash; Alexander) reveals that complex patterns of co-operation and competition are the result of natural competitiveness (individual and species strategies consistent with inclusive fitness and Sociobiology) conditioned by environmental factors that make co-operative strategies meaningful and successful both at the individual and the group level. Thus,

> political philosophy can be understood as a response to the fundamental predicament facing human civilization - survival over time through the establishment of political orders. Precisely because the ambiguity of cooperation and competition is natural to humans, it is never completely clear how we can and should relate to each other. And because both selfishness and altruism have a natural root that has been transformed by cultural change, it is rare that political institutions are universally acceptable and stable. Hence, humans continually seek the 'right' or 'just' way of organizing their social life in the hopes of establishing standards for justifying, improving or criticizing existing institutions.
>
> (Masters, 1989: 21)

After a review of the findings of contemporary ethology and Sociobiology, Masters concludes that it is no longer adequate to assume that society is entirely the result of human volition or agreement, or that the plasticity of our social behaviour is due to an absence of human nature. 'We have an innate behavioral repertoire that can be used to qualify human beings as social animals' (Masters 1989: 28). He goes on to elucidate that behavioural repertoire drawing upon an extensive bibliography of research in human ethology *(ibid.:* chs 2-3; Masters, 1994). A full inventory of this repertoire can be found in Eibl-Eibesfeldt's (1989) comprehensive study of human ethology.

The crux of his argument, as noted by Losco (1995), lies in Masters' lengthy explanation of politics as a biological phenomenon and the presentation of his model of human behaviour as a biological phenomenon (see chapter 1, figure 1.3). Here and elsewhere Masters takes care to explain that the contemporary life sciences reject simple dualities and stand four-square in support of an interactional view of behaviour reflecting the biocultural evolution of human social behaviour. It is this interaction of genes and culture, manifest through the organism and expressed phenotypically as complex behaviours that represents his model's capacity to support political inquiry at different levels of analysis where different elements of reality are examined. Masters argues that individual behaviour is conditioned by biological potential, which is expressed through the genotype. Because the range of behavioural possibilities is considerable, and the expression can be in the form of symbol systems through culture, the study of this behaviour requires inquiry at all levels and thus makes naive reductionism

an impossibility, even while reductionistic moves are allowed for the purposes of particular research projects. Masters concludes that:

> [human behaviour is the] product of an integration, within the brain and central nervous system of each individual, of phylogenetically selected information transmitted by the genes, historically selected information systems transmitted by language and cultural symbols, and individually learned information acquired during the life cycle.
>
> (Masters 1989: 135)

Drawing upon research in ethology and primatology, Masters discusses the importance of evolved behavioural repertoires that include bonding, aggression and flight arguing that '[a]ny complete understanding of the way individuals compete and gain power must consider the symbolic gestures of emotion and dominance that originated in hominid evolution but have been subtly influenced by human cultural practices' (Masters, 1989: 40). The study of facial displays is one method for recording behavioural responses that reflect this human biogrammar. 'When primates interact, their status can typically be inferred from their display behavior. Changes in dominance are foreshadowed by slight but significant modifications in facial and bodily gestures' *{ibid.:* 41).

Extensive studies cited by Masters reveal that the *tabula rasa* view of learned behaviour cannot be sustained because there is a natural predisposition for social behaviour that is 'preprogrammed in the human brain' (Masters, 1989: 42). Masters' own research on human responses to the facial displays of political candidates demonstrates this point. It also shows concretely how biopolitical research informed by evolutionary theory and Sociobiology can effectively link micro-political research to macro-level political issues - that is, support for specific candidates (see *ibid.:* 59-68; Masters and Way, 1996). Thus, he concludes:

> As a description of the mechanisms underlying human social behavior, the *tabula rasa* psychology of Hobbes and Locke - as well as its prolongation in the psychological tradition that treated the human brain as an undifferentiated 'black box' whose responses were entirely due to individual learning and experience - must be abandoned. Although human nature is complex, it can be understood by using scientific methodologies ... It is no longer adequate to assume that society is entirely the result of human volition or agreement, or that the plasticity of our social behavior is due to an absence of human nature ... We have an innate behavioral repertoire that can be used to qualify human beings as social animals.
>
> (Masters, 1989: 68)

In moving to the level of society, language and cultural change, Masters recognises that the human nature he previously described is too general and can't be 'the only basis of a naturalistic understanding of politics' *(ibid.:* 69).

He concludes that: An adequate theory of politics must explain the difference between "stateless societies" (organized on the basis of informal face-to-face social relations) and states (with much larger populations as well as formal governments) - and a constant is usually insufficient to explain variation' *(ibid.:* 69).

In his discussion of politics as a biological phenomenon, Masters goes on to show that the levels of the gene pool (for the species), the symbol pool (for society) and the central nervous system (for the individual) parallel one another in serving as the information systems (or rules, codes and protocols) that provide structure and order at their respective levels. These information-coding systems 'enable populations and individuals to survive and reproduce' (Masters, 1989: 136). Although the connection was never made to other levels of reality, Karl Deutsch in *Nerves of Government* (1963) made a strong case for understanding the sense in which the political system was concerned with the processing of information by individuals and groups and that information was power.

> cultures can be viewed as information systems based on a series of interrelated codes. To be sure, human cultures and societies elaborate complex systems of material artifacts - tools that manipulate the environment, symbolic objects and works of art - that are 'artificial organs' not transmitted through the gene pool. But artifacts become extinct if humans cannot communicate the mode of producing, using, or understanding them; hence, without speech, variability is limited to those actions that can be visibly imitated, such as techniques of using preexisting objects or moving through the environment. While some species use tools, humans make them in unequalled variety, in all probability because only humans can communicate verbal instructions to program the production of tools.
>
> (Masters, 1989: 137)

The fundamental point is that we cannot explain the functions of culture as an information processing system without understanding how the individual processes information and we must recognise that the former, despite our considerable range of biological potential, is constrained by the limitations of our evolution to date. Culture becomes an extension of that potential, precisely because we have the physical capacity to transfer knowledge and skills (culture) from one generation to the next in a most effective way. Because information is generated at the level of individuals and at the level of systems (collectivities), there is the potential for a high degree of variability, hence 'the probability of contradictions between individuals or groups is exceptionally high' (Masters, 1989: 138) for our species.

> Since the three pairs of systems in [Masters' model] are virtually never in complete equilibrium, a society's regime or political system has the function of determining the priority of potentially conflicting messages and rules of action. Because this function can be satisfied without the existence of a state

> — a social institution specialized in the establishment and enforcement of the 'rules of the game' - politics is present in all human populations.
>
> (Masters, 1989: 138-9)

Thus as numerous anthropologists have shown, politics and political systems have existed in various forms in various social orders throughout human history. Whether or not enforced by a central government, the law functions as a programme whose primary function is to channel the behaviour of individuals and groups comprising a society. 'Though laws also establish procedures for resolving conflicts, use of these mechanisms is, in a technical sense, a secondary function that reflects ambiguity or conflict in the interpretation of social rules by different individuals' (Masters, 1989: 139).

This leads Masters (1989: 140) to offer the following definition of politics as the behaviour that simultaneously partakes of the attributes of bonding, dominance and submission that the human primate shares with many other mammals and those of legal or customary regulation of social life, which are characteristic of human groups endowed with language. Politics is not merely what ethologists have called agonic or agonistic behaviour. Competitive rivalry for dominance exists in sports, on school playgrounds and in business without thereby deserving the name politics. Nor is all behaviour governed by legal norms automatically political for, as cultural anthropology teaches us, legal or customary rules govern childhood, marriage and the entire range of human social life.

Therefore political behaviour

> comprises actions in which the rivalry for and perpetuation of social dominance and loyalty impinges on the legal or customary rules governing a group. As such, political science has a peculiar status, for it lies at the intersection of ethology and anthropology - or, more broadly, at the point where the social and natural sciences meet.
>
> (Masters, 1989: 140)

The political subsystems of societies are regulatory in function and their scope (reflected in the variety of forms these subsystems take) and degree of inclusiveness become critically important alternative strategies for the survival of the human groups that are affected by the regulatory rules promulgated by those political subsystems. Though largely consistent with other definitions of politics in mainstream political science, this definition requires that we relate these alternative strategies (i.e. types of political orders/systems) to their specific ecological niches and to the larger international (global) environment in which they compete and co-operate as part of the larger drama of the evolution of our species. As we see below in our discussion of Peter Coming's biopolitical theory, this fundamental problem of survival represents the greatest challenge of all. It also directs our attention to the 'crises and sequences' of political development (see chapter 3) throughout human history.

Masters sees a life science perspective as challenging the existing tradition of

political thought on at least three important perennial issues: materialists versus idealists; the 'so-called quarrel of the ancients and moderns', and the related question of whether there is inevitable progress; and on the relationship of human nature to politics (Masters, 1989: 143). While we cannot examine each of these challenges in the detail that Masters does (see *ibid.:* 142-52), it is clear that biopolitical theory can contribute in significant ways to the debates over these issues and can provide a theoretical framework that reframes these issues in light of the contributions of the life sciences to our understanding of the complex interactions of material and symbolic variables, of individuals and the collective, and in explaining the processes of change in complex systems at the level of genes, individuals, groups and the species.

For Masters, the problem facing political theory is not the origin of politics and society; rather, it is the foundation of civilisation and the centralised state (Masters, 1989: 152). Why does the state arise in the course of human history after so long a period without the need of such an institution? Indeed, as Masters observes, there almost seems to be a contradiction between the elitist character of a centralised state and the individualism of neo-Darwinian theory of natural selection. The natural tendency of human groups after reaching a certain size was to fission off into smaller groups and exploit another ecological niche, thus maintaining small groups and face-to-face relationships governed by social norms and not requiring an elaborate state structure *(ibid:* 216-23). After carefully reviewing literature from anthropology on the origins of the state that might offer explanations based on the physical limitations to problems - such as fissioning, inter-group conflict, innovative technologies (for example, in the first instance, agriculture) and the impact of feedback models that track a process of organised complexity over time - Masters concludes that all of these causal factors must be taken into consideration and used to evaluate specific cases in their individual environmental settings. This overall process of adaptation results in a wide range of alternative strategies for maintaining social order while sustaining pre-existing interpersonal patterns of interaction.

Although not suggested by Masters, we would argue that by following this line of reasoning we come to understand the emergence of alternative paradigms of political order throughout human history - including the chiefdom, the city state, ancient empires, commonwealths, confederacies, the modern empire (including colonialism and imperialism), the modern nation state, totalitarian societies and, most recently, experiments like the European Union - as concrete adaptations to constantly changing environmental settings. Although significantly different in their scope and complexity, all of these sets of political institutions are superimposed upon the more natural long-standing processes whereby inclusive fitness strategies and patterns of conflict and social co-operation have shaped behaviour while remaining consistent with the natural behavioural repertoire of the human species (see chapter 3 for further discussion of this process of political evolution).

Finally, Masters offers the claim that biopolitical theory, based on a life science informed theory of human nature and evolution, points to three broad

features that characterise a new naturalism which offer a 'return to natural justice' (Masters, 1989: 227ff.). These features include 'respect for human individuality and cultural difference; the duties of virtue entailed by social obligation; and the concern for human justice' *(ibid.:* 228). This new naturalism rejects subjectivism, extreme relativism and absolutism in the realm of values and ethics. 'Natural justice requires, then, a willingness to balance one's own immediate selfish needs not only by cooperation with others in the hopes of reciprocity, but even by acts of self-sacrifice that contribute to the collective good without reciprocity' *(ibid.:* 230).

Fundamentally, this new naturalism builds upon the absolute necessity of variability at all three levels of Masters' model: the gene pool, the individual and the species. To ensure variability, it is necessary to establish criteria of ethical behaviour that will increase the likelihood of our survival as a species with variability intact. Thus, there is neither a specific political system nor a fixed code of ethics that can meet the demands of all social and ecological settings. Human moral systems will be judged on a pragmatic basis: have they provided adaptive advantage for their practitioners and have their practitioners respected the necessity for modification of and experimentation with their current ethical strategies? And that success cannot be ultimately predicted. As Masters puts it: 'Unlike historical determinists, biologists do not imply that the process of change is one of improvement or that we can necessarily predict the future. A new naturalism, like contemporary physics, leads to moral reasoning that is based on "relative objectivity": truths that depend on time and context are nonetheless truths' (1989: 244). Over time we will be able to judge what regimes and what moralities offer the greatest survival potential to our species.

In addition to Masters' version of the new naturalism, the work of Larry Arnhart extends this discussion to pursue an answer to the political problem of 'how to shape the moral character of human beings to conform to a naturally good way of life' (1988: 1). Just as Somit and Peterson are concerned with the aspects of human nature, the human behavioural repertoire, that make democracy possible in the face of an historical bias toward authoritarian political regimes, Arnhart (1998:1) seeks to explain those aspects of universal human nature which sustain family life. The dependence of the young on adult care is an enduring feature of human nature and one which must be considered in the construction of a political order that can be sustained over time. Like Masters, Arnhart (1998: 6) subscribes to the view, based on extensive ethological and social biological research, that '[h]uman beings are by nature social and political animals, because the species-specific behavioral repertoire of *Homo sapiens* includes inborn desires and cognitive capacities that are fulfilled in social and political life.' He argues that '[h]uman beings have a natural moral sense that emerges as a joint product of moral emotions such as sympathy and anger and moral principles such as kinship and reciprocity' (Arnhart, 1998: 7; see also J. Wilson (1991, 1993a, b) and de Waal (1989, 1996)). We can rely on 'relative objectivity' to make prudential judgements about political orders and moral systems in specific contexts.

Synergy and the evolution of organised complexity

Peter Corning, in a series of related publications over the past thirty years, has explored the natural tendencies among organisms to create combined effects through their behaviour, often for their mutual benefit and occasionally to their disadvantage depending upon the perspective of the participants, as in predator-prey relationships. Synergy is the key concept in his approach. He has provided an extensive treatment of this subject in *The Synergism Hypothesis* (Corning 1983). This was foreshadowed in his earlier work (Corning 1971a, 1974, 1976) that was among the first efforts to get contemporary political science to take biology seriously and to think about the nature of politics and the enterprise of political science in new ways.

Corning (1983: 314) has been an advocate of a definition of politics as social cybernetics. Building upon evolutionary theory, systems analysis and cybernetics, he offers this definition:

> Politics may be seen as a 'steering' process by which decisions are made with respect to public (common or intersecting) goals, as well as the processes of communication (including feedback) and control by means of which relevant goal-oriented social behaviors are implemented. In short, politics consists of goals, decisions, communications, and control.
>
> (Corning 1983: 314)

Politics therefore is a collective survival enterprise and, thus, political science ought to be a survival-oriented policy science (Corning 1977). Arguing that survival is the *sine qua non* for politics, he has shown how the natural human tendencies toward both conflict and co-operation and self-interest and altruism have so often been effective as our species has repeatedly solved environmental challenges, often through synergistic processes. There is, as he shows through numerous micro- and macro-level examples, considerable evidence of synergy at all levels of life. As with Masters, Corning is concerned with moving beyond sterile and outdated dichotomies that belie the interactive and multi-causal character of the evolution of societies and political systems in particular (see his discussion of the interactional paradigm, 1983: ch. 4). Ultimately, what he describes as a teleonomic evolutionary process reflects our ability as a species through biocultural evolution to counteract entropy through organised complexity, thus giving humanity a wide range of survival strategies. The issue, however, is the sustainability of these strategies over time and the capacity of species to create new strategies as the environment changes and based on the processing of feedback at all levels.

Synergy is defined as 'the combined (interdependent) effects produced by two or more parts, elements, or individuals ... and is a ubiquitous phenomenon in nature and human societies alike' (Corning, 2000: 133). He views synergy as a

> pan-disciplinary lingua franca for the functional effects produced by cooperative phenomena of various kinds; a terminological shift would underscore

> the fact that the differently named phenomena studied by various disciplines are in fact variations on a common theme in the natural world. ... [Synergistic effects provide the] underlying functional basis for the evolution of complex systems ... in nature and human societies alike.
>
> (Corning, 2000: 133)

In chapter 3 we will review the application of Coming's synergism hypothesis to the case of political evolution (see Corning and Hines, 1988).

Evolutionary biopolitics and democracy

Somit and Peterson, both individually and together, in a series of articles (Peterson, 1991; Somit, 1991; Somit and Peterson, 1995, 1996), an edited volume (Somit and Wildenmann, 1991) and culminating in a book-length treatment (Somit and Peterson, 1997) have explored the 'natural' basis for hierarchy and dominance structures in human societies and the implications of these findings for politics. They argue that authoritarian political systems have predominated during the time of our existence as *Homo sapiens,* whereas democracy as a type of political order is tenuous at best and runs counter to certain features of the human behavioural repertoire. However, they posit that under conditions of material abundance, and because of our capacity for indoctrination, it is possible to sustain democratic politics.

Their interpretation of the ethological and primatological data leads them to conclude that the natural tendencies toward hierarchy and dominance structures make the achievement of democracy much more difficult than is commonly assumed by proponents of democracy, many of whom are informed by an outmoded psychology that fails to recognise the interactive character of genotype-environment interactions. Somit and Peterson's research is significant because it shows with respect to a particular type of political order, democratic political order, how the evolution of human beings has created some real limitations that must be overcome if political equality, rather than political inequality, is to prevail in any given society. Somit, among the first proponents of biopolitics, has played, as has Peterson, a leading role in the International Political Science Association's Research Committee #12 on Biology and Politics. He and Peterson have sustained a highly productive collaboration for twenty-five years and have been the principle chroniclers of biopolitical research through literature reviews over the years and most recently through the important book series, *Research in Biopolitics* published by JAI Press. Now in its seventh volume, this series is an invaluable source of information about developments in biopolitics.

Somit and Peterson contend that a real democracy 'has two basic characteristics: first, something akin to universal suffrage and majority rule via free competitive elections; second, what is customarily called the "rule of law," that is, the effective protection of civil and political rights by a reasonably independent judiciary' (1997: 17). Our natural tendencies to construct hierarchies and dominance structures ought to lead us to establish authoritarian political

structures, and indeed, that is the prevailing reality throughout human history. Why then, ask Somit and Peterson, do we occasionally create and sustain democracies? It is not, after all, the case that democracies only appear very early on in human history and then much later in the twentieth century, as if to suggest that somehow our capacity to sustain democracy had evolved.

In keeping with others who have asked this research question, the authors summarise the internal and external conditions that are essential for the emergence and survival of democratic political systems. The internal prerequisites they cite include: distribution of wealth; education; urbanisation; communication networks; ethnic, linguistic and religious unity; a disaffected 'out' elite; wisdom and flexibility of the existent regime; prior history as democracies; predisposing civic culture (Somit and Peterson, 1997: 18-25). They also posit certain external requisite conditions that have to be met for democratic politics to emerge and survive. These include: colonial status (e.g. whether democratic institutions and processes were encouraged by the coloniser); regional factors (e.g. preponderance of authoritarian regimes in the region or a large contingent of democratic political systems); the interests of competing powers (e.g. the support of a superpower); and global fashion (e.g. the idea, from Huntington (1991) that democracies appear in periodic waves) (Somit and Peterson, 1997: 26-9). They conclude:

> Whatever the relative importance of the internal and external factors - and that importance may well vary considerably from situation to situation - both are only necessary rather than sufficient conditions for the birth and continuing survival of a democratic government. One more factor, also a necessary but probably not a sufficient condition is essential. We refer, of course, to that uniquely human attribute, indoctrinability.
>
> (Somit and Peterson, 1997: 29)

Next, they carefully examine the six available studies of the rise and survival of democracies including studies by Dahl, Vanhannen and the Freedom House Survey (see Somit and Peterson, 1997: ch. 4). They conclude that although the 'roster of sovereign nations has expanded ... [nonetheless, the long-standing pattern has altered little, if at all - authoritarian states still constitute a very substantial majority, and democracies still a relatively small minority, of political societies', which is what their argument would suggest to be the case (Somit and Peterson, 1997: 44). They then proceed to develop their argument for the significance of human indoctrinability as an evolved human capacity that makes it at least possible for democratic political systems to exist.

We would add the caveat that this capacity for indoctrinability as a feature of the human behavioural repertoire also makes it possible for political ideologies, in general, to be effective in shaping individual and collective political behaviour. If indoctrinability functions as Somit and Peterson suggest it does, then it too is a necessary but far from sufficient condition for democracy and other factors must be present to 'tip the balance' in favour of more egalitarian politics. That

suggests to us that the environmental context (for example, a resource rich or a resource scarce environment) or the internal and external variables of Somit and Peterson, continue to be extremely important and causally significant for democratic political institutions and processes. It may even be the case that the individual leader plays more of a role than he or she is usually given credit for playing in making a difference in what gets indoctrinated. Then, too, it is necessary for the gains through co-operation to be understood as potentially greater than the gains through competition for a more egalitarian strategy to gain popularity (see Hines, 1983).

Like Masters and Schubert, Somit and Peterson support the position that there is human behavioural repertoire that has evolved over our long existence as a species and that the interaction between genotype and environment has led to a well-established tendency toward hierarchy and dominance relationships in human groups and societies, so much so that they are ubiquitous. They provide an extensive review of the considerable evidence of the naturalness of dominance and hierarchy among primates and among humans in particular. The primary reason for the sustained evidence of dominance and hierarchy lies in the fact that they contribute to the reproductive success and inclusive fitness of individuals (Somit and Peterson, 1997: 53).

> Dominance furthers predictability, and predictability, in turn, benefits both the dominant and the subordinate. The former gains the desired resource (and resulting possible enhancement of inclusive fitness) at no greater cost than a possible threat or two; the subordinate, by yielding, escapes a clash that might otherwise reduce or literally end his or her reproductive possibilities.
>
> (Somit and Peterson, 1997: 54)

The importance of creating and maintaining order, particularly as populations become larger and population density increases, is not to be underestimated.

Somit and Peterson (1997: ch. 6) review the considerable evidence that supports the claim that we have a natural tendency to obey. This experimental evidence, including Milgram's (1974) research and several replications of his experiments, reveals a consistently strong willingness on the part of individuals to accept authoritative commands, even when the consequences are potentially harmful to con specifics as well as to themselves. This capacity supports the claim that indoctrinability is also part of the natural human repertoire of behaviour. But the biological basis of belief does not imply a propensity to follow any specific set of beliefs.

> There is almost no limit to the range and variety, or eccentricity, of the values humans are capable of accepting and acting upon. This is true in religion, in philosophy, in ethics, in art - and in politics. By its very nature, consequently, indoctrinability carries with it a potential susceptibility to democratic notions, however we might be otherwise genetically inclined. It

> is this potentiality that, when combined with the requisite confluence of economic and social conditions previously discussed, enables democratic ideas to take hold, to influence political behavior, and thus to make democracy sometimes possible.
>
> (Somit and Peterson, 1997: 78-9)

Again, it is the benefits of a stable social order - being able to devote oneself to other self-interested goals (for example, reproduction) rather than being engaged in constant competition - that makes this a successful behavioural strategy for individuals and groups. However, over time and with the growth in the size and complexity of human groups, 'indoctrinability has become a fecund source both of intrasocietal ethnic and religious violence and of inter-state hostility, bloodshed, and warfare' (Somit and Peterson, 1997: 82). One can even argue that this adaptation has become dysfunctional in ways that dominance and hierarchy have not. Somit and Peterson (1997: 82-3) go so far as to suggest that indoctrinability can result in the disruption of society, not just serve to bind human beings together. Although they do not discuss revolution or political change at any length, clearly this human tendency has profound implications for how popular support for or against a political order can manifest itself under certain environmental conditions.

The bottom line may well be the fact that considerable effort must go into the establishment and the nurturing of a democratic way of life. Pragmatically speaking, the test of any political system will be its ability to provide a social order that meets the needs of those whose obedience and indoctrinability is required. Absent the benefits that are required by both the elite and the masses in any society, a political order can only sustain itself for a limited period of time. In the process, the environment will change and the supports for the political order will decrease, remain the same, or increase. Properly, Somit and Peterson (1997) devote their last chapter to a discussion of the importance of having foreign and domestic policies that protect and preserve democratic political institutions and processes and policies that sustain the environmental characteristics that make democracy workable as a collective survival strategy. In particular, they urge a more focused policy of civic indoctrination through education - a controversial proposal, but one that is entirely consistent with their analysis. While we do not have all the answers to these poignant questions, we know that the natural tendencies toward hierarchy, dominance and obedience can result in the decline of democracy because that has been the norm.

Somit and Peterson have shown how evolutionary theory can be used to elucidate an important problem in the political theory of democracy. They conclude by reminding us that:

> *Homo sapiens'* social and political behavior is thus a function of the interplay between nurture and nature. For this reason, an explanation cast in purely evolutionary terms would be as seriously mistaken as the *tabula rasa* perspective, which looks solely at social conditioning, a perspective that has

> dominated the social and behavioral sciences for most of the twentieth century. Our desire here is to redress the balance, not to replace one grave misconception with another.
>
> (Somit and Peterson, 1997: 124)

In addition to the biopolitical theorists discussed above, Glendon Schubert and John Wahlke, both highly regarded figures in the behavioural political science movement, have embraced biopolitics as a natural extension and fulfilment of the promise of the behavioural revolution in political science. Wahlke's views are discussed at length in chapter 4 and Schubert's empirical research on justices and courts is reviewed in chapter 5. In chapter 1 we introduced Glendon Schubert's (1976) model of a life science paradigm of political behaviour. In a wide range of studies, based extensively on research in ethology and primatology, Schubert has explored the implications of his model for understanding political behaviour. Much of this work has been assembled in a volume, *Evolutionary Politics* (1989), that includes his earlier formulation of the model and covers political ethology, political evolution, evolutionary theory, evolutionary development and political thinking.

Evolutionary politics and the components of a life science approach

Perhaps more than any other political scientist, Glendon Schubert has immersed himself in the fields of ethology, primatology and the brain sciences, to mention some but not all of the many disciplines that contribute to a life science perspective on politics. His use of experimental and observational methods, combined with the articulation of an evolutionary theory of politics, makes his contribution, like that of Masters, extremely important to the development of biopolitics. As he points out:

> What political scientists generally need most, but understand least, is evolutionary as distinguished from historical theory. Political scientists do not need to understand evolutionary theory because it explains everything; it certainly does not do that, and besides, it can predict very little - in the sense in which classical physicists think of prediction ... Evolutionary theory should be important to political scientists because it is directly and highly relevant to an adequate understanding of the behavior of all animals, not excluding the political behavior of humans. Political scientists can and do understand static slices of culture, stained by survey research for their inspection on the functional equivalent of a glass slide with computer output substituting for a microscope; but they cannot deal effectively with cultural dynamics except as an aspect of cultural evolution. And to understand cultural evolution ... it is first necessary to comprehend the biological evolution that is the template for cultural evolution.
>
> (Schubert, 1989: 125)

Schubert defines the task of a life science approach to politics as involving the identification of the principal components of life science theory, methods and empirical knowledge about animal behaviour, and the demonstration that this 'information necessarily transforms an exclusively culturally determined understanding of both human politics and political science' (Schubert, 1989: 324). Such a life science approach includes three major components: (1) *ethology,* which deals with how and why animals behave as they do; (2) *ecology,* which focuses on how environmental definitions of niches provide the stimulation and stress that proffer the opportunities and constraints to which animals respond in their behaviour; and (3) *evolution,* the theories of how generalised and persistent changes in ecology result in reciprocal changes, first in animal behaviour and then in animal physiology (Schubert, 1989: 324-5).

Conclusions

In this review of biopolitical theory hopefully we have demonstrated the significant challenge that a life science based approach to political science presents to the discipline of political science. We have argued for a model of political behaviour that accurately and adequately reflects the interactive character of the human genotype and the environment, mediated by human physiology including the structure of the human brain (see chapter 5), in creating the human phenotype. By examining the contributions of leading biopolitical theorists, we have illustrated how the facts and theories drawn from the life sciences can be applied to the study of important political questions. We have also shown how a life-science-based study of politics can be informative in ways that provide an understanding of human political behaviour that goes beyond existing mainstream approaches within political science. In the next chapter we turn to an examination of the work of biopolitical scientists in the fields of comparative and international politics.

3 Comparative politics, world politics and international relations in biopolitical perspective

Introduction

The fields of comparative politics and international politics afford a number of examples of how the application of the theoretical frameworks discussed in chapter 2, particularly those of Masters and Corning, can contribute to the field. Comparative politics has always been concerned with the comparability of structures, processes and behaviour in the context of contemporary nation states. Comparativists have also been concerned with the historical development of the above and the unique contexts in which countries have 'developed' (see Apter, 1996). Both comparative and international politics also invite further consideration of the issues surrounding the levels of analysis problem in research, which is discussed at some length in chapter 4. And both fields include the study of elite political behaviour.

There is also a real sense in which the international discipline of political science treats the study of politics in specific countries (for example, American politics or British politics) within the broader context of comparative politics. Indeed, although both authors were trained in American institutions, we readily acknowledge the appropriateness of this view. Research that would be described as American/British politics' or American/British political behaviour' in a discussion of political science research with an American or British audience will have been included, by implication, either in chapters 2 or 5 or to some degree in this chapter and is therefore not treated in a separate chapter.

As the following discussion will make clear, we see the evolution of politics, political institutions and political behaviour as so interconnected that, from the vantage point of biopolitics, it seems inappropriate to disconnect them by using a particular set of field or sub-field categories for the discipline in order to organise our discussion. Moreover, from the perspective of biopolitics, many of the distinctions drawn between comparative and international politics are not relevant (see Mair, 1996). The evolution of political institutions through a process of adaptation to changing environments over time involves both domestic and foreign policy and hence blurs the distinction between comparative and international politics. The two fields merge intellectually as we consider the evolution of politics in all its manifestations. This is even

more apparent as we examine the study of political development and modernisation or as we consider the approaches of scholars like Wallerstein (1991), whose world systems approach is quite consistent with an evolutionary approach.

Our own view of political evolution (Corning and Hines, 1988) suggests that one line of potentially fruitful research would be to study and characterise innovative adaptations (political evolution) and their spread or demise over time. These political innovations which mark an evolutionary change have taken the form of paradigms of political order (for example, city states, ancient empires, the modern nation state, modern empires, confederations, federal systems and contemporary experiments like the European Union) and discrete institutions (for example, modern bureaucracies, political parties and interest groups). Wallerstein's (1991) work looks at the evolution of world systems in a similar way and the two research programmes are quite compatible and share much in common in their theoretical underpinnings. For these reasons, we advocate the use of the terms 'world politics' and 'international relations' as being more reflective of the contextuality and configurative character of politics at all levels, both in the past and in the contemporary world.

In this chapter we will review several lines of inquiry that have been pursued by proponents of biopolitics in both comparative and international politics. In the field of comparative politics we will examine research on the origins and purposes of politics and the state (Masters, Johnson, Geiger and Hines) and on political development and political evolution (Corning, Corning and Hines). In the area of international politics, we will loosely follow the example of Vincent Falger (1994) and focus on aspects of the study of peace and war, the exercise of power in international politics, the essential actors and units of analysis and the various attempts to categorise and classify the world system over time. First, we will look at comparative politics and comparative political analysis. Then, we will examine some early works on international politics within the biopolitical frameworks of Pettman (1975, 1981) and Wiegele (1979a) as well as Falger's (1994, 1997) interpretations of the field of international politics. Finally, we will explore briefly the applicability of ethological studies of peace and war and the relevance of examinations of the 'politics of identity' (ethnicity, xenophobia, patriotism). Obviously, the discussions of the evolutionary origins of politics and the state, although discussed in the section on comparative politics, are equally relevant to international politics. Indeed, one might argue that the political evolution of systems of politics - world systems, if you will - is as applicable to the study of international politics as it is to comparative politics. Curricular issues associated with the structuring of a programme in government, politics, or political science have much to do with the organisation of the study of politics, but will not be a part of our discussion.

Comparative politics and comparative political analysis

In a recent review of the literature of biopolitics in the mainstream field of comparative politics, Watts referred to the contributions that have been made as 'scattered outcroppings in the comparative terrain where life science insights applied by political scientists have attempted to make a contribution, and may have expanded those areas in useful ways' (Watts, 1994: 209). This is probably a fair characterisation of the contributions to date in this field, at least in so far as the contributions were specifically efforts to address comparative politics as a sub-field of political science.

Perhaps the greatest contribution of biopolitics has been to enlarge the field dramatically. For example, by advocating the comparison of non-human primate behaviour to human behaviour and by recognising the importance of human prehistory and early history, proponents of biopolitics have reconfigured comparative analysis to include a much wider range of subjects of study than has constituted the traditional sub-field of comparative politics. Another important point, not taken into consideration by Watts, is the fact that the most dynamic movement in comparative politics, the study of political development and modernisation, was replete with works (for example, Almond) that were informed by structural-functionalism and were at least implicitly evolutionary in as much as they sought to explain social change in the West and then in the non-Western world as developmental. This period of significant work during the 1960s and 1970s (which includes the first of Wallerstein's major works) also saw the competition between comparative political analysis and area studies or regional studies. The former sought generalisations, including probabilistic explanations using aggregate data analysis, across space and time (aspiring to nomothetic explanations) whereas the latter emphasised the idiographic interpretation of distinctive developments in specific countries and regions (historical and contextual explanations).

This intellectual tension is reconceptualised within an evolutionary framework as the transfer of institutions and political processes that represent evolutionary adaptations and survival strategies in a particular setting to other settings (ecological niches) where they may or may not prove successful. As our examination of work on the origins of the state will show, the political evolution of the state represents the first major example of a specific adaptation that has been successfully transferred to other environments over time, albeit in a variety of forms, as should be expected given the qualitative features of various settings. Thus the historical and configurative analysis of the area specialist complements the attempts at generalisation through historical and developmental analysis. Political evolution is reserved to define those innovative adaptations that resulted in new structures and processes being created to perform political functions.

As early as 1968, Harold Lasswell, writing in the inaugural issue of the journal *Comparative Politics,* argued for a comparative method that was inclusive and that adhered to 'the requirement of contextuality' He observed that the comparative method as then employed by political scientists was 'insufficiently

contextual, inadequately problem-oriented and unnecessarily restrictive in technique. In brief, it has been insufficiently configurative' (Lasswell 1968: 6). He went on argue for the 'recognition of the role of the political process in prehistoric as well as in historic times' *(ibid.).* He even went so far as to recommend the 'formidable expansion of research on nonhuman societies' as an opportunity to compare and contrast genetic constitutions in relation to variable environmental contexts. Lasswell's 'contextuality' is a useful condensation of the argument made by us in the chapter on methodology about the importance of using multiple research strategies and methods at different levels of analysis to gain greater understanding of the contextuality of events. This is a straightforward call for the application of the interactionist paradigm and of evolutionary theory to the study of political change even though the vocabulary of Lasswell was not explicitly derived from evolutionary theory. Lasswell's emphasis on the dimension of time and on developmental analysis underscores, as did Thorson (1970) in one of the first works to use the term biopolitics, the significance of human evolution in the larger context of biological evolution.

It is also worth noting that the work of Wallerstein (1991) with its emphasis on the historic development of world systems that constitute successful macro-level adaptations fits this configurative analysis programme of Lasswell. Moreover, Wallerstein strongly advocates changing the paradigm of social science to an historical, developmental paradigm which, although not explicitly evolutionary, nonetheless is entirely consistent with a general systems and evolutionary paradigm (see Wallerstein, 1991, in particular).

In a recent review of the field of comparative politics in *The New Handbook of Political Science,* Mair claims that while the tendency of comparative political research in the 1950s and 1960s was to emphasise ' universal relationships, and thus global comparisons, the tendency within comparative research over the past decade or so has been to move away from general theory by emphasizing the relevance of context' (Mair 1996: 328). Reflecting much the same tone and sensitivity to the tension between the general and the particular, Apter (1996) compares the old institutional approach (before World War II), the new comparative politics (post-World War II through the 1960s) and the neo-institutionalism that he sees currently leading the field in popularity. This most recent trend is very consistent with biopolitics' emphasis on political evolution as adaptation to context (environment, ecological niche) and on the importance of determining what caused the success or failure of that adaptation over time.

As the debates over the claims for political development and modernisation raged in the 1960s and 70s, there was at least one political scientist, Braibanti (1969, 1976), whose background was in comparative administration and bureaucracies and who was influenced by the work of Lasswell and the importance of contextuality (Hines, 1978). His treatment of political development showed a concern for the tension between external (usually Western) and indigenous values in Third World or developing countries. The political challenge of changing culture and institutions in pursuit of political modernisation

and development was enormous and, frankly, was seldom met. Even today we see how difficult this process is throughout the world.

Braibanti (1969) saw the process of political development as including four essential elements: architectonics, diffusion of power, institutions and innovations. Although he never used the term 'political evolution,' these four elements reflect the essence of what that term implies, namely, the successful adaptation in the first instance, or subsequently as the innovation diffuses, of a new strategy for collective survival that involves new elements of culture, institutions and participation. Braibanti offered the concept of 'architectonics' to describe the complex process of the adaptation of novel political forms (for example, constitutions, bureaucracies) into indigenous societies where the most fundamental change that is required is in the realisation of 'common agreement on a fundamental polity of the state - an overarching purpose which gives form, cohesion, and direction to all public action within a sensed community' *(ibid.:* 37). This is another way of describing the process that Masters' (1989) describes (see chapter 2) whereby the natural tendency toward behaviours that would be explained by inclusive fitness can give way to reciprocity relationships that Masters refers to as mutual aid and sociability and that Corning (1983) would identify as examples of synergy.

Consistent with Masters and Corning, Somit and Peterson's discussion of the human capacity for 'indoctrination,' which is also described in chapter 2, provides the biopolitical framework into which the elements of Braibanti's concept of political-administrative development can be seated. The same compatibility exists with the series on political development sponsored by the Social Science Research Council, especially the volume on crises and sequences of political development (Binder, 1971). The biopolitical framework helps to identify the essential research problem (achieving political and social order in the face of a human behavioural repertoire that is somewhat limiting for altruism and sociability) and the concrete, historical analysis of specific cases of political development along the dimensions of architectonics, institutions (including rule of law, Braibanti, 1969a), diffusion of power through social participation (see Masters, 1989) and innovation, of which the origin of the state is the quintessential example.

We are convinced that comparative political research thus becomes much more inclusive and more susceptible to explanation using both proximate and ultimate types of explanations within the evolutionary framework of biopolitics. Whether one is interested, as Roger Masters (1989; Masters and Way 1996) has been, in comparing individual reactions to political candidates in different countries using ethological methods, or whether the subject is comparing the effects of age and age structure on collective political decision-making at the level of local governments (Schubert, Wiegele and Hines, 1987) using a variety of methods of data collection and analysis, or whether the focus is on the evolution of world systems (Wallerstein, 1991), the overall framework remains one of comparing the effects of variable contexts (for example, structures, cultures) on recognisable patterns of human behaviour (for example, hierarchies and dominance

structures) that are part of our evolved behavioural repertoire as a species. As Sullivan and Masters describe the framework for their own research: 'Humans, like other primate species, have evolved an elaborate system of expressive displays that function in relations of dominance as well as in other social interactions. The concepts and methods derived from ethology and social psychology allow us to explore the way this system functions as a means of integrating social information and cultural expectations in popular responses to political leaders' (Sullivan and Masters, 1994: 237).

In pursuing this kind of comparative research, we concur with Watts when he urges that we must avoid naive reductionism (see chapter 4) and 'conceptualize human behavioral and organizational plasticity as a series of "potentials" that are differentially augmented and rewarded depending on environmental contingencies. Biological organisms interact with their environments in a mutually-interactive process of epigenesis in which both biological potential and environmental conditions play a role in the final form sociopolitical behavior takes' (Watts 1994: 233). The emergence of specific institutions at specific times and in specific places take the form of successful adaptations to an environmental setting (political evolution) is exactly the phenomenon to which Watts refers. The focus within comparative politics that has the most immediate affinity with a biopolitical approach is the study of political development and modernisation. We shall now turn to an examination of that literature.

Political evolution: the particular case of the origins of the state

As has already been suggested, one of the most robust and contentious areas of research in political science during the past few decades has been the study of the processes and outcomes of what has been generally labelled 'political development' and 'modernisation' (see Apter, 1996; Mair, 1996; Rustow and Erickson, 1991; Wiarda, 1985; Chilcote, 1994 and Almond, 1990). Among proponents of biopolitics, Corning and Hines (1988), after reviewing debates in this literature, have argued for the incorporation of these key concepts of political development and modernisation into a larger process, the process of political evolution. Their approach is intended to place the study of political development and modernisation into a much longer, historically speaking, and more encompassing frame of reference that extends from the earliest human settlements to the present global system. This approach is largely in sympathy with the approach of Wallerstein, although the focus is more on the discrete cases of political evolution at the societal level rather than on the macro-level of the world system.

A particular example of a research question that invites the use of the concept of political evolution as constructed by Corning and Hines (1988) is the question of when, where and why the state emerges. Political scientists have generally ignored the question of the origins of the state (Hines, 1983) and have not recognised the possibility that there is a biological (evolutionary) basis for

politics (Masters, 1989; Johnson, 1995). Indeed, outside of biopolitics, the work of political anthropologists in general has been sadly ignored by the discipline of political science, even though attention was directed toward the potential contributions of anthropology by Friedrich as early as 1968. As indicated earlier in the discussion of political evolution, the emergence of critically important new political institutions and the detailed description of the circumstances (environmental factors) associated with their emergence is a major focal point of comparative political inquiry from a biopolitical perspective. Political anthropologists have been keenly interested in these historical developments and there is a considerable literature that addresses the question of the origins and elaboration of the state, its precursors, its spread and its component institutional parts (see Hines, 1983; Geiger, 1985, 1988; Masters 1989; Corning, 1983; Johnson, 1995, for citations of this literature).

The state, like other institutions, emerges in response to historical and ecological conditions that serve as a stimulus to human beings to create and pursue alternative strategies for survival and for the attainment of other values and goals as reflected in human culture. Though there are many different interpretations and explanations offered for the origin of the state, we do not review them in detail here. Some observers emphasise conflict and balance of power dynamics, others emergence through innovative behaviours of leaders and the manipulation of symbols, and others feedback mechanisms and complexity, and still others, ecological limitations and population pressures.

Masters, after reviewing all these alternatives notes, that from the perspective of evolutionary biology, the emergence of the state is especially hard to explain because:

> Social cooperation in very large groups of animals seems to violate the basic premises of the neo-Darwinian theory of natural selection ... if natural selection primarily tends to favor the reproductive success of individuals, cooperation or self-sacrifice that benefits unrelated strangers ... should be less adaptive than selfish or nepotistic behavior benefiting close kin and reciprocating conspecifics.
>
> (Masters 1989: 153)

After reviewing the implications of inclusive fitness theory and the problem of 'free riders' and the notion of reciprocation among unrelated individuals (reciprocal altruism), he proceeds to show how recent studies of the possibility of group selection lead to the conclusion that:

> since contemporary theories of natural selection stress the priority of individual reproductive success, one can never presume that a behavior has been selected because it redounds to the benefit of the population or species. But it is equally erroneous to assume that ... natural selection never generates behavior of this sort.
>
> (Masters 1989: 161)

He posits a dialectical relationship between individual inclusive fitness and group interest, particularly in a complex social species like *Homo sapiens.* This is particularly the case for humans whose larger brains and complex linguistic systems have allowed them to embrace a much wider range of social behaviours than other animals. This is exactly the dynamic and dialectical process that is described by those who have sought to explain how the state emerges in human history from a biological and anthropological perspective (see Alexander 1979, 1987; and numerous references in Hines, 1983; and Johnson, 1995).

International relations, world politics and biopolitics

We will use the expressions 'international relations' and 'world politics' interchangeably, rather than international politics or studies, because we believe it is more consistent with the biopolitical perspective which, following ecology, stresses the interrelatedness of phenomena at various levels and because it reflects our conflation of comparative and international politics. As Falger observes, 'the relationship between biopolitics and international relations is not self-evident. Leading biopoliticians do not often think of international relations when they introduce the biological approach to their readers' (1994: 117). Wiegele, himself a leading proponent of biopolitics and specialist in international relations, also commented that:

> Perhaps no association seems as remote as that between biology and international relations. It is usually assumed that the 'high politics' that so often characterises relations between nations assures the isolation of international affairs from the more mundane aspects of political life.
>
> (Wiegele 1979: 101)

Despite their assessments of the lack of receptivity to biopolitics in the study of international relations, there is actually a substantial and growing body of scholarship that explores elite behaviour in decision-making, the relationship of the human behavioural repertoire to international conflict, and the biopolicy of environmental and health issues (see chapters 6 and 7 of this volume for a discussion and sources).

The first appearance of a challenge to take evolution and the life sciences seriously in the study of international relations, leaving aside more historical forebears (see Wiegele, 1979; Falger, 1994, 1997), may well have been the work of the Sprouts (1965, 1968) in introducing ecology and an article by Masters (1964) comparing world politics to a primitive political system, thus introducing both the ethology and the anthropology of the early state to readers. Following closely was Coming's (1971a) first attempt to present a more comprehensive and avowedly evolutionary view of the relation of the life sciences to the study of politics, including international relations.

Wiegele credits Mills (1973) and Pettman (1975) as being trendsetters in the 1970s. Mills (1973) argued that policy issues including food supply, reproduction

and human adaptability, which are of concern to and addressed by the life sciences, have become an important part of modern international relations. Pettman went so far as to claim that:

> The growth of inter-disciplinary interest has substantially enhanced the number of levels that can be related to a political explanation for world affairs, with the horizontal expansion into other disciplines further encouraging the number of vertical levels brought to bear. The contemporary study of world politics now ranges from the evolutionary ascent of humankind to his possible ecological demise, from Betelgeuse to the man in the street, from the machinery and social performance of the brain to the group behaviour of baboons. It moves with more or less ease from biology to cosmology, from psychology to physiology, and from ethology to anthropology, and on the vertical plane from the gene through multiform man to his world systems and societies.
>
> (Pettman 1975: 24)

Pettman is quite adamant about the need for students of international relations to press on beyond the mainstream topics of their research and explore the vertical and horizontal dimensions noted above. How, for example, can we talk about war - a central question in the study of world politics - without talking about conflict in general, of which war is a particular, albeit especially violent, form? How can we talk about conflict in general and war in particular without talking about aggression or self-transcendence, loyalty, obedience or the urge to survive? And how, in all humility, can we pronounce on drives, needs and capacities like these without some associated knowledge of psychology, biology, ethology and brain physiology? To do less would be to abuse the real scope of the problem in the interests either of analytical precision, misplaced academic modesty, activist fashion or some such defence of a provincial status quo. Likewise, can we talk about imperialism and the profit mechanics for the market economy without discussing dishonesty and greed? And these in turn may well have to be seen as human attributes of a biological or cultural-anthropological kind, or as psychological or sociological processes, before their full political implications become clear (Pettman, 1975: 27).

Pettman provides a lengthy discussion of many of these vertical and horizontal linkages and sees real prospects for the expansion of the study of international relations to incorporate insights from the life sciences. Despite Pettman's rhetoric, the impact of biopolitics and the life sciences on the teaching of international relations has been limited. Somit, Seo and Peterson (1994) in reviewing textbooks in international relations found that there was only a modest, positive trend in the number of references in textbooks to the relevance of ethological and sociobiological concepts, particularly as applicable to the study of violence, war and conflict. However, they also observed that these references often reveal that the authors are still relying on the outdated and popularised work of Lorenz and Ardrey rather than on contemporary research

and that they seem to be unaware of the work of their fellow political scientists working within a biopolitics paradigm *{ibid.:* 138).

As was the case in comparative politics, we find the early work of Harold Lasswell, beginning in the 1940s, to have prefigured much of what today constitutes a biopolitical approach to international relations. Lasswell's 'developmental analysis' and his articulation of the 'world manifold of events' represent an early attempt to show the seamlessness of the vertical and horizontal dimensions referred to by Pettman (see Hines, 1998 for a review of Lasswell's contributions and citations; Lasswell, 1970 [1947]; and Eulau, 1969). Today, the work of Wallerstein (1974, 1979, 1980, 1984, 1991) presents somewhat the same challenge to the social sciences to produce work that is more contextual and configurative in its analysis. As he puts it, 'everything that is historic is systemic and everything that is systemic is historic' (Wallerstein, 1991: 229).

Wiegele (1979a), in reviewing the biology of international relations, organises his discussion into research on the nation, the international system (although without mention of Wallerstein's work), international crises (with emphasis on the behaviour of elites under stress during international crises) and then deals with the biopolitics of political elites and human conflict separately. Falger structures his discussion around three key questions in international relations: '(1) the causes of war and the conditions of peace/security/order; an essential subsidiary problem is the nature of international power; (2) the essential actors and/or units of analysis; (3) images of the world/system/society of states' (Falger 1994: 116). He then interprets international relations research in light of the framework of biopolitics. Both of these reviewers conclude that there is much that biopolitics has contributed and can contribute to the study of international relations.

Falger (1994: 119) reminds us that the realist strain in international relations theory emphasises the study of power and that both realists and Marxists recognise that human beings and nation states are self-interested and tend to behave accordingly, hence the idea of national self interest. He cites the claim of Waltz that '[International politics like all politics, is a struggle for power. Whatever the ultimate aims of international politics, power is always the immediate aim' (Waltz 1979: 117). This quest for power is then understandable in the context of the ultimate evolutionary goal of survival for the individuals and the structures (for example, the state) that are engaged in the pursuit of power.

Falger (1994: 119) also points out that at least two well-known figures in international relations, Morgenthau (1967: 31) and Wright (1955), have been influenced by biology. The former understands that '[t]he drives to live, to propagate and to dominate are common to all men' (Morgenthau, 1967: 31; see also Falger 1997). Waltz (1959) recognises the level-of-analysis problem and argues for a research programme that moves from the level of states and societies and the level of individual decision makers, always to be understood 'in relation to the international environment in which the actions take place' (Falger, 1994: 121). Falger claims that 'it would be easy for biopolitical scientists to add relevant information and methodology at the individual level' and that the study of

'group formation and, in particular, the origin of the state itself are highly relevant for the field of international relations, although so far underutilized' *{ibid.:* 121). He also urges that more attention be given to the differentiation of ultimate and proximate causes, noting that Waltz raises the question of whether the causes of war are best understood in terms of 'human aggression on the level of individuals, in the nature of organized states or societies, or in the nature of the international system itself *(ibid.:* 121). Waltz's own conclusion that the context of 'anarchy' in the international system is a necessary precondition for war invites the further consideration of the individual decision makers and the conditions existing in the particular states and societies involved in conflict.

Although not mentioned specifically, we would add (consistent with the levels of reality and analysis in Masters' model) that the rhetoric and symbols used by the decision makers are relevant and must be included in an analysis that appreciates the importance of the role of culture in explaining the occurrence of war. Lasswell (1970), particularly in his work on propaganda, understood this dimension all too well as does Johnson (1986, 1987), as shown in his work on the use of pseudo-kinship terms (fatherland, motherland). Eibl-Eibesfeldt (1979), one of the foremost figures in ethology, has put this in context in his study of the biology of peace and war. Our capacity to define others out of humanity-cultural pseudo-speciation in Eibl-Eibesfeldt's framework makes it possible to engage in conflict with con specifics by shifting the conflict to the interspecific level:

> Over the biological norm filter that inhibits destructive aggression in man as in other creatures, a cultural norm filter is superimposed that commands us to kill. The important point to bear in mind is that destructive war is the result of cultural evolution. Furthermore, it is not, as is sometimes maintained, a pathological phenomenon, but performs important functions ... It also accelerated biological and cultural evolution by intensification of selective pressures. This applied both to the rapid development of the brain and to the development of altruistic behavior. The question remains open whether humanity can break out of this self-reinforcing process of increasing aggressivity or is bound to go on passively subjecting itself to it.
>
> (Eibl-Eibesfeldt, 1979: 123)

This capacity helps explain why we can overcome the limitations of inclusive fitness strategies to embrace reciprocity and strategies of mutual aid and sociability despite our natural tendencies to behave in an entirely self-interested way. It is this capacity to extend the 'in group' beyond kin to include fellow countrymen that, when joined with our natural tendencies to form dominance structures and hierarchies, enables us to construct the state (for more detailed discussions of this topic, see Masters, 1989; Corning 1983: 310ff.; Shaw and Wong, 1989; White, 1997).

Wiegele's review includes an extensive discussion of his own research (Wiegele, 1973, 1976, 1977a, b; 1978a, 1979a, 1982a) on elite decision-making under stress and Falger cites the same works in his discussion of the relevance of

biopolitical methods for the study of individual and small group behaviour in decision-making. Clearly, the rational actor and organisational behaviour and process models of Allison need to be complemented by this kind of rigorous empirical research, however difficult it may be and however much it may rely on remote assessment and interpretation of recorded materials (see Salter, 1996). Falger briefly discusses man-environment relationships in his review, but cites only Pirages (1978). We have treated this dimension extensively in chapter 7 in the context of ecological politics and the biopolicy of the environment and will not deal with it further here except to note that the relevant literature is far more extensive although often not explicitly biopolitical.

International politics and the threat of chemical and biological warfare

One of the areas where proponents of biopolitics have made a particularly significant and preponderant contribution is in research on the controversies associated with chemical and biological warfare and weapon systems and attempts to control those weapons. The late Tom Wiegele, Leonard Cole and Raymond Zilinskas, in particular, among members of the Association for Politics and the Life Sciences, have pioneered in this research. The use of chemical attacks in the Iran-Iraq war, the threat of more extensive development and use of such weapons by Iraq in the Gulf War and the 1995 sarin nerve gas attack by the Aum Shinrikyo cult in the Tokyo subway has increased fears of a real chemical and biological terrorism and warfare threat (Cole, 1996, 1997; Tucker, 1996; Chevrier, 1996; Zilinskas, 1996).

Cole has explored the important question of why these sinister weapons are not employed more extensively. In his most recent article (Cole, 1998) he draws upon biological and cultural explanations in offering the hypothesis that the reason has to do with the longstanding taboo about poison weapons that seems to be universal among human societies. Cole notes that '[b]y the mid-1990s, as many as 25 (countries) had chemical weapons programs and 17 had biological weapons programs' (Cole, 1998: 119). Wiegele had observed as early as 1994 that:

> Modern nations find themselves at the beginning of a period in which biotechnology might very well play a major role in weapons development. Without question, this represents a significant new element in the history of human conflict. Nations have never had the capacity so thoroughly to harm or destroy life as found in humans, animals and plants. Moreover, such deleterious effects can be exercised over extended time periods and without fear that an aggressor will be discovered. Defense against such an attack is virtually impossible.
>
> (Wiegele, 1994: 107)

However, Geissler's (1992) proposal which appeared in *Politics and the Life Sciences* for 'vaccines for peace' represents a very important possible response to this threat.

We must remember that the potential for destruction using viruses (e.g. transmissible spongiform encephalopathies - TSEs) that are spread from animals to humans and among humans - which can take many years to manifest themselves in severe illness and inevitable death - is real and frightening. The recent spread of such a category of viruses, of which mad cow disease (bovine spongiform encephalopathy - BSE) is but one example, that has resulted in the documented death of some humans, underscores the reality of this threat. While we may hope that Cole (1998) is correct about the taboo against poisonous weapons, and that this taboo would extend to the intentional spread of lethal viruses, we must not rely upon that hypothesis to protect us from these potentially devastating consequences. Much like the environmental hazards that loom in the form of global warming and the greenhouse effect, the dangers of biotechnological and more traditional weapons of chemical-biological warfare are a sobering reminder of how inextricably connected politics is with developments in the life sciences.

Conclusions

As the discussion above hopefully demonstrates, the literature of biopolitics that is applicable to the study of comparative politics, world politics and international relations is both substantial in its contributions and growing quite extensive. The evolution of political institutions, especially the emergence and institutionalisation of the state, is a research topic that is centrally relevant to those fields. The importance of our understanding of human nature and the role it plays in defining what is quite possible and what is difficult in terms of political behaviour offers much to students of politics who recognise that the achievement of social order is highly problematic. This has special bearing, as was shown in chapter 2, with reference to Somit and Peterson's research on human nature and democracy, which in turn has profound implications for world politics and the prospects for the expansion of democratic institutions and social participation in international relations.

In the next chapter we examine the philosophical and methodological issues that must be addressed if biopolitical theory is to achieve the promise that it appears to offer for the study of politics at all levels. The discussion that follows about levels of analysis has been anticipated to some degree in this chapter. The remaining chapters focus upon political behaviour and biopolicy. Chapter 7, in particular, which deals with ecology and environmental policy is germane to the subject matter of this chapter and some of the issues joined here are revisited in that discussion. We agree with Falger (1994: 129-30) that there is an extensive research agenda to pursue.

4 Methodological issues in biopolitics

Introduction

The life sciences perspective that we are advocating requires political scientists to venture into the various life science disciplines and become familiar with their facts, theories and methods. Occasionally these methodologies are not too different from the empirically based research done by some social scientists (for example, non-participant observation). However, the majority of political scientists engaged in empirical research are using survey research techniques and aggregate data analysis of various sorts. Fundamentally these researchers' goal is to employ statistical methods to obtain probabilistic explanations. Others are working within the framework of rational choice theory and are developing formal theory. Some are even combining traditional and behavioural methods into a 'new institutionalism'.

With few exceptions, mainstream political science is not using those methods that have been devised to gather facts and analyse information based on experimental or quasi-experimental design for the purpose of explaining observed behaviour. The exception, as one might expect, has been the field of political psychology, a field that is growing steadily closer to a life science derived paradigm as exemplified by the recent developments in evolutionary psychology (Walsh, 1995, ch. 1; Gladue, 1992). Proponents of biobehavioural research have begun to apply methods taken from ethology, primatology and psychology, in particular.

In this chapter we will review the philosophy of science issues (for example, the level of analysis problem and reductionism) and methodological controversies involved in this paradigm shift (see Masters, 1995). We will also discuss the work of some of the practitioners of biobehavioural research to show how they are employing a variety of methodologies to study the implications of an interaction paradigm for the study of political behaviour.

Reductionism

The challenge presented by E.O. Wilson's *Sociobiology,* (1975) and subsequent work in Sociobiology has been the most formidable theoretical and methodological challenge to take biology seriously to confront the social sciences in general,

and political science in particular. In its essence, the challenge offers a strong reductionist claim - the capacity to explain political phenomena in biological terms. It is this reductionist challenge in its various manifestations that we shall examine in this chapter. Considerable attention will be given to the methodological issues that arise as political scientists turn to biology. An attempt will also be made to sort out the literature in biopolitics into distinct groups and to discuss the implications of the research programmes associated with these groups.

In the twenty-five years since Wilson's book was published, controversy continues to surround his work and that of other sociobiologists. Facts and theories from the life sciences do pose serious theoretical and methodological challenges and real opportunities to the social sciences. Some might argue we should all gird our loins and defend the autonomy of our discipline and the validity of our scholarship. Anthropologists, and especially sociologists, have responded rather vigorously. More recently, as sociobiologists, including Wilson, have moderated their claims somewhat, there has been more light and less heat (see Losco, 1998; Somit and Peterson, 1998).

Political scientists have not been very receptive to the arguments advanced by proponents of biopolitics, despite our discipline's long history of borrowing from other disciplines. Is the biological connection to be treated so altogether different from our other connections? Perhaps not. As serious scholarly discussion displaces the more inflammatory ideological rhetoric that characterised the initial reaction to Sociobiology and biopolitics, it may be that the inclusion of biological variables in greater numbers in the study of political behaviour or the incorporation of insights from evolutionary biology will come to be seen as much needed, even welcome. For that to occur, we must move beyond the older debates that tended to result in ideological reactions rather than scientific ones.

We certainly do not mean to slough off the concern that Sociobiology is a new version of social Darwinism, but we do not intend to discuss the charges and counter-charges that have been made. For a summary of the ongoing debate, see Losco's succinct review (1998) and the other contributions to Somit and Peterson (1998). It goes without saying that the potential for abuse, as in most fields of human endeavour, is real and care must be exercised to avoid exaggerated claims and to prevent prejudicial manipulation of biological facts. Lest we not forget, there has been extremism as well by those who argue for a completely malleable human being whose behaviour can be moulded through operant conditioning following a purely environmentalist determinism. It is well past the time for social scientists to move beyond nature vs. nurture controversies and accept the interactional model that stresses the combined effects of both the genotype and the environment in the phenotype. To draw premature closure to biopolitics or any other quest for knowledge on the grounds that there is the possibility of a slippery ideological slope would be unfortunate and would represent an abandonment of a scholar's time honoured defence of freedom of inquiry. For political science this is heightened because the disciplines of psychology and anthropology are taking a very different approach and many in the life sciences

are extending their interest in dialogue and collaboration with the social and behavioural sciences.

There is not as yet an accepted paradigm or research programme which defines how the life sciences and political science can or should converge, what the central issues and/or appropriate strategies of inquiry are and what aspects of the life sciences are most appropriately included under the increasingly expansive umbrella of political science (see Masters, 1994; White, 1996). The matter of accommodating biological facts is, in short, still very much a matter of debate. While some observers are urging less reaction and more empirical application - a familiar and certainly legitimate request - others remain concerned about matters of conceptual clarification and the ordering of priorities. If, as the philosopher of science Paul Feyerabend (1970) contends, members of scientific communities are characterised by their tendency to adhere to two complementary though seemingly contradictory principles, the principle of proliferation (of hypotheses, theories) and the principle of tenacity (rigid requirements for falsification to avoid premature rejection of hypotheses, theories), it may be accurate to describe those involved in the study of biopolitics as having reached the point where the tendency toward proliferation is about to be seriously challenged or checked by the tendency on the part of some to become more tenacious in their assessment of what is to be sanctified as in keeping with what they see as the most significant research possibilities. We argue that the time has come for us to press harder to determine the core assumptions and major lines of research that are associated with biopolitics as a paradigm (see White, 1996 and Masters, 1994).

Theoretical biopolitics refers to those attempts to employ biological facts and biological theories in explanations of political behaviour. Such a reliance on biological facts requires that these students of biopolitics consider the philosophical and methodological issues involved in crossing this disciplinary boundary. Thus theoretical biopolitics also includes efforts to develop an adequate epistemology and methodology for biopolitics. Further, theoretical biopolitics, as has been demonstrated in chapter 2 above, can be divided into biobehavioural and evolutionary biopolitical theory, reflecting the micro and macro level emphases, respectively. In this chapter, methodological issues will receive more attention than questions of epistemology and ontology, however important those may be (for example, see Hines, 1979, 1982a).

Applied biopolitics refers to the social use of biological facts and biomedical technologies and applications, which not only have political implications, but also have led to extensive public debate as evidenced by the recent congressional hearings and presidential commissions on recombinant DNA technology, genetically engineered crops, research on the human genome and biological engineering. A contemporary example is the debate over stem cell research. This dimension of biopolitics fits more closely the definition offered by Lynton Caldwellinl964.

Biopolitics, according to Caldwell, although it certainly does not designate a science, is a useful piece of shorthand to suggest political efforts to reconcile

biological facts and popular values - notably ethical values - in the formulation of public policies. It affords a selective focus on a portion of the larger issue of the relationship of science to society. Caldwell's understanding of biopolitics is clearly not what others mean by the term, though they do not deny the obvious political implications of advancing biomedical technology. Their sense of what constitutes biopolitical inquiry suggests more the study of the biological parameters of political behaviour and attempts to explain political behaviour by recourse to biological variables at either the individual or the collective level, a distinction that will become crucial later on in this chapter. Chapters 6 and 7 are devoted to an examination of the many dimensions of 'biopolicy'.

Thus it seems quite appropriate for the moment to classify work done in the area of biopolitics and place it along a theoretical and applied continuum. We must recognise the important fact that the tendency to explain political behaviour with biological variables, either in part or in whole, sooner or later requires a consideration of how biological facts are to be accommodated in the formation of public policies (rather than theory) that will affect human behaviour in intended and unintended ways.

Classification of research in theoretical biopolitics

Recent reviews of the literature of biopolitics have tended to delineate it into two major categories. Following the classification of materials in the various bibliographies by Somit and Peterson 1990, we find that over half of the articles in which a biological approach is indicated deal with either (1) ethological and sociobiological approaches (we refer to these as evolutionary biopolitics), or (2) physiological influences on political behaviour (we will refer to these as biobehavioural biopolitics).

Albert Somit's review articles (1968, 1972), which provide much of the rationale for the comprehensive bibliography, concentrate on the utility for and impact of ethology and physiological research on political behaviour research. Much the same can be said of Glendon Schubert's review articles. Schubert (1973, 1975, 1976), however, while acknowledging the research done in ethology and at the macro-level of biological systems (what we have labelled evolutionary biopolitics), seems to suggest that the real key to cultivating the biological connection lies chiefly in the area identified as biobehavioural biopolitics. Nonetheless, it was at the level of systems that biological ideas initially had their greatest impact, particularly in the nineteenth century, largely through organic metaphors (see Mackenzie, 1979). However, in the mid-twentieth century, emphasis began shifting to the micro level within biology. The challenge is to incorporate all levels of analysis into a rigorous biopolitics. Glendon Schubert summarises the situation in this way:

> It is perfectly understandable that, when political science began to move away from mechanical metaphors to biological metaphors of 'systems' of political relationships, groping for an overarching paradigm that might

> better guide inquiry into and interpretation of the manifestly complex and multifaceted empirical relationships of politics, lateral interdisciplinary ties were established with nineteenth century macrobiological theory at the same level at which Herbert Spencer (or, if one prefers a more up-to-date example, Talcott Parsons) sought to develop models of social systems. It is understandable because it is so much more difficult to develop cross-ruffs linking the leading interfaces (viz., 'cutting edges') of two disciplines, especially when the twain have not been closely interdependent in the past. But organismic level systems theory is not where the action was in biology during the late forties, at either Chicago or Michigan and certainly this has remained true of the non-Soviet scientific world during the past quarter of a century. The action has taken place first in microbiology, biochemistry, biophysics, molecular biology, genetics (including genetic engineering) and CNS neuro-physiology, and secondarily in comparative psychology and ethology (especially primatology), and ecology. These are the aspects of modern - that is, twentieth century - biology that political science is going to have to cultivate.
>
> (Schubert, 1976: 161)

Indeed, David Easton's important work on political systems was derived from biological and ecological concepts applied to living systems (see Lazlo, 1991). The point we wish to make here - and it is an important point for the discussion which follows - is that those students of biopolitics who are seeking essentially to extend the behavioural paradigm in political science tend to be most inclined toward the literature of microbiology and physiology (including physiological psychology), a preference which associates them with one camp within the discipline of biology. This version of biopolitics is fairly classified, we believe, as supporting biobehavioural inquiry at the level of the individual.

Those interested in ethology, population biology, ecology and the theory of evolution are linking up with another camp within biology (macrobiology) and are concerned with collectivities and systems. Within the discipline of biology, the latter camp is commonly referred to as traditional (organismic) biology, whereas the former is more closely associated with the concerns of molecular biology. That there are fundamental differences between these positions will become more evident once we have discussed some of the philosophical and methodological issues in contemporary biology (White, 1996).

For the present, assuming the distinction to be valid within biology, we shall continue to develop the distinctions in the context of biopolitical inquiry. One of the proponents of biobehavioral biopolitics, Thomas Wiegele, has underscored this difference of opinion and expressed a preference even more explicitly than Schubert. Having acknowledged the usefulness of ethology and evolutionary studies 'for providing organising concepts', he points to the methodological problems involved in using the comparative perspective on animal behaviour and remarks that the bulk of this literature 'does not deal with the human organism in the first instance'. Moreover, he states 'for political scientists to get involved in

the serious methodological debates of the ethologists strikes this writer as a waste of energy. These debates are an awkward method of advancing our knowledge of political man ... We should not wait for the science of human ethology to bloom, nor should we concern ourselves in a primary way with the internal controversies of the ethologists.' He goes on to say that the most productive avenues for political scientists to develop 'a more operationally comprehensive definition of human nature lie in the life sciences that are devoted exclusively to the study of man ... The life sciences that have dealt with the human organism directly and in an empirical way include medicine, psychopharmacology, neuroanatomy, biochemistry, epidemiology, psychosomatic medicine, human biology, psycho-physiology, human physiology, and human endocrinology' (Wiegele, 1978a: 6-7).

We shall have more to say about Wiegele's reasons for advocating this preference later in the discussion of the level of analysis problem in biopolitical inquiry. It must be noted at this point that the preference, as stated, rests largely on a desire to do empirical research and on a desire to avoid the methodological problems associated with evolutionary biopolitics. It seems only fair to note, without further commentary, that there are serious methodological problems involved in conducting the experiments with human subjects that would be necessary in order to produce significant empirical research in biobehavioural political science (see Watts, 1981). Indeed, these limitations encompass the whole range of ethical issues in research on humans, including a lack of available research funding. Together, these constitute serious obstacles to advancing research in this area. However, we hasten to add that these problems are also present for the proponents of 'pre-behavioural' (to use Wahlke's expression) researchers (see Eulau, 1963). The social and behavioural sciences do not have the research funding that they need, especially for longitudinal and replicative studies that are essential for the future of any behavioural research programme. Biobehavioural biopolitics, in part because of its research methods, is thus closely linked with the policy issues (including ethical considerations) in applied biopolitics.

Others have echoed preferences similar to Wiegele's, and for similar reasons. Perhaps the most considered treatment of the relationship between biobehavioural and evolutionary biopolitics is that provided by John Wahlke. Because of Wahlke's singular attention to the relationship of biopolitics to the behavioural paradigm in political science, we want to consider his position in some detail. In his paper on 'Research Prospects for Biobehavioral Political Science' and subsequently in his APSA presidential address, Wahlke notes the sense of disappointment in 'political behaviorism', disappointment expressed by critics and proponents as well. He characterises this earlier work as primitive political behaviouralism and urges greater use of biobehavioural science in order to overcome earlier limitations.

Quite properly, Wahlke asserts that the distinctive feature of behavioural political science has been its adherence to the unified view of science (with physics as the model science), a position which sustains the quest for empirical

theory. The major premise of political behaviouralists 'was a seemingly rigorous empiricism, often expressed as "methodological individualism", i.e., insistence that the ultimate legitimate unit of observation in political study is the acting human individual, all other phenomena being regarded as "merely" some collective expression of or inference from those observations' (Wahlke, 1977: 1). Wahlke (1977: 3) is quick to point out that the major shortcomings of political behaviouralism were (1) the failure of 'micro-level' studies 'to articulate with appropriate "macro-level" concerns of political science,' and (2) the overwhelming 'reliance on an unrealistic and misleading model of the individual political actor, or, as earlier political scientists might have said, a defective conception of human nature'. We concur in Wahlke's assessment. If only political behaviouralists had been as concerned as Heinz Eulau was in his original formulation of the behavioural persuasion in politics, or as Wahlke is today.

In his early (1963) discussion of units and levels of analysis in behavioural inquiry Eulau took great care in pointing out the problems involved in moving from micro to macro levels of analysis. Unfortunately, other political scientists never fully engaged in a debate that has been thoroughly documented in the philosophy of social science literature and in sociological theory - the methodological individualism-holism controversy. Eulau clearly accepts methodological individualism as a guiding methodological principle. The following statements bear this claim out.

> The political behavior of the individual person is the central and crucial empirical datum of the behavioral approaches to politics ...
>
> The political behaviorist concentrates on the behavior of individuals whose interactions and transactions make up collective behavior, even if he is concerned with describing and explaining the actions of groups, organizations, or other large collectivities. Groups, organizations, or nations have no independent status apart from the conduct of the individuals who are related by behavior towards each other in certain ways. This does not mean that groups, organizations, or other formations are not 'real' and meaningful units with structural properties and functions of their own. They certainly are. In fact, the great bulk of problems interesting the political scientist concern the actions of such groups. But, from the behavioral perspective, these collectivities exist and behave the way they do only insofar as the people composing them act in certain ways.
>
> (Eulau, 1963: 14-15)

Eulau goes on to suggest that in choosing the individual as his empirical unit of analysis, the political behaviourist does not deny the reality of institutions, but merely asserts that institutions do not and cannot exist physically apart from the persons who inhabit them. The political behaviourist is likely to stress this point because institutional and behavioural analyses have, at times, been treated as if they were opposed to each other. But for Eulau:

> They are not. Political institutions are never more or less different from the patterns of behavior of the people who create them or the regularities of their actions. If this be so, institutions can and must be analyzed in terms of the behavior of their molecular units, the individuals whose relations to each other and behavior towards each other are more or less rigidly structured.
>
> (Eulau, 1963: 15)

We shall refer back to Eulau's position later when the distinction between ontological and methodological individualism and holism (collectivism) is discussed. For the moment, the reader may ask what Eulau means when he says that collectivities are, in fact, 'real' and possess structural properties and functions of their own. While discussing levels of analysis in political behavioural research Eulau (1963: 21) stresses the fact that the interdisciplinary nature of this research requires pursuing lines of inquiry at different levels. Problems have a way of spilling over disciplinary boundaries. Attempts to solve them in terms of a single discipline's concerns are likely to be partial and unsatisfactory. Only for the purpose of inquiry do we think of what is social but not political, cultural but not political, or personal but not political as analytically distinct. It is more appropriate, therefore, to speak of levels of analysis - the social, cultural and personal levels - on which political behaviour may be examined.

Eulau even addresses the charge of 'reductionism' in this early work. The behavioural persuasion in politics has been especially criticised in this connection and charged with 'reductionism': for example, an interdisciplinary orientation inevitably reduces the political to the social, cultural, or personal; that the *political* is taken out of *political* behaviour. Eulau argues that this is not a reduction, but rather an expansion of political relevance that marks the behavioural approaches:

> Just what is political in behaviour cannot be determined by criteria of immanence. An immanent or essentialist definition of politics is a convenient and certainly an arbitrary way of limiting one's scope of inquiry. This is the traditional way of proceeding with an investigation. But it is just because the traditional method has been found wanting that it is no longer feasible to draw the boundaries of a research project in politics too rigidly. If it can be shown that explanation of things political is possible, if not necessary, on different levels of analysis, including that of personality, the product of inquiry is not the result of reduction but rather an expansion of the political arena.
>
> (Eulau, 1963: 23-4)

These very same concerns are addressed by Wahlke, which suggests to us that we have not yet reached a clear understanding of the level of analysis problem. For that reason, the problem plagues biopolitical inquiry as well. Corning (1983, 1998) has explored this problem in great detail. His 'synergism hypothesis' examines the dynamic quality of interrelationships at various levels with allowances

for both upward and downward causation - all of which must be understood as particular configurations that give rise to natural selection (1998: 150). Lasswell (1968) was certainly correct when he claimed that comparative analysis in political science was insufficiently configurational.

Clearly Wahlke and other proponents of biobehavioural inquiry are, in Eulau's words, expanding the scope of politically relevant inquiry to include the body (soma). But is it not also the case that the proponents of evolutionary biopolitics are also expanding the scope of political inquiry in meaningful and relevant ways? We shall attempt to answer that question in the affirmative somewhat later. The legitimacy of an interdisciplinary assault on political phenomena would seem to be an accepted fact today. And yet, as Wahlke (1977:2) laments, there have been serious disappointments in the generally descriptive character and disconnected nature of political behavioural analysis. Will further expansion help solve those problems? Let us consider Wahlke's reasons for suggesting that it might.

To begin with, he suggests, political behaviouralists have neglected macro-level concerns of political science to the detriment of their research. While methodological individualism

> may be a valid principle to govern observation and analysis of data ... it is inadequate and inappropriate for the kind of conceptual analysis essential to knowing what activities and what elements or aspects of individual's behavior it is important to observe. The concepts and categories used to describe and explain micro-level behavior scientifically are essentially apolitical.
>
> (Wahlke, 1977: 3)

Hence, the increasingly frequent complaint that political behaviouralism is 'trivial'.

Moving to a consideration of the macro-level, Wahlke reminds us that the scope and objectives of macro-level political science are not defined in terms directly descriptive of behaviour as such. Politics, government, and their cognate and derivative concepts and categories are not labels or index-names for classes of activities or sequences of activities discrete from all other human behaviour. Rather, they are according to Wahlke

> abstractions, constructs which, when embodied in macro-level questions about governmental structure, system, process, function, or development, and their place and role in the social and historical life of societies and mankind, help us identify and orient us toward the elements or aspects of individual behavior which we should observe and explain. Empirical political inquiry must logically begin at the macro-level.
>
> (Wahlke, 1977:3)

Behavioural political science's shortcomings are not due, in Wahlke's view, to its proponents' failure to utilise an existing body of macro-theory. To the contrary,

'remissness lay rather in the implication, if not the wish, that micro-level political behavior research could or would replace macro-level study, that not just worn out or useless macro-level conceptions were to be discarded but macro-level political science in general.' The apparent contradictions often noted between, on the one hand, the behavioural persuasion as micro-analysis exemplified by the work of Eulau and, on the other, by the macro-behavioural orientation exemplified by the search for an organising framework at the systems level in the work of David Easton and of Peter Corning (as well as that of the general systems theorists) may now be seen as an attempt to overcome the original level of analysis problem as restated by Wahlke. Easton's attempts to relate political socialisation research to the macro level concept of supports become paradigmatic of the kind of research programme that Wahlke feels is essential. We do not mean to suggest that the systems approach is itself only a theory of macro-politics. It is intended to frame inquiry across and among levels. We contend that macro-level theory is legitimate and necessary and that macro-level studies are useful not only for heuristic purposes or for providing interesting concepts - a viewpoint expressed by Wiegele when he demotes ethology and Sociobiology in favour of bio-behavioural inquiry at the micro-level (physiological variables).

Nothing we have said so far, however, answers the question: Why include biological variables? Wahlke suggests that the formulation of macro-level political theory will require extensive conceptual housecleaning not just by political behaviourists but by political science as a whole. Does this mean another behavioural revolution? Is the debate among advocates of biopolitics but a microcosm of the larger controversy in the discipline concerning the use of macro-level concepts and the findings of micro-level research? We believe the answer to the second question is yes and that the first question is improperly phrased. If we were to ask whether it is essential to the research programme of political behaviouralism to incorporate the findings of the life sciences, a strategy which will require some intellectual retooling, then our answer is an unequivocal yes. For as Wahlke correctly observes, the early acceptance of methodological individualism as a first principle of behavioural methodology led researchers to rely too heavily 'on a conception of the behavioural dynamics of human actors borrowed largely, and in over-simple, unsystematic fashion from social psychology'. From Wahlke's perspective the life science perspective is necessary in order to have a truly behavioural science.

For Masters and Willhoite biological facts help to provide a clearer understanding of human nature, recovering the Aristotelian notion of man as a political animal and, not insignificantly, rendering the traditional concern of political philosophy with human nature more relevant. But how exactly do macro-level studies grounded in ethology and Sociobiology link up with micro-level studies of the impact of physiology, psychopharmacology and molecular biology on individual behaviour? We shall postpone answering that question until we have examined the philosophical and methodological issues that dominate contemporary biology and are therefore very important to biopolitics.

Philosophical and methodological issues in contemporary biology

It should come as no surprise to political scientists (though it may) that there is less consensus on theoretical and methodological matters among contemporary biologists than might be hoped for if biological facts are now to be utilised to help explain political phenomena. A recent volume edited by Somit and Peterson (1992), for example, explores the current debate over the theory of 'punctuated equilibrium' in evolution and includes contributions from leading figures in the debate within biology as well as biosocial science researchers. Even such important debates within biology, however, do occur within the broad framework of modern evolutionary theory.

The danger of 'overspecialisation',' with its limited vision, is only too evident when one finds political scientists dabbling in a small corner of another discipline. Hopefully, when (if?) we become more serious students of biology many of these shortcomings will have been overcome. John Crook's caution regarding the use of ethological evidence is most appropriate and can be generalised to include all biological facts.

> Much in human ethology and in the inferences to be drawn from animal to human studies remains highly theoretical and, exciting though these ideas may be, caution in their application is needed. The uncritical acceptance of the ideas of the non-scientist Robert Ardrey by many who preferred skilled writing and glib thought to solid academic statement sounds a warning. To know the importance of a neighboring science to one's own requires a reading of the original materials.
>
> (Crook, 1976: 274)

In the meantime, we must note the conflicts within biology, and in so doing we are better able to characterise the debate within biopolitics discussed above. Ecologists, ethologists, microbiologists and molecular biologists (to mention a few specialities) are as distinctive as students of public administration, political philosophy and international relations in political science. The right hand often does not know, and what's more may not seem to care, what the left hand is doing. Some evidence of the differences of opinion may be found in David Hull's *Philosophy of Biological Science* and Ronald Munson's edited collection, *Man and Nature: Philosophical Issues in Biology.* We shall discuss these disagreements under the headings of reductionism and causal explanation in biology.

Reductionism revisited

It is noteworthy that at the same time that social scientists are wincing in the face of a reductionist challenge from Sociobiology, biologists are still grappling with their own reductionistic challenge. It is perhaps worth noting that the use of a 'rational choice' model in formal theory is also reductionistic. This has led to

various criticisms of a model that is viewed as truncated and inadequate for conceptualising the complexities of human behaviour (see Cook and Levi, 1990 and Green and Shapiro, 1994). The 'biological revolution', stemming largely from the emergence of molecular biology has invited the elimination of biology as a distinctive science. Consider this:

> The reduction question is one aspect of what has been called in the last few years 'the crisis of modern biology' If molecular biology is indeed the biology of the future and all biological phenomena can be explained in physical and chemical terms, then traditional biology seems destined to be replaced. On the other hand, if there is something about biological laws, concepts, or processes that precludes their ever being reduced, then biology will forever remain an essentially separate and independent discipline. The reduction issue obviously involves the fundamental character and status of biology, and how it is dealt with may prove to be of primary theoretical and practical importance.
>
> (Munson, 1971: xix-xx)

Does this sort of issue sound familiar? Is there a distinctly political subject matter, methodology, vocabulary, etc.? The parallel with the level of analysis problem in the social sciences is only too obvious.

The original Cartesian conception of biology as reducible to physics (for example, explanation in biological terms is reducible to explanation in physical terms) is currently disclaimed by proponents of organismic biology who hold 'the common conviction that biological phenomena cannot be understood adequately in terms of theories and explanations which are of the so-called mechanistic type' (Nagel, 1971: 19). Surely political scientists recall the concern expressed by members of their discipline over the 'mechanistic', 'behaviouristic' drift of the discipline toward psychological reductionism. Recall also Eulau's disclaimer noted earlier. The complaint is both common and more long-standing than the specific debates of the behavioural revolution in political science.

Mechanistic and organismic metaphors, models and analogies have been characteristic of all social thought. They are fundamental forms, reflecting real differences of perspective and requiring the most serious effort to do justice to the claims made by those representing both perspectives. For every proponent of reduction, there is likely to be a proponent of emergence, or, in terms more familiar to the social scientist - for every individualist, there is a collectivist. Needless to say the methodological debate between individualists and holists has been rendered more complex by the accretions of meaning that have developed around these fundamental forms of social thought. For that reason, we shall deal with the methodological individualism-holism controversy in the next section of this chapter.

Causal explanation

In addition to the problem of reductionism in biology, there are a number of problems and disagreements concerning the nature of causal explanation.

Following Ernst Mayr's (1971 [1965]) discussion, these may be described as problems resulting from: (1) basic differences between functional and evolutionary biology; (2) the meaning and utilisation of 'teleology'; (3) the problem of prediction; and (4) the problem of indeterminacy in evolutionary theory. Functional biology is concerned with structural elements - their operation and interaction, that is, the functions performed by structures. Through analysis (breaking down into component parts) the functional biologist isolates the object of study through controlled experimentation. 'The chief technique of the functional biologist is the experiment and his approach is essentially the same as that of the physicist and chemist' *(ibid.:* 34).

Alternatively, the evolutionary biologist is not concerned with the how, but with the why and finally what for? Recognising that everything is both time and space bound, the evolutionist insists that a full understanding requires that we trace the history of structure, that is, the evolutionary adaptation of the organism as a whole.

Helpfully, Mayr provides an analogy with information theory to heighten this distinction:

> We can use the language of information theory to attempt still another characterization of these two fields of biology. The functional biologist deals with all aspects of the decoding of the programmed information contained in the DNA program of the zygote. The evolutionary biologist, on the other hand is interested in the history of these programs of information and in the laws that control the changes of these programs from generation to generation.
>
> (Mayr, 1971:35-6)

An even more helpful clarification of how causality is viewed differently for the functional and evolutionary biologist is provided by way of an example, the causes of bird migration. What Mayr demonstrates is that there are four different and important types of causes involved. First, there is an ecological cause based on the fact that the bird would starve in winter in New Hampshire. Second, there is a genetic cause based on the genetic inducement for the bird to respond to specific stimuli in the environment, which signal the onset of winter. Third, there is an intrinsic physiological cause based on photoperiodism, which generates a response to the decrease in day length. And finally, there is an extrinsic physiological cause based on the specific environment features of a particular day when the temperature drops suddenly, thus triggering the intrinsic physiological response. The first two of these causes represent ultimate causality while the second two represent proximate causality:

> Still another way to express these differences would be to say that proximate causes govern the responses of the individual (and his organs) to immediate factors of the environment, while ultimate causes are responsible for the

> evolution of the particular DDTA code of information with which every individual of every species is endowed.
>
> (Mayr, 1971: 37)

The distinction here drawn between proximate and ultimate causation is an important one. Citing the same example of bird migration, David Barash, who, along with Wilson and Trivers, has been a major contributor to the field of Sociobiology, has stated that the study of Sociobiology employs evolution to interpret the basic patterns of animal social behaviour and provides a rather sweeping synthesis of behaviour, painting with broad strokes across a range of phenomena and species. An evolutionary approach involves a level of analysis different from that typically employed by social scientists. The two viewpoints can be distinguished conveniently as proximate causation versus ultimate causation (Barash, 1977: 37). Moreover, in the long run explanations of behaviour that take both proximate and ultimate causes into consideration will be the most satisfying. 'In the short run, it is a worthy exercise to step back periodically from any explanation of behavior and ask whether it is proximate or ultimate. Neither is inherently better, but neither one alone is complete' *(ibid:* 39).

Thus biologists have come to understand the interactional nature of individual behaviour and species evolution. The old nature (instinct, endogenous) versus nurture (learning, exogenous) debate between biologists and social scientists, respectively, is resolved in Sociobiology because it makes no sense to consider animals' development and behaviour in the absence of an environment. Likewise, the extreme of environmentalists' claims would posit an environment without any organism. In short, all phenotypes derive from the interaction of an organism's genetic potential with its environment and behaviour is as good a phenotype as any other (Barash, 1977: 39). This point has been argued persuasively, in our view, on behalf of biopolitical inquiry by Losco (1996), Masters (1975) and White (1972). Recognising the interactional nature of this phenomenon goes a long way toward reducing the tendency to see in Sociobiology or biopolitics a new form of social Darwinism. It also underscores for the social scientist the research task of integrating micro- and macro-level analysis and helps to alleviate professional fears of reductionism.

In this way, biologists, in the face of the challenge of molecular biology, have apparently managed to retain the legitimacy of macro-level inquiry into complex biological systems. However, it must be admitted that causal explanation in a formal sense is more readily attainable at the level of proximate causation than ultimate causation. Mayr concedes this point in his discussion of the problem of prediction.

> Although prediction is not the sole criterion for assessing the validity of causal explanation, it is accorded high status among the scientists' objectives in theory construction. Evolutionary theory can provide detailed explanations of previous events and current conditions, but is less able to make reliable predictions, except in the trivial sense of predicting that the greater

> the 'fitness' of the organism the greater the likelihood of reproductive success. Much greater predictive value inheres in the biologists' ability to predict structural and behavioural characteristics as a result of classification or to predict physiochemical phenomena on the molecular level. When we are interested in complex ecological interactions or evolutionary events indeterminacy causes more serious problems.
>
> (Mayr, 1965: 46-8)

Mayr offers four classes of reasons for indeterminacy:

1 Randomness of an event with respect to the significance of the event. Spontaneous mutation, caused by an error in DNA replication, illustrates this cause for indeterminacy very well. The occurrence of a given mutation is in no way related to the evolutionary needs of the particular organism of the population to which it belongs.
2 Uniqueness of all entities at the higher levels of biological integration. The uniqueness of biological entities and phenomena is one of the major differences between biology and the physical sciences. Physicists and chemists have difficulty understanding the biologist's stress on the unique, although such an understanding has been greatly facilitated by the developments in modern physics. If a physicist says, 'Ice floats on water', his statement is true for any piece of ice and any body of water. The members of a class usually lack the individuality that is so characteristic of the organic world where all individuals are unique, all stages in the life cycle are unique, all populations are unique, all species and higher categories are unique, all inter-individual contacts are unique, all natural associations of species are unique, and all evolutionary events are unique. Uniqueness, of course, does not entirely preclude prediction. We can make many valid statements about human attributes and human behaviour and likewise about other organisms. But most of these statements ... have purely statistical validity. Uniqueness is particularly characteristic for evolutionary biology. It is quite impossible to have, for unique phenomena, general laws like those existing in classical mechanics.
3 Extreme complexity. Every organic system is so rich in feedbacks, homeostatic devices and potential multiple pathways that a complete description is quite impossible. Furthermore, the analysis of such a system would require its destruction and would thus be futile.
4 Emergence of new qualities at higher levels of integration. 'When two entities are combined at a higher level of integration, not all the properties of the new entity are necessarily a logical or predictable consequence of the properties of the components'. This difficulty is by no means confined to biology, but it is certainly one of the major sources of indeterminacy in biology.

The importance of these caveats to biopolitical inquiry should not be missed. Perhaps this appreciation for the complexity of the phenomena under study is what makes biology more attractive as a model science than physics to some political scientists. Moreover, these limitations should not be construed as denying evolutionary biology or the social sciences their scientific status. More rigorous causal explanations (process laws), which are applicable to closed systems, can be achieved, if only for the behaviour of biological (open) systems during specified periods.

> In such cases a biological law could not necessarily apply to a species throughout its existence but only in special circumstances; for example when some of its members enter a previously unoccupied ecological niche or when one of its populations becomes reproductively isolated from the main body of the species.
>
> (Hull, 1974: 59)

As can be seen from the above discussion, biologists have been constrained to develop scientific theories in many of the same ways as social scientists. There is every indication that researchers in biology have become less self-conscious about their status as 'scientists' and have turned their energies to providing explanations of biological phenomena at various levels, in the context of an overarching evolutionary framework. Political scientists should learn from this example.

Getting behaviour and evolution together

We have been concerned thus far with pointing to an apparent division of labour within biopolitical research that roughly parallels a similar division within biology (and a division within the philosophy of science as will be shown below). We have attributed to biobehavioural researchers the objective of extending and thereby fulfilling the promise of the behavioural paradigm in political science. A cautionary note was introduced by contrasting the views of Wiegele and Wahlke concerning the priorities of biopolitical research. Following Wahlke, the point was emphasised that micro and macro political research are both essential to the development of a non-trivial science of politics. To underscore this view, consideration was given to the situation in biology. If we are to avoid the disappointments noted above, it is essential that both programmes proposed for biopolitical inquiry (biobehavioural and evolutionary) be not only tolerated but also vigorously pursued.

With that objective in mind, some questions can be raised. Does the evolutionary framework provided by Sociobiology escape some of the problems earlier discussed? Are micro- and macro-level political phenomena capable of being integrated in an evolutionary framework? Do the major concepts and problems of interest to Sociobiology relate in a meaningful way to major concerns of political science, or are they too only trivially related? In attempting to respond to

some of these questions it will be necessary to return to the methodological problems involved in accommodating different levels of analysis.

The level of analysis problem revisited

In the above discussion of theoretical perspectives in biopolitics, we suggested that there might be some confusion among political scientists as to Eulau's explanation of the choice of the individual actor as the unit of behavioural analysis. Eulau clearly dodged the charge of reductionism, alleging that he was expanding the scope of relevant inquiry, not reducing it. This is a clever attempt, but there is a difference between reductionism as a view which posits ultimate explanation through successive analysis down to the fundamental unit, for example, in classical physics the atom and the problems experienced by political scientists as they expand the scope of their inquiry to include, for example, Third World countries, private sector interest groups, the impact of personality and so forth (see Sartori, 1970).

In the case of reductionism, there is an implication of disciplinary hierarchy that is not a factor in the case of mere expansion of scope. Furthermore, there is a clearly posited criterion of meaningfulness - that is, the capacity for operational definition which is characteristic of behavioural political science, at least in theory if not practice. Reductionism usually implies one or more of the following: the necessity to reduce theoretical terms to observation terms (operationism); reduction of all science to some ideal unity (unified view of science); reduction from the complex (whole) to the simple (part). This is not an issue that can be side stepped. The reductionism of methodological individualism and the determinism so often linked with methodological holism are issues that still plague biopolitical inquiry.

A major reason for discussing the methodological issues in contemporary biology was to show how biologists working at different levels of analysis have apparently come to understand the interdependence/complementarity of their research. Mayr's and Barash's remarks help to clarify the way in which micro- and macro-level research and ultimate and proximate causes together provide an adequate explanation of biological phenomena.

We know of only one discussion of the level of analysis/explanation problems with specific reference to biopolitics. In their study, Albert Somit and Meredith Watts emphasise that critics of biopolitics tend to 'underestimate the diversity of the intersections between biosciences and political science' (Somit and Watts, 1994: 9), which leads those critics to mistakenly assume there is only one biological perspective and that is entirely reductionistic. As we have shown, there are biologists working at various levels of analysis with different research objectives. Borrowing from the ethologist Jan Tinbergen's work (1963, 1972), they offer the following categorisation (see Table 4.1) to help distinguish the levels of analysis and types of explanation used to study behaviour.

Categories 1 and 2 above represent the 'how' questions when studying behaviour and 3 and 4 represent the 'why' questions. Thus there are two

Table 4.1 Types of explanation

Level of Analysis	*Causal*	*Historical*
Individual	Physiology 1	Developmental 2
Species	Function 3	Evolution 4

Source: Adapted from Somit and Watts (1994: 9).

different levels at which the very different research questions of 'how' (proximate) and 'why' (ultimate) can be researched, leading to very different types of methods and explanations.

Because political science deals with the behaviour of individuals (for example, political leaders) and with their collectivities (i.e. complex organisations of government) and with interaction it would seem only too obvious that there must be linkages (for example, the heavy reliance on the concept of role in behavioural political science). In political science there is a particular problem however. The issue of individualism versus holism (collectivism) seldom is treated as merely a methodological issue. Normative considerations, or more accurately ideological considerations, make it virtually impossible to distinguish methodology from ontology and to control for 'bias'. The primary objective here is to show that holistic, macro level explanations are justifiable on methodological grounds and need not, although they often do (depending on the researcher), entail assumptions of organicism (i.e. the whole is greater than the sum of its parts in an ontological sense; 'group mind', Hegelianism, etc.).

The debate over units and levels of analysis stems from a controversy over the relative status of disciplines and the kind of explanations they typically provide. Can sociology, for example, be reduced to psychology (that is: Can a sociological explanation be rendered in psychological terms? Can psychological theory explain, and explain more fully, all sociological phenomena?). Another way of putting the issue is to ask whether there are societal facts and societal laws, which require other than a psychological explanation to be fully understood. In political science the behavioural revolution may be seen as an attempt to answer that question negatively. Recall Eulau's assertions. In his view, the best explanation (i.e. most complete) must account for societal facts in terms of the behaviour of individuals. Small wonder that Wahlke finds primitive behavioural studies 'adrift' and unanchored in the non-trivial macro-level concepts that have for so long constituted the traditional or institutional approach to the study of politics.

Obviously, this complex methodological issue has been made more complex by the coming together of several concerns: methodology, ontology and epistemology. The debaters often confuse these concerns. Certainly that is the case in discussion of the level of analysis problem in political science where these distinctions are blurred. But let us characterise the issue further and see the points of disagreement between individualists and holists. The two positions may be described as follows:

> [T]he question is whether we should treat large-scale social events and conditions as mere aggregates or configurations of the actions, attitudes, relations, and circumstances of the individual men and women who participated in, enjoyed, or suffered them. Methodological individualists say we should. Methodological holists (or collectivists, as some prefer to be called) claim, rather, that social phenomena may be studied at their own autonomous, macroscopic level of analysis. Social 'wholes' they say, not their human elements, are the true historical individuals.
>
> (Dray, 1967: 53)

The individualist asserts 'that ultimate or final explanation of the more significant social phenomena must be given in terms of at least typical dispositions including beliefs, attitudes, and volitions of anonymous individuals involved' (Dray, 1967: 55). This position is virtually synonymous with that attributed to Eulau earlier.

J.W.N Watkins, a proponent of methodological individualism, defines methodological holism as the view that the social behaviour of individuals should be explained in terms of the positions or functions of these individuals and of the laws which govern the system. These laws are regarded as *sui generis,* applying to the whole as such and not derivable from individualistic principles, according to Watkins (1955: 58).

As these statements by philosophers involved in the debate suggest, there often is a tendency to lump methodological, ontological and epistemological considerations together. This leads Maurice Mandelbaum to observe that the defender of methodological holism is often unfairly charged with holding the position of ontological holism. The result is that:

> It would therefore seem that anyone who wished to reject the metaphysical theses of holism in general (for example 'the whole is greater than the sum of its parts') would be committed to accepting the methodological principle which has been defined as methodological individualism.
>
> (Mandelbaum, 1955: 332)

This is more or less the view that dominates political science (at least behavioural political science) today. Mandelbaum, however, supports the view that there are societal facts, which can and should be studied by the social sciences as autonomous disciplines:

> One cannot understand the actions of human beings as members of a society unless one assumes that there is a group of facts which I shall term 'societal facts' which are as ultimate as are those facts which are psychological in character. In speaking of 'psychological facts' I refer to any facts concerning the thoughts and the actions of specific humans beings.
>
> (Mandelbaum, 1957: 478)

To the political scientist who is familiar with the problems of aggregate data analysis and the 'ecological fallacy,' the issue raised here is clearly an important one. How does one account for those aspects of politics that are especially complex? The political scientist engaged in research on the socialisation process must assume societal facts and typically explain collective behaviour in terms of the impact of societal facts. However, he also uses survey research to account for behaviour in terms of the attitudes, beliefs and opinions of individual political actors (note: still with the problem of the ecological fallacy).

The point we wish to emphasise is that for one to hold the view that societal facts are irreducible does not require that one deny the ontological view that society consists of individuals in favour of the view (ontological holism) that society is somehow an independent entity - more than the sum of its parts. Critics of methodological holism have often asserted this to be the case, as has already been suggested. Thus those who reject the historicism of Hegel (for example, Popper and Hayek to mention only two) with all of its ideological implications are unfairly rejecting a method on ontological and ideological grounds. The epistemological objection to methodological holism, which is at the same time a central tenet of empiricism and may be restated as operationism, is that we cannot observe the macro features of social groups but we can observe human individuals or material objects.

> Whenever we wish to point to any fact concerning societal organization we can only point to a sequence of interpersonal actions. Therefore, any theory of knowledge which demands that all empirically meaningful concepts must ultimately be reducible to data which can be directly inspected will lead to the insistence that all societal concepts are reducible to the patterns of individual behavior.
>
> (Mandelbaum, 1957: 486)

This would seem to be a formidable objection, given the positivist-empiricist tone of contemporary political science. Interestingly, it is an objection that would render much that passes for political analysis today circumspect by empiricist standards. But the problems of operationalising concepts in political science are only too well known.

The methodological holist asserts that there may be explanatory accounts of societal facts using macro-level concepts without the necessity of restating these concepts and explanations in terms of individual behaviour. An obvious issue here - one we cannot deal with at length because of its complexity - is the matter of whether individual behaviour may be said, on this view, to be determined by societal facts. If this is in no sense true, then one can readily dismiss macro-sociological accounts of collective behaviour as, for example, provided by Marx and Durkheim. In political science, the relationship of this matter to ideological considerations seems only too obvious. Likewise, to the extent that biopolitics may offer a deterministic account of behaviour (for example explanation relying on factors ranging from ecological variables to genes) it too will be

resisted by some on a variety of grounds including ideological grounds masquerading as methodological objections.

Proponents of biopolitical inquiry will undoubtedly be called upon again and again to clarify the sense in which they employ a holistic methodology without being ontological holists. At the same time, proponents of biopolitics will often engage in reductionism when seeking to explain a phenomenon at one level of physical reality through the use of variables at a lower level of reality. This is the essence of analysis. It need not represent a claim of extreme reductionism whereby societal facts are denied and the reductionism proceeds all the way to the genetic level. Different problems require different levels of analysis and different methodologies. Biopolitics requires multiple methods and allows for, and indeed encourages, explanations of phenomena at different levels. Now we may better address another issue raised by Wahlke in his critique of early behavioural research.

> Accepting methodological individualism as a premise, political behaviorism further accepted implicitly the Weberian conception of behavior and action, according to which understanding human behavior as differentiated from the motions of inanimate objects or the behavior of nonhuman animals, entails the intellectual method Weber called *verstehen.* That is, most political behaviourists tacitly agreed with Weber's notion that to understand human behavior (observable, physical acts) in any particular instance, one must know its 'meaning' to the actor, i.e., his motivations, rationale, and cognitive picture of the situation in which he acts.
>
> (Wahlke, 1977: 4)

Wahlke is quick to point out the seeming paradox in this:

> Thus, despite a methodological creed nominally built on rigorous empiricism and methodological individualism, behavioral science came to focus its research attention not really on empirically observable movements and actions of material persons, but dualistic phenomena comprising the overt physical actions of individuals, which are of course, empirically observable, and a presumably underlying causal or motivational element of conscious thought, emotion, or 'attitude,' which (although this is rarely admitted or faced as a fact) is in principle not empirically observable because it is non material or mentalistic in nature.
>
> (Wahlke, 1977: 4-5)

Although Wahlke declines to discuss the philosophical questions raised by his observations, we have raised them sufficiently here, though by no means exhaustively, to see the implications of this rarely admitted fact for political analysis. Indeed, for Wahlke this is one of the major reasons why further consideration of the biological bases of non-cognitive aspects of human behaviour holds such

promise. Such research promises to be more consistent with empiricist canons of scientific research.

Wahlke's conclusion, although not altogether condemnatory by any means, is that the resultant over employment of survey research as the main tool of behavioural analysis 'dulls the mind of researchers to the possibility of resort to other techniques' (Wahlke, 1977: 5). Unfortunately, Wahlke does not deal with the problem of 'legitimising' macro-level (holistic) methodology at this juncture, although he does lament the 'lack of anchorage in macro-level theory' *(ibid.:* 6). This would seem to present a problem since macro-level theory, an holistic or collectivist enterprise, is not, as we have seen from our discussion of the individualism-holism dispute susceptible to theoretical reduction to the level of the individual once we have admitted to societal facts. In one sense, the problem may stem from the fact that most political scientists are unaware of the full implications of adhering to methodological individualism, much less the requirements of a positivist-empiricist philosophy of science. If we accept those standards we are left with the problem of how macro-level concepts are to the operationalised, if societal facts are not, *per se,* observable (as was also the case with 'attitudes'!). Operationism refers to the view that: All theoretical terms of any science whatever are reducible to descriptions of the operations or procedures of measurement, so that measurement statements themselves are reduced to descriptions of the experimental procedures in terms of which such measurements take place' (Wartofsky, 1968: 349).

This view is grounded in the 'positivist verifiability theory of meaning' in which all the statements of a theory which are not, or could not be reduced to observation statements on a phenomenal or operational basis are regarded as 'empirically meaningless and outside the domain of positive science' (Wartofsky, 1968: 349-50). This view, of course, is what ultimately leads to the reduction of chemistry to physics and, so it would follow, the non-physical sciences of biology, psychology and the social sciences would be reduced as well.

On such a thesis, all living things would differ from non-living things only in degree of complexity of structure, said not in kind, in any irreducible sense. In such a view, living organisms are nothing but machines - that is, organisations of physical elements of a certain structure. Therefore the complete scientific description of life would be a physicochemical one, expressible fully in physicochemical laws. The persistence of distinctive biochemical, biophysical, biological formulations would only be a practical expedient, marking the difficulty of accomplishing the full reduction to physics, because of the great complexity of structure of living things (Wartofsky, 1968: 351).

The inappropriateness of this physical reductionism is underscored by White (1996). Neither Wahlke nor Wiegele would associate themselves with this position as presented, although to some extent it is implied in the biobehavioural line of inquiry. Wahlke does urge that we turn to the disciplines which deal much more systematically and comprehensively and in a more rigorous scientific fashion with human organisms and their 'behaviour defined in more scrupulously empirical terms', than does the brand of social psychology thus far

displayed in political behaviour research. Presumably the same rationale underlies Wiegele's preference for biobehavioural inquiry over evolutionary biopolitics. He must at least conclude that there may be serious problems with leaving our understanding of scientific explanation grounded in positivism if we are going to recognise the legitimacy of macro-level explanations. As stated earlier, however, this book cannot deal adequately with the epistemological dimension of theoretical biopolitics (see Hines, 1979).

Evolutionary biopolitics

Wahlke's main objective in seeking to overcome our biobehavioural illiteracy is to make it possible for us to formulate 'more important, interesting, and fundamental questions about people's behavior in political contexts' (Wahlke, 1977: 6). To achieve that objective, Wahlke sees the sciences of evolutionary biology and ethology, as well as physiology, psychochemistry, psychopharmacology endocrinology and behaviourist psychology, as supportive of a redirection of research effort. By drawing upon these disciplines we may gain a 'depth and breadth of perspective which should ultimately drive us back to more fundamental macro-level concerns and base-line hypotheses, and make us formulate these more explicitly and carefully than has so far been the case in political science' (Wahlke, 1977: 7).

With respect to the former group of disciplines (those we have associated with evolutionary biopolitics), he argues that their concern with the organised (social) behaviour of animal life leads us to reconsider such basic questions as whether man is by nature a social (political) animal. As well, ethologists are fundamentally concerned with the identification of morphologies of behaviour; the behavioural equivalent of anatomy. In particular, sociobiologists are interested in those 'preprogrammed patterns of behavior which every individual of the species will manifest in essentially the same way under similar circumstances or in response to similar stimuli' (Wahlke, 1977: 8). This, of course, refers to the critical distinction between instinctual (preprogrammed) and learned behaviour. And the attribution of cause to instinct is the issue that most often arouses critics of Sociobiology who raise cries of genetic determinism. Since we cannot consider this issue in detail, we will only note that Barash and Masters have dealt at length with the variability of genotypic influence among living organisms. Suffice it to say that culture (environment), the capacity for complex communication, through language, and related factors clearly make explanations of human behaviour more difficult and require that consideration be given to multiple causal factors.

The interesting question for the proponent of biopolitics is whether there may be similar patterns of behaviour associated with the formation and maintenance of polities. To investigate that possibility from an evolutionary, ethological perspective would bring us back to a whole series of macro-level questions concerning the collective existence of man. For instance, what are the behavioural dynamics underlying the aggregation of people into particular

political communities such as city-states here, nation-states there, feudal networks some times, monolithic authoritarian, centralised bodies another? How versatile and malleable are human beings in their capacity to organise themselves into political communities? Are there limits to the size of such groupings, or to the principles men devise to define membership or exclusion from them? What changes in behaviour accompany transformations in the variety or extent of polities over time? (Wahlke, 1977: 8).

Roger Masters (1989), for one, has taken the lead in relating biopolitical research to many of the traditional concerns of political inquiry (for example, origins of the state, social contract, natural right, obligation and conflict). He has drawn primarily upon the findings of ethologists and sociobiologists set in the context of evolutionary theory. Sociobiology, with its central concern with such behaviours as aggression and altruism (co-operation), offers a new way of conceiving of the matrix of man and environment - an evolutionary perspective that is concerned with ultimate causation. It must be noted, however, that socio-biologists are not of one mind with respect to the question of levels of analysis. Sociobiologists have offered different explanations of these patterns of behaviour, some of which treat the individual as the base unit of evolution and some of which support the idea of group selection (see Losco, 1996). It is this position that Master's criticises in the work of Trivers, pointing out the latter's failure to treat populations, species and gene pools as units of evolution as well.

Both Masters and Barash recommend an approach that combines individual and population levels of analysis to explain patterns of behaviour. In an important critique of sociobiological research, Masters relates the tendency of some sociobiologists (for example, Trivers) to deny autonomous status to social systems for the reason that 'natural selection is said to operate at the level of 'individual reproductive success', and only at this level,' to a mode of analysis that is familiar to the political scientist.

This mode of analysis is not new in the West. On the contrary, it can be traced to the beginning of Western political philosophy and recurs wherever social contract theories have been formulated to account for human politics. Like the pre-Socratics, not to mention the tradition of Hobbes, Locke and Spinoza, recent sociobiologists account for co-operative behaviour - and especially for altruism - in terms of the long range or rational advantage of individual partici-pants. And like such social contract theories, the concept of 'inclusive fitness' leads one to treat selfishness as a natural given, only transcended when the circumstances make it profitable to do so (Masters, n.d.: 4; see also Masters, 1989).

While praising the usefulness of inclusive fitness theory to provide counter-intuitive hypotheses subject to empirical testing (for example, explanations of altruistic behaviour) that relate to well known political views (for example, 'Rousseau, Kant, and Rawls' explanations of how 'social co-operation, ethical restraint, and self-sacrifice can follow from a rational analysis of long range self-interest'), Masters rejects the exaggerated claims (when made) that 'inclusive fitness theory will permit the discovery of genetic causes for all manner of

human behaviour, that Sociobiology points to a deterministic or causal theory of politics, or that this mode of analysis is the only way of approaching the subject' (Masters, n.d.: 8, 12). As discussed much earlier, the difference between proximate and ultimate causation is an important consideration. Moreover, for reasons of complexity of life forms, contemporary biologists have all but rejected total reductionism as a research programme. This is a conclusion that political scientists might be well advised to accept.

Other sociobiologists have offered different explanations of altruistic and other behaviours than inclusive fitness theory based upon considerations of environmental variability, the gene pool as a system and the sheer complexity of survival enhancing behaviour. In sum, there are more relevant independent variables to be considered than inclusive fitness theory can account for. Continuing the parallel with the Western tradition of political thought, Masters concludes that the employment of inclusive fitness theory represents an individualistic mode of thought whereas its critics' alternative explanations constitute a more sociological group approach. Both are needed. 'In the tradition of Western political thought, this means a willingness to take seriously the individualism of the pre-Socratics and Hobbes as well as the group orientation of Plato and Hegel' (Masters, n.d.: 37).

Heinz Eulau and Susan Zlomke (1995) have offered an extensive review of Masters' model of 'Human Behaviour as a Biological Phenomenon' (see figure 1.3 in chapter 1). In that critical review they summarise:

> At issue really is the question whether this vision of 'living systems' is at loggerheads with a sophisticated view of modern physical sciences that assumes probability, multi-causality and two-way interaction, and for which statistics now provides the necessary theoretical and methodological tools. We think that there is no conflict. The trouble is that the debate over reductionism versus antireductionism has long been carried on in terms of vague notions of something called 'holism' that not only denied any kind of causal analysis but elevated this denial into a principle of 'wholeness' asserting that the whole 'is more than the sum' of its parts. To the contrary, we believe that Masters' biologically inspired model, if properly reconstructed, can in fact accommodate multi-causal or some mode of two-way functional analysis.
>
> (Eulau and Zlomke, 1995: 193)

We concur with Masters' (1995) response, particularly his observations about the need for a paradigm shift and the difficulties communicating across paradigms (see Hines, 1982a). It is this, he argues, that makes it difficult for Eulau and Zlomke to comprehend his position on some of the issues where there appears to be a case of being at loggerheads with the 'behavioural persuasion' advocated by Eulau. But we agree with Eulau and Zlomke that absolute clarity on these important issues of physical levels of reality (ontology) and levels of analysis (epistemology and methodology) is essential. Our lengthy discussion of methodological individualism and methodological holism attempts to locate this debate

in the larger context of philosophy of social science debates. The bottom line is that a life science informed biopolitics champions multi-causal and multi-level inquiry. Nothing less will do if we are to provide adequate explanations of human political behaviour. Argument by analogy is legitimate, but it is quite different than argument by homology. The issue of reductionism, as we hopefully have made clear, is an issue that generates more heat than light. The exchange between Eulau/Zlomke and Masters exemplifies that problem. The reconstruction of Masters' model called for by Eulau and Zlomke is best achieved through empirical research where multi-methods are employed to study complex patterns of political behaviour at a variety of levels of both reality and analysis. Biologists and social scientists will continue to debate the issues of whether there are 'societal facts' and 'societal laws' (to use Mandelbaum's expressions). Theoretical biopolitics includes research into all levels of Masters' model.

Applying multi-methods to biopolitical research

In this section we will briefly review several examples of the wide variety of research being done by proponents of biopolitics. Hopefully these examples will convince the reader of the real value of employing a multi-causal, multi-method strategy that uses theories, concepts and methods drawn from the life sciences and from mainstream social and behavioural science research. The most thorough and up-to-date collection of empirical research in biopolitics is provided in the recent volume edited by Somit and Peterson (1996). In particular, the contributions by Barner-Barry (1996), Salter (1996), Masters and Way (1996), Schubert (1996) and Kitchin and Peterson (1996) demonstrate the applicability of methods derived from the life sciences for the study of political behaviour in natural settings. While this substantial body of research has not had a major impact on mainstream political science, the work constitutes a real challenge to the prevailing methods of the discipline and can only be ignored at the cost of having political science achieve the status of an empirically based social science. We cannot understate the importance of conducting the study of human political behaviour in naturalistic settings as a way of advancing our knowledge of political behaviour. Let us now turn to a brief examination of several of these research projects. More of these findings are discussed in chapters 5 and 6.

Wiegele, Schubert and Hines (1986), with funding from NIH's National Institute on Aging, undertook a comparative study of the effects of age (an individual property) and age structure (a group level characteristic) on political decision-making in local councils in three states (New York, Illinois and South Carolina). The study sought to test several hypotheses related to the degree of influence exerted by older members of local councils and to determine if older councils (i.e. gerontocratic councils) functioned differently than mixed-age and younger councils.

This multi-method study sought to employ research methods that have been developed by ethologists studying animal behaviour in the field and sociograms used by sociologists to study influence in-groups. Drawing upon studies by

ethologists of dominance structures, they sought to find how influential elderly members of councils were and whether the age structure of the councils had an effect on the behaviour and the influence of elderly council members. Through direct observation of the behaviour of councils over a period of one calendar year, data was collected and analysed. The research team observed more than 250 meetings of local councils totalling 500 hours of direct observation time. Audio tape recorders, pocket computers programmed as event data recorders and extensive field notes were used to collect data. In addition, interviews were conducted with council members.

Schubert, Wiegele and Hines (1987) have summarised their findings as follows:

> Findings show that old age was associated with greater participation in the group by actors and greater responsiveness by the group toward actors; while with regard to relative age, younger members received higher responsiveness from groups and participated at grand mean levels. Overall, being old was associated with status and involvement in small-group political interactions, but the ascriptive prerogatives of older age did not close out the opportunities for achievements by the relatively young.

The researchers also found that older groups proceeded more cautiously and more informally than did younger groups. The more homogeneous the groups (younger or older), the more combative or agonistic the leadership style, but the leadership style was also less oppositional. A particularly important finding that relates individual characteristics and group properties was the following: 'We found that chronological age has important, but far from determinative effects on power.' Apart from its contribution to role, seniority and status, elderly age appears to define a special status of social position within groups that might be utilised as a basis for the exercise of influence. 'This effect, which appears to hold for elderly members, regardless of young, mixed, or old age structures in their councils, is critical for the emergence of effective gerontocracies within aging political institutions' (Schubert, Wiegele and Hines, 1986: xvi).

This research exemplifies the ways in which political scientists can deal with research hypotheses that invite the use of a wide range of empirical research methods, including those outside the mainstream of political science, but familiar to practitioners working within human ethology and primate studies. In addition, the study shows the potential for moving from the level of the individual to the level of the group and for including developmental properties (i.e. age) in explaining political behaviour (influence and deference in local councils). Incidentally, the one purely gerontocratic town council, located in South Carolina, scheduled its meetings at 9:00 in the morning rather than the customary evening meeting so that the elderly members of council could be fresh and alert to perform their civic duties - an adaptation that reflected their own recognition of the effects of ageing on their decision-making capacity as a group and as individuals.

Roger Masters and several colleagues at Dartmouth College studied the effect of the facial displays by candidates on voters' perceptions of the candidates. In a series of studies 'conceived in the light of social psychology, human ethology and cognitive neuroscience, these experiments explore the interaction of emotion and cognition in viewers' responses to televised images of politicians' (Masters and Way, 1996:62). They found that voters respond positively or negatively to certain facial displays by candidates.

> Our findings show that display behavior is potentially of great importance in leader-follower relationships, but that the effects are extremely complex. Viewers accurately distinguish the different types of display: average ratings of excerpts showing happiness/reassurance, anger/threat, fear/evasion, or neutral cues consistently show significant differences, with the scales congruent to the type of display rated higher than other descriptive categories. When rivals are shown during a single experiment, particularly at election time, descriptions are correlated with the viewer's established political attitudes. Even then, however, objectively defined differences in nonverbal behavior are clearly perceived by the average citizen.
>
> (Masters and Way, 1996: 64)

This pattern of voter responsiveness held from the American context to the French context, thus presenting the possibility of cumulative comparative research:

> Broadly speaking, happiness/reassurance elicits positive feelings (and can reduce negative ones), whereas fear/evasion is most likely to produce negative feelings in viewers. Patterns of response to anger/threat are intermediate: while there was no significant difference between the positive feelings during happiness/reassurance and anger/threat in our French study, Americans felt similarly when watching anger/threat and fear/evasion, each of which elicits less positive and more negative feeling than happy/reassuring excerpts.
>
> (Masters and Way, 1996: 65)

This research, conducted over more than a decade, has shown the applicability of ethological research methods, derived from an evolutionary perspective, for the study of political behaviour. Using ethological methods for the direct observation of physical behaviour and the construct of attention structure, Masters and others have consistently observed that humans respond to visual images of an agonistic or hedonistic nature in ways similar to the patterns discovered in the study of primate social (political) behaviour. Their research also takes into consideration a large number of other contextual variables that contribute to 'the system by which nonverbal cues communicate feelings and potentially modify attitudes' (Masters and Way, 1996: 66). A sampling of those variables includes channel of communication, performance style of the leader, viewer's

pre-test attitude to the leader, party, ideology, and other opinions, gender, culture, socio-economic status and ethnic background. These significant studies, conducted over time show how multiple methods of analysis, including experimental methods, grounded in biopolitical theory can broaden our understanding of human political behaviour. The authors' conclusion bears repeating:

> The fact that nonverbal behavior can produce emotions that unconsciously change voters' minds - combined with the ability of crafty media experts to select images - should give us pause. If our political system is to be reformed, it should be in the direction of increased focus on the verbal content of parties, platforms and candidates' speeches. Paradoxically, it is experimental research in biopolitics that shows us most clearly the danger that human language and reason will be overshadowed by feelings elicited by nonverbal cues we share with nonhuman primates.
>
> (Masters and Way, 1996: 89)

A number of other significant studies have been undertaken to show how verbal behaviour (political speech) can be analysed. For example, Schubert (1996) has done a thorough analysis of Clinton's inaugural address and he collaborated in a study on the role of oral argument in the United States Supreme Court decision-making (Schubert, Peterson, Schubert and Wasby, 1992). These studies show the 'significance of examining nonlinguistic, as well as linguistic aspects of political speeches' (Schubert, 1996: 114). Kitchin and Peterson (1996) have developed a method for the remote assessment of political actors to ascertain how they think, thus adding 'cognitive style' to other measures of character and patterns of leadership behaviour. Finally, Salter (1996) provides a useful review of visual recording methods in biopolitics and summarises his own work in studying command giving in several Australian organisations (Salter, 1995). These studies show how varied the techniques are that are available for the study of political behaviour in naturalistic settings and through remote assessment. All are consistent in seeking to bring methods from ethology and other social and behavioural science disciplines to biopolitical inquiry.

Peterson and Somit (1994b: 36), in reviewing the research methods taken from the life sciences and applied to political research cite the following techniques that they find to be distinctive and valuable: linguistic/psycholinguistic analysis, physiological measurement (for example, circulating hormone levels), observation, psychophysiological/psychophysical technology, reaction time and non-verbal communication. Based on their review, they find that three of these methods in particular - observation, non-verbal communication and psychophysical/physiological measurement - have been used extensively (Peterson and Somit, 1994b: 42). We agree with Peterson and Somit that this promising beginning needs to be expanded considerably if an empirical demonstration of the value of biobehavioural research is to convince the discipline of political science of the value of these methods and the biobehavioural theory that supports their use.

Conclusion: from theoretical to applied biopolitics

For reasons, which may already be apparent, we believe that evolutionary biopolitics and applied biopolitics, though fraught with their own research problems, may well enjoy a brighter near future than biobehavioural inquiry in political science. For the present, the descriptive work (human ethology, human sociograms) associated with the first stages of sociobiological research and the employment of macro-level analysis of the sort exemplified by ecological analysis and by the 'survival indicators' work of Corning is far less threatening in its political implications and requires far less retooling than biobehavioural research. The problems involved in conducting experimental research on human subjects constitute a major obstacle and often a legitimate restraint on the biobehavioural research programme. Early hopes that this line of research would flourish, for example at the State University of New York at Stony Brook with Lodge and Tursky, were not realised. Nonetheless, this important component of a fully-developed biopolitics, as indicated by the significance of Masters' research described above, needs to be pursued.

This is not the place to undertake a thorough examination of the ethical issues involved in specific kinds of biobehavioural research. However, if political scientists are to be involved in experimental research with human subjects consistent with the techniques employed in the life science disciplines that provide the foundation for biobehavioural inquiry, then this subject must be fully aired. After all, it is no more acceptable to draw causal inferences from experimental research on animals than it is to assume, a priori, that patterns of social behaviour in animals are homologous with patterns of human social behaviour. These are matters of empirical investigation. Simple, deterministic, causal explanations, whether sociobiological or neurophysiological, despite their appeal will be detrimental to the objectives associated with the work in theoretical biopolitics discussed above, because such explanatory claims carry ominous political implications.

Unless the work in theoretical biopolitics is linked to the concerns of applied biopolitics we shall have only another fact-value controversy and biopolitics will not have overcome any of the disappointments of earlier behavioural political science or the criticisms of behaviouralism offered by post-behavioural critics. It is indeed time for a reconstruction of political theory, and biopolitics can, in our opinion, make a major contribution to that reconstruction through its thoroughgoing approach to human nature and its evolutionary foundations. At the same time, we recognise that these potential gains will never be realised unless the practical political and ethical issues surrounding this new approach to the study of political man are dealt with as seriously as issues of methodology and technique.

5 Biology and behaviour

Perhaps the one area where the evidence of biology's impact on politics is most conclusive and controversial is in political behaviour. Ironically, it is the one area where biological evidence has been suppressed because it conflicts with the dominant social science paradigms. Although acknowledgement of the biological foundations of behaviour need not negate the belief that environmental factors are also crucial to understanding human behaviour, the history of the debate is an acrimonious one with a tendency to coalesce into orthodox opposing camps. As a result, biological models of behaviour, even when seen as heavily moderated by environmental influences, are controversial in political science and in Western societies in general. For reasons discussed here, this intransigence against a more interactive model of behaviour becomes less tenable with each announcement of findings that link biology with behaviour.

Two decades ago in his presidential address to the American Political Science Association, John Wahlke argued that political science must surmount its biological illiteracy. As Charles Merriam had done two generations earlier, Wahlke called for integration of knowledge about human behaviour offered by the hard science behavioural disciplines as well as the softer brands of psychology. In light of recent advancements in knowledge about how the human organism works coming from neuroscience, genetics and ethology, Wahlke's conclusions are even more appropriate today. Biobehavioural sciences must be seen as fundamental to the study of political behaviour. We must draw heavily on ethology and its vast knowledge of other species but also look at species characteristic, preprogrammed behavioural patterns unique to humans.

> This fact, which is still ignored by many psychologists, is quite simply that behavior patterns are just as conservatively and reliably characteristic of species as are the forms of bones, teeth, or any other bodily structures ... That behavior patterns have an evolution exactly like that of organs is a fact which entails the recognition of another: that they also have the same sort of heredity.
>
> (Lorenz, 1965: xii-xiii)

Despite impressive work in the biological sciences, political science as a discipline resists the idea that political behaviour may have genetic or biological roots, because this admission challenges the assumption that humans are cultural, not biological, animals. For Wahlke, this refusal dodges the main issue that culture itself is an expression of human response to the physical and human environment (1979: 193). There is a failure to recognise the inseparable interdependence of the biological and the cultural. The result is the failure to distinguish between cases where (1) people are behaving in ways characteristic of all human organisms acting in similar circumstances and (2) their behaviour is best described as distinctly individual responses - for example, behaviour different from what might be expected from (1). Those who study political behaviour should apply ethological principles as working hypotheses and directives for research and stop arguing over nature/nurture, genetics/culture, etc. Elsewhere, Wahlke concludes: 'the rapid advance in knowledge across a broad range of biobehavioral sciences threatens to make political science obsolete if it does not impart such knowledge to its students' (1991a: 52).

As discussed in chapter 4, such a shift in emphasis will also require major methodological changes. Instead of relying almost exclusively on survey research and on individual self reporting of behaviour and attitudinal scales, methods are needed to observe actual behaviour, research techniques now the domain of ethologists. Verbal reports have been found to be poor reflections of actual behaviour. Wright, for instance, found no linkage between attitudes on political support and actual political support as measured by behaviour (1976).

Political behaviour is not simply a function of socialisation or conditioning and any research that fails to appreciate this is bound to fail. Actual political behaviour can be understood only in terms of tendencies, which are a legacy of our species' evolutionary past (Somit and Peterson, 1998: 569). As such, it is influenced by genetic and evolutionary factors as well as resulting physiological factors such as health status, nutrition, stress, overcrowding and so forth. As noted by David Easton:

> To the extent that genetic characteristics impose limits on the behavior of individuals, this may have implications for political life … Politically relevant traits cannot be neglected as part of the total environment in which a political system operates. The fact that political science tends to do so, does not, of course, reduce either their theoretical or empirical importance.
>
> (Easton, 1965: 72)

The focus of this chapter is on the genetic and neurological determinants of behaviour. It also examines the impact of health status, nutrition, disability, ill health and so forth, on political behaviour and leadership. In combination, it is argued that biology represents a critical factor in any explanation of behaviour, one that we neglect at great peril of misrepresenting the entire enterprise.

Although work on the biological foundations of political behaviour has lagged behind the study of behaviour in general and has not been systematic, a signifi-

cant literature has been produced in recent decades. Although methodological problems still plague this research area, for the reasons discussed in chapter 4, the major barriers continue to be political in nature. Under the paradigm shift outlined in this chapter, however, the field would be much more amenable to the inclusion of biological variables for political behaviour.

The genetic links to behaviour are increasingly apparent, largely the result of genetic research under the humane genome project. Although applications are yet limited, genetic diagnosis capabilities will provide us with an array of predictive tests, of varying reliability and preciseness, for susceptibilities to many personality and behavioural traits. Moreover, in the next decade gene therapy will likely emerge for many of these traits. As a result of this new genetic knowledge, and its applications in testing, diagnosis and therapy, the linkages between the genome and behaviour are again becoming matters of heated controversy (see Parens, 1997).

Ultimately, the controversy over behavioural genetics will focus on the brain, because it is through the neural system that genetic influences are manifested. Furthermore, the more we understand the functioning of the brain, the more we are led to the conclusion that we as individuals are limited by what our individual brains permit (see Appendix A for an overview of the rapid development in the study of the brain). This is not to be interpreted as suggesting that our brains determine behaviour, but rather that they mediate genetic and environmental influences. In the words of Roger Masters:

> The neurochemistry of behavior is not the same theory as genetic determinism. On the contrary, neurotransmitters like serotonin vary from one individual to another for many reasons, including the individual's life experience, social status and diet. Genes may influence neurochemistry. So do behavior, culture, and the social environment.
>
> (Masters, 1994: xiv)

Ultimately, however, the brain affects or mediates every action and thought of both political leaders and citizens. Our capacity for enjoyment, suffering and behaviour to some degree is inscribed in neurons and synapses. As a result our interpretation of the world, including the political and social dimensions, and our responses to it are dependent on the internal organisation of the brain. Therefore, in order to make sense of human behaviour we, by necessity, must understand the organisation and functioning of the system that controls or modulates it, the central nervous system.

More specifically, attention needs to be placed on neurotransmitters. Because they are the important communication links between neurons, they logically are the prime targets for explanations of behaviour, especially when they malfunction. Those neurotransmitters, which appear central to behaviour are dopamine which is crucial to the regulation of motor behaviour; serotonin which handles much of impulse transmission; norepinephrine which is involved in transmitting impulses to the autonomic nervous system, and gamma aminobutyrec acid

(GABA) which inhibits neurons from firing or sending impulses. Understanding of these neurotransmitters (as well as epinephrine, glycine, glutamic acids and the endorphins) is likely to provide a better appreciation of the role of the brain in human emotion and behaviour.

The findings of neuroscience, then, require a model, which acknowledges that the brain has a major role in explaining behaviour. As noted by Changeux:

> The development of the neurosciences has brought another way of looking at behaviour ... The neuronal content of the black box can no longer be ignored. On the contrary, all forms of behavior mobilize distinct sets of nerve cells, and is at their level that the final explanation of behavior must be sought.
>
> (Changeux, 1997: 97)

Although it is debatable as to whether we will ever be able to describe a particular behaviour in terms of specific neuronal activity (we doubt it), it is crucial that this neural dimension be an integral part of any respectable paradigm of behaviour. To ignore the role of the brain is no longer possible in light of what we now know even in the rather primitive stages of neuroscience.

Current behavioural science theory, especially, will have to be qualified by neuroscience findings. Although uncomfortable to many behavioural scientists, new knowledge of the brain must be incorporated if the behavioural sciences are to retain credibility as science. 'Even now the new developments in the biochemistry of the brain and in psychopharmacology demand attention by social scientists, if only at the public policy level' (White, 1992: 16). Although inclusion of the biological sciences in the social sciences is by no way an original theme (see Wiegele, 1979a; Blank, Caldwell, Wiegele and Zilinskas, 1998), dramatic advances in the neurosciences over the past decade make it more imperative.

The rapid development of cognitive science along with behavioural genetics has already led to significant alterations in psychological theories of abnormal behaviour. 'Perhaps the greatest source of optimism and excitement in the field of abnormal psychology in the last twenty-five years has been the tremendous advance in the study of the biological bases of behavior' (Bootzin *et al.* 1993: 88). This enthusiasm, however, has not generally extended to the social sciences, particularly political science.

As critical as it is that a neuroscience dimension be incorporated into explanatory models of behaviour, this does not mean that conventional factors be neglected. In criticising behavioural genetics, Parens notes that 'as long as our society seeks simple explanations for phenomena as complex as the differences between individuals and groups, danger looms' (1997: 17). While this means that the biological bases of behaviour, both genetic and neuronal, should not be viewed as deterministic forces, any model that minimises their cumulative impact is not only simplistic, but also deceptive. Cory (1999) argues that neuroscience should be considered the bridge between the natural and the social sciences. This does not require a reductionist programme that shrinks all social science to

fit the terms of biology, but rather one which serves to establish anchors and linkages through which the social sciences can introduce entirely new variables from their unique perspectives and levels of analysis.

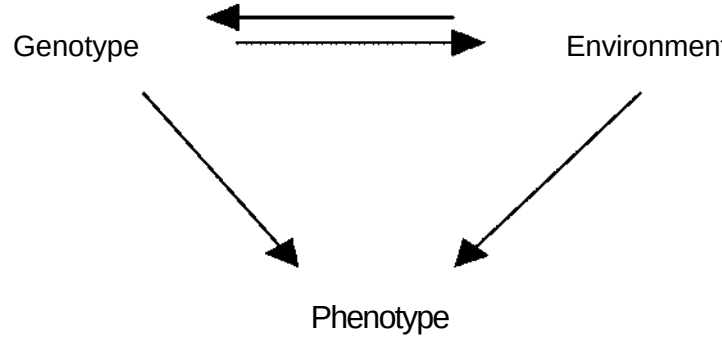
As discussed in chapter 1, biological models of behaviour, even when heavily moderated by environmental influences, will always be controversial in Western societies. They challenge the foundational concepts of democracy: equality, individual freedom and free will. They also suggest that social change will not necessarily lead to desired changes in behaviour.

The interactive brain model

Despite lingering debate at the extremes by adherents of either genetic or environmental deterministic models of human behaviour, in general most observers agree that some combination of nature and nurture are crucial. Often the disagreement centres on the proportional contribution of each factor, for example, what per cent of variation can be explained by genetics and what by environment. In most cases, these positions fail to appreciate the dynamic, interactive nature of the genetic/environment relationship in their quest to explain the influence in either/or terms. This neglect becomes even more obvious when the brain is put into the equation.

The interactive model (Figure 5.1) holds that the genes and the environment are reciprocally related and therefore can influence one another over time. More importantly, both the genotype and the environment act to produce a specific phenotypic expression that defines the individual. Although this joint action serves to explain individual variation, it is not possible legitimately to generalise individual variation to population differences despite sexual, racial and ethnic patterns in genotype and social environment.

While this interactive model places nature and nurture in perspective, it fails to incorporate what we argue here is the critical linkage factor, the brain. Even identical twins are unique individuals as a result of environmental influence mediated by the brain. Although maternal twins hold all genes in common, and in some cases have frighteningly similar lives, the details of their neural connections are individually unique. In order to explain behaviour or capabilities, one cannot minimise the role of the brain or view it as an empty organism.



Figure, 5.1 Interactive model of behaviour

Elliott White (1992) provides an excellent discussion of this problem in political science. He argues that new insights in neurobiology must be considered as an end to the notion of the empty organism because 'the direct and significant impact of the brain on our emotions, intellect, and behavior has already been conclusively demonstrated in a number of ways' (1992: 35). White argues that while a 'systematic synthesis of the subject matters of the neurosciences and social sciences seems premature', clear evidence of the central role of the brain in accounting for human thought and action 'dictates that this role be fully acknowledged within the social sciences' (1992: 19).

In his critique of rational choice theory and contemporary studies of voting behaviour, John Wahlke contends that they still rely on the classic 'black-box' model of behavioural psychology (1991a: 179). According to Wahlke, this model (see Figure 5.2) is concerned only with functional relationships between observed stimuli and observed responses and not with 'how' the connections are made so as to produce the responses. He goes on to recommend steps that can be taken to conduct experimental research, which attempts to fill in the black box and incorporate biological variables.

What both Wahlke and White are calling for is not a deterministic model of behaviour, but models that include the full range of factors that can help explain political behaviour. They want to see efforts that make use of knowledge from the life sciences to begin to fill the empty organism and illuminate the black box.

According to an expanded interactive model (Figure 5.3), the brain is the key mediator of both genetics and the environment for the individual. Brain chemistry increasingly is being found as critical to our understanding of behavioural patterns, personality, and a range of individual capabilities. Neuroscience, therefore, offers an indispensable tool by which to explain why we are what we are and how we might make improvements on what we are. The brain provides a focus for analysing the rich combination of genetic, environmental, and ultimately neural factors that define what we are. Unlocking the secrets of the brain is the key to explain not only why we differ from other species but also to understanding variation among humans.

Conversely, any study of the brain's structure, function and role without consideration of the genetic bases and environmental influences that shape its attributes would be remiss. As noted earlier, the brain requires constant stimula-

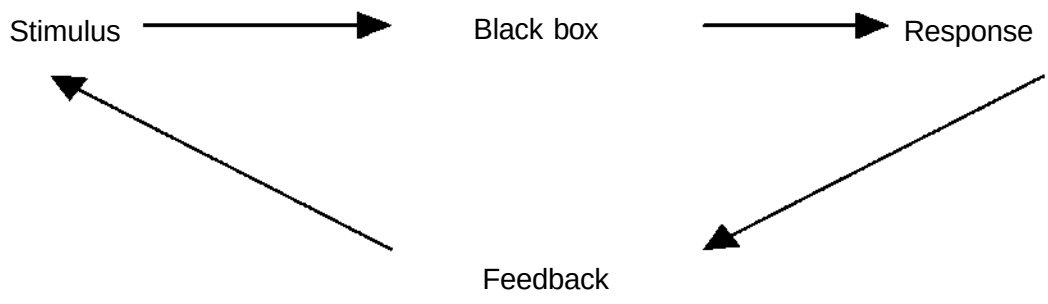


Figure 5.2 Black box model of behaviour

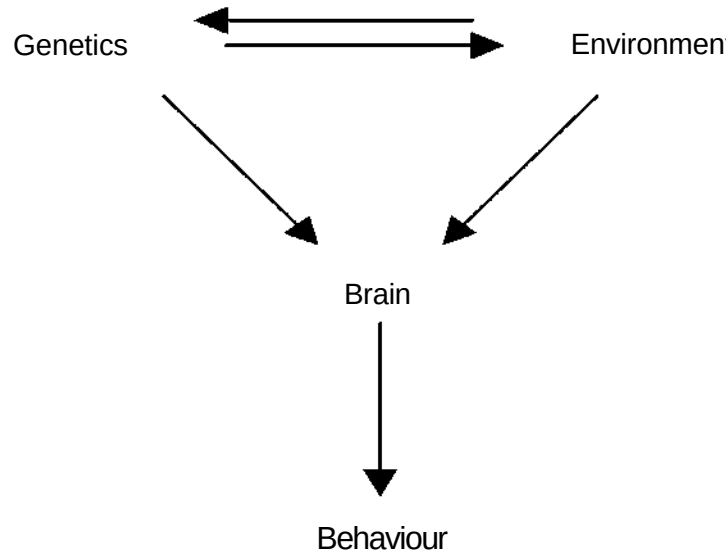


Figure 5.3 Interactive brain model of behaviour

tion by the environment in order to develop. Without sensory input and intellectual challenges of a positive nature full potential cannot be approached. Studies of infants increasingly demonstrate that the plasticity of the developing brain is remarkable, but that in the end without either adequate genetic grounding or environmental stimulation its growth will be constrained. Thus, while the brain is the great mediator it too is dependent on the genotype of the individual and the environment within which the individual operates.

Ironically, just at the time when we are beginning to understand through neuroscience the full importance of the brain for human thought, capacity and behaviour, forces are at work to negate or at least weaken such claims. Criticisms of reductionism, of a chemical-based form of eugenics, are becoming increasingly vocal and vehement. Neuroscience, it is argued, threatens to unleash forces that shift social responsibility to individuals and that threaten institutions based on the environmental model. Moreover, others fear that neuroscience and cognitive research too easily dismiss the mind as nothing but chemical-electrical impulses and thus dehumanise or somehow demystify humanhood. With these high stakes, neuroscience and the brain-centred model will continue to elicit intense controversy in the coming decade.

The modular brain

According to holistic theories postulated by Descartes and many others, there is at some level a master site within the brain where all the separate components converge. This notion of a master control site, although intuitively attractive because it represents the T as a single entity, is not supported by our knowledge of how the brain operates. The brain does not, and in fact is incapable of, acting as a single integrated whole. Instead, very specific functions of the brain are highly localised, and these localised units (often termed modules) are linked

together in a complex structure. For example, the neurons that allow our vision to differentiate straight lines differ from those that delineate curves.

The modular brain theory, however, transcends simple localisation of function. What is most remarkable is that despite the division of labour, the brain has evolved structures that link these components together in predictable ways. Although specific functions are localised, all neurons and nuclei communicate with other modules. Multiple connections all operate simultaneously in parallel. This means that there is no cortical terminus, no master site or seat of consciousness. No one area holds sway over all others. All the separate modules do not report to a single executive centre. For instance, while there is no one emotion centre, the genesis and expression of emotions takes place in a constellation of groups of neurons, or modules, or what Changeux terms 'integration foci' (1997: 21).

There are several areas where strong evidence supporting the modular theory has been uncovered. One of the most studied is language where it has been found that the brain processes language by means of three interacting sets of structures. First, a large collection of nuclei in both the right and left cerebral hemispheres represents conceptual, symbolic interactions with the environment, mediated by sensory and motor systems. These functions categorise and organise objects, events and relationships. Second, a smaller number of nuclei generally located in the left hemisphere represent individual sound units and syntactic rules for combining words. Finally, a third set of neural systems mediates between the first two. This set can 'take a concept and stimulate the production of word-forms, or it can receive words and cause the brain to evoke the corresponding concepts' (Damasio and Damasio, 1992: 89). Moreover, spoken and written comprehension are centred in separate areas of the brain, with knowledge organised to include all modules operating simultaneously.

The fact that performance of simple functions is localised does not, however, negate the possibility that overall strategies for performing an integrative operation cannot be effectuated by combining different simple functions. Kosslyn and Koenig distinguish an integrative function (for example, language) from the simpler component functions in arguing that we can have it both ways. Some functions are localised, but the brain also works as a whole to produced integrated functions that are not localised. The tasks of research, then, are to characterise what the functions are, which parts of the brain carry each one out, and how the functions work together (Kosslyn and Koenig, 1992: 12).

Studies of memory also strongly reflect the modified modular theory of the brain. There is conclusive evidence that memory is not a single entity, but rather a process comprised of many essential components. Memory cannot be found in any single structure or location in the brain, though its components have been localised with increasing preciseness. There are many different dimensions and channels of memory storage that have been isolated. First, there are two separate channels of memory storage centred in different parts of the brain. Specific recall is centred in the temporal lobe and its connections to the limbic system. In contrast, habit formation, through which we remember how to perform skills is a

more diffuse system located primarily in the striatum. There is also evidence that the hippocampal system is involved in episodic memory, that over time (weeks or months) it transfers to the neo-cortex (Kandel and Hawkins, 1992).

In addition, there is a complementary relationship between two types of memory. Associative memory acquires facts and figures and holds them in long-term storage. However, such knowledge is of no value unless it can be brought to the forefront by working memory, itself a combination of different types of short-term memory. Working memory allows for short-term activation and storage of symbolic information and permits manipulation of that information (Goldman-Rakic, 1992: 11). Working memory is the basic element in language, learning, thinking and behaviour. There is evidence that it is carried out in the prefrontal lobes, which also perform executive functions such as problem-solving, planning and organising, which require working memory.

Closely related to memory is the function of reason or thought. Kosslyn and Koenig (1992) see reason as the best example of an integrative function. Like memory, reason requires the orchestration of many component processes. In addition to memory subsystems, reasoning incorporates a host of processing subsystems including perceptual encoding, imagery subsystems, action subsystems and perceptual input subsystems. Also, like memory the reasoning process assumes the presence of a decision system that co-ordinates all the others so that a specific goal can be met.

Consciousness

Perhaps the most mysterious aspect of the mind is consciousness or self-awareness, which can take many forms from experiencing pain to planning for the future. Often the mind has been equated with consciousness, that which makes a human a human. Consciousness provides us with the continuity of our selfhood across our life. We are not only conscious of things but also conscious about our feelings about them. We can even be conscious of our own feeling of being conscious about something (regress). Harth terms consciousness the 'most challenging phenomenon exhibited by the brain' (1993: 133). But what is consciousness; a state of the mind or the activity of neurons?

Neuroscience research, as in other areas, has undermined traditional ideas about the unity or indissolubility of our mental life. Consciousness makes it appear that a single individual is the recipient of all sensations, perceptions, feelings and the originator of all thoughts, but, according to Daniel Dennett and others, this apparent unity of the I and its self-awareness is largely an illusion. For Erich Harth 'There is in the brain no single stage on which the multiple events picked up by our senses are displayed together' (1993: 133). Rather, consciousness is a process, a kind of global regulatory system dealing with mental objects and computations using those objects.

Most operations of the brain take place outside our conscious awareness (see Marcus *et al.,* 1998, linking neuroscience to political intolerance and judgement). They, instead, are carried out by a combination of genetic instructions and

learned reactions to sensory inputs. We remain unconscious of most of our brain's activity. In fact full awareness would be an impediment to our functioning. Restak (1994a: 129) notes that while the unconscious brain comes closest to a materialist's image of an intricate, thoroughly deterministic machine, the conscious brain is very different. At the highest levels of consciousness we experience a self-conscious controller who wills, remembers, decides and feels emotion.

Although there appears to be little argument with the assumption that consciousness requires brain activity, there remains disagreement as to whether we can ever explain consciousness solely by the workings of the brain. According to Scott, for instance, consciousness is a real, 'awesomely complex phenomenon' that cannot be reduced to some fundamental theory or a simple biological or chemical reaction (1995: 159). Similarly, while Churchland concludes that the state of consciousness is primarily a biological phenomenon, the contents of consciousness are 'profoundly influenced' by the social environment (1995: 269).

Churchland's distinction between a state and content appears to be supported by neurological evidence. It has been discovered that while the content of consciousness, as with memory, is found in the cerebral cortex, the maintenance and regulation of a conscious state is centred in the reticular formation region of the midbrain which serves as an activation system for wakefulness. Because consciousness cannot occur without wakefulness, it is dependent on the activity of one of the most primal parts of the brain. However, since consciousness also requires content and a relationship to that content, it is always the product of interrelated activity of the neo-cortex and the reticular activating system, thus again manifesting the modular brain in action (Restak, 1994: 126).

Consciousness then is a unique property of the brain that is effectuated by a large number of interacting neural assemblies operating in parallel. Consciousness is inextricably tied to memory, reliant on attention activating functions, and interconnected with sensory regions of the brain. Although we cannot substitute a description of physical brain events for consciousness, it does arise only through the joint activity of billions of neurons organised in assemblies or mental objects. For Restak, this evidence demonstrates that 'Consciousness, thought, memory, will, emotion - none of these has any independent outside reality other than in the context of the human brain. All are based on the brain's organization' (1994: 13).

Before the death knell is sounded for dualism, however, it is important to note that there has not been a decisive resolution of the mind-brain question. Even if the mind is the expression of the activity of the brain and the two are in actuality inseparable, this does not mean that it is useless to separate them for analytical purposes. While mental phenomena arise from the brain, mental experience also affects the brain as demonstrated by many examples of environmental influences on brain plasticity (Andreasen, 1997: 1586). Scott concludes that it is not necessary to choose between materialism and dualism. Both can be accepted with certain reservations. For Scott: 'We must construct consciousness from the relevant physics *and* biochemistry *and* electrophysiology *and* neuronal

assemblies *and* cultural configurations *and* mental states that science cannot yet explain' (1995: 159-60).

The more neuroscience explains how the brain works, the more difficult will be the task of the dualists who demand an immaterial mind. With the rapid developments in our understanding of the mechanics of the brain, themselves the products of the imagination of human minds, consciousness will lose some of the mystery that has surrounded it since at least the time of Plato. Although this is viewed as a threat by those who believe that we lose something special and private when we debunk the mind as separate from the brain, their fear of this shift to a modified materialism is probably premature. No matter how much we advance in neuroscience, it is unlikely the debate will disappear.

Similarly, despite activities in artificial intelligence, information theory and cognitive science that would reduce the mind to the workings of the computer, it is improbable that the mysteries of the human mind will be explained or replicated by even the most sophisticated computers imagined by the minds of humans. In the words of Jonathan Miller: 'Consciousness may be implemented by neurobiological processes - how else? - but the language of neurobiology does not and cannot convey what it's *like* to be conscious' (1992: 180). The philosophical debate surrounding the mind-brain relationship and human consciousness will not abate in spite of growing evidence of the importance of physiochemical factors for behaviour.

The genetic-brain connection

Given the complexity of the workings of the brain as compared to the human genome, it is clear that no simple one-to-one relationship exists between them. It is estimated that the human genome contains approximately 40,000 genes, many of which are common to many species. Even the differential expression of all 40,000 genes, however, would fail to explain the extreme diversity of neuronal connections and the vast range of human behaviour. This fact does not negate the significant role that genes play in determining the boundaries and framework of the functioning brain. As noted by Changeux, a relatively small number of genes are sufficient to control the division, migration and differentiation of the neurons shaping the neo-cortex. The genes prescribe a template for neural functioning, but this template is completed by the environment and by the unique experience of each individual.

In addition to prescribing the generic template for the human species, genes provide the foundations for variation among individuals in terms of neural configuration and capacity. This impact is most obvious when dysfunctions occur due to deleterious genes or chromosomal abnormalities, as found for instance in Tay Sachs disease or a fragile X chromosome. Discoveries from the Human Genome Project (HGP) are positing many such direct linkages between the genes and the brain and these are likely to accelerate in the coming years.

Many potential linkages between genes and behaviour are already the focus of considerable controversy such as the genetic bases of addiction, aggression and

risk taking personalities. Whatever findings emerge, however, ultimately the power of the genes will not be sufficient to explain the details of neuronal organisation, the precise form of every nerve cell, and the exact number and geometry of the synapses of any individual brain. If, however, the differential expression of genes is incapable of explaining the diversity and specificity of an individual's neural connections, what is?

One intriguing theory of the gene-brain linkage is that offered by Changeux. His 'epigenetic' theory of selective stabilisation is consistent with current knowledge of neuronal development and with our understanding of human genetic variability. Changeux contends that this epigenetic process does not require a modification of the genetic material because it acts not on a single cell but rather on a higher level of groups of nerve cells. He argues that the genetic 'envelop' opens to more individual variability as we move up the evolutionary chain to humans. Whereas in other animals most behaviour is genetically programmed, in humans it is not, thus opening human behaviour to other influences.

The theory of selective stabilisation assumes that the genetic influence is critical up to the point where the number of neurons peaks soon after birth. It is here that Changeux's model reverses what would be a more intuitive neuronal building process. What follows this point for Changeux is a growth process based on regression as some neurons in each category die due to redundancy and some of the terminal branches or axons and dendrites of surviving cells degenerate.

Changeux uses language acquisition and hemispheric lateralisation to support his theory. Learning a language is accompanied by a loss of perceptual capacity, by an attrition of spontaneous sounds and syllables (1997: 244). Similarly, he argues that at a certain critical moment, similar if not identical neuronal structures exist in both hemispheres, but that they are lost selectively on the right or left early in childhood. For Changeux: 'the word "growth" should thus be understood in the sense of the lengthening and branching of nerve fibers, which eventually connect the cell bodies to each other (and to their targets) after the cells are differentiated and in place' (1997: 212). Under this theory, to learn is to stabilise pre-existing synaptic combinations and eliminate the surplus. Therefore, activity can only be effective if the neurons and their basic connections already exist before the interaction with the outside world.

Whether the process of learning and growth is based on selective stabilisation as argued by Changeux or on the basis of the gradual building of new neural connections through life, the role of genetics is not deterministic either in terms of specific neural connections or behaviour. Despite these limits, genes do exert powerful influence on the brain and are critical to our understanding of how it works. Rapid advances in knowledge of molecular biology and applications of direct relevance to the brain are likely to complement similar developments in neuroscience. Although the genome cannot explain all the intricacies of the brain, we cannot explain them without a better understanding of genetics.

This move from diagnosis to therapy raises many policy issues regarding what role the government ought to play in encouraging or discouraging such research and application. It also raises ethical questions concerning parental responsibili-

ties to children, societal perceptions of children, the distribution of social benefits and the definition of what it means to be a human being.

In light of new genetic interventions in the brain, questions arise as to what constitutes a deficiency or disorder. This question is particularly poignant as linkages are found between protein levels and characteristics such as personality traits (Cloninger *et al.,* 1996), sexual orientation and aggression. As noted earlier, researchers have identified a gene (D4 dopamine receptor gene or D4DR) linked to novelty seeking or excitable personality (Bower, 1996) while another variant has been linked to neuroticism (Lesch *et al.,* 1996).

Moreover, while gene therapy is now focused on identifying specific genetic factors in neurological diseases or disorders, pressures for gene enhancement are likely to follow, particularly in the US with its competitive culture and faith in technological fixes. Like eugenics, the history of intervention in the brain is a controversial one. This controversy will intensify as associations are found between genetics and brain function, mental disorders, addictive behaviours and social deviance.

Research into genetics and the brain promises to accentuate the already acrimonious political debate over human nature, personal identity and equality. Traditionally, differences both in genetic complement and behaviour have tended to be defined as diseases, disorders and conditions to be treated. The way we as a society respond to these remarkable technological advances and the knowledge that spawns them depends to a large extent, therefore, on our conceptions of equality and inequality. There is historical evidence to suggest that the forces that embrace such findings as proof of inequality are strong. Commitment to the view that all humans are innately equal will face powerful challenges in ensuring that new knowledge is directed toward that end. This will be reflected at two levels: (1) should society pursue certain areas of research; and (2) under what conditions should individuals be encouraged or required to undergo the types of treatment being developed?

Health status

Human bodies and their functioning are an integral part of everyday life. A broad array of physiological factors has been studied, although systematic analysis has been lacking. Among those examined are height and weight, age at puberty, menstrual cycle, body image, brain structure and function, biorhythms and psycho-physiological arousal. There is substantial evidence that illness, poor health and disability can have profound effects on behaviour.

When illness strikes a person is less able to carry out his or her usual roles and is manifestly less able to engage in outside activities (Abeles and Ory, 1991: 178). As a result they adopt an illness role which defines appropriate behaviour for a person in that condition (Sanders, 1982). Adopting this role protects the person from criticism that he or she is not fulfilling normal expectations - as ill they are considered exempt from their normal obligations (Peterson, 1991: 45). Moreover, adoption of the illness role is associated with increased passivity, exemption from

carrying out normal social obligations and a reduction in social functioning. Increased social isolation, lessened social interaction, depression and lowered psychological well-being and sense of competence are also related to the illness role (Mechanic and Hansell, 1987).

Given that health status has direct and substantial effects on all aspects of a person's life, political behaviours at some level must be affected. One study of rural elderly, for instance, found that poor health is correlated with lower levels of political efficacy, interest and participation (Peterson, 1987). Other studies have found that poorer health is associated with depressed levels of participation and more negative and passive political views across a variety of populations including students, adults, members of Congress and federal appeals court judges (Schwartz, 1976). Hudson and Binstock surmised that the lowered political participation of the very elderly 'may be interpreted in terms of physical decline' (1976: 370).

Closely tied to health status are physical fitness and energy levels. The more physically fit a person is the healthier they are likely to be. Similarly, the healthier and more fit they are, the likelier they are to have higher energy levels. Unfortunately, the studies here have yielded inconclusive results, possibly due to methodological limitations. Most of these studies have relied on self-reports of fitness and energy level (Schwartz, 1970) or on crude measures such as a treadmill test (Wiegele *et al.,* 1975) and chest expansion (Booth and Welch, 1976). Sadly, the lack of significant funding appears to have discouraged more extensive and recent studies in these areas.

One of the few more contemporary studies on the impact of health status on political behaviour is that of Peterson (1990) based on three separate samples; a sample of rural elderly and two national samples (the 1982 and 1984 National Opinion Research Center (NORC) General Social Surveys). In addition to testing the health-behaviour relationship, Petersen also hypothesised that healthier people would be more conservative in terms of party identification, acceptance of more traditional values, lower support for government involvement in individual's lives and self-identified conservative identification. Moreover, he suggested that healthier people ought to be less alienated. Petersen hypothesised 'As health problems increase, political interest will decline, political efficacy will decline, political participation will decline, conservatism will decline, and alienation will increase' (1990: 86).

A health status index was created using two questions from the NORC surveys: (1) 'Would you say your own health, in general is excellent, good, fair, or poor?' and (2) 'How much satisfaction [do] you get from your health and physical condition [a very great deal, a great deal, quite a bit, a fair amount, some, a little, none]?' Although the correlation coefficients of health status with political behaviour were found to be in the predicted direction, overall they were modest. When controlled for age, sex, income and education, correlation coefficients were diminished, although the 'general patterns' held. Peterson concluded while health status is not the dominant factor in shaping people's political orientations, it does have 'an independent impact on a range of politically relevant variables'

and should no longer be excluded as a predictor of political orientations and behaviour (1990: 92).

Nutrition

As with health status, there is considerable research linking nutrition with behaviour and there is reason to believe that it affects political behaviour as well, despite the lack of substantial political research. There are several reasons to suspect this linkage. Dietary deficiencies are associated with heightened depression, lowered energy levels, apathy, irritability, impaired motor activity and diminished cognitive ability (see Johnson and Stout, 1999; Dreze *et al,* 1995). The 'net behavioral consequences of malnutrition are likely to be physical and mental lethargy' (Schubert, 1981: 8), which reduces self-esteem and the individual's ability to cope. Malnutrition can also cause temporary central nervous system deficits and diminished cognitive ability in adults and longer-term deficits in infants and young children (Smolin, 2000).

Petersen argues that poor nutrition also affects people through its role as a stress producer because it diverts their attention from broader concerns as they try to cope with their personal problems. Constant hunger and inadequate nutrition under certain circumstances can act as a frustration and lead to heightened aggressive behaviour, although comparative national research demonstrates this might be a transitional stage and is likely moderated by how repressive society is (Schubert, 1982).

The principal impacts of malnutrition on political behaviour are a function of lower energy levels, diminished mental and physical abilities, and apathy and depression. These biological effects lead in turn to decreased levels of political interest and activity. In a study of older Americans, Petersen (1987) found that poor nutrition is correlated with diminished political efficacy and participation. In his more extensive analysis, he again found that poor nutrition, as expected, is associated with lower levels of political efficacy, political interest and political participation. He also found it related to less conservative attitudes and more cynicism about politics. As with health status, the relationship between nutritional status and various political variables holds even when controlled for age, sex, income and education. While the impact of nutrition on behaviour is not huge, its non-recognition in the political behaviour literature is not warranted.

Health and nutritional status have clear political ramifications. Populations whose health and nutritional needs are unmet are less politicised, less likely to approve of the status quo and less efficacious. As such, poor health and nutrition help to maintain the powerlessness of the disadvantaged and reduce their potential for political effectiveness. With this knowledge it is possible that a regime could explicitly use biological oppression to pacify the masses. There is a real possibility that some unpopular regimes manipulate food supplies as a biochemical means of political control. This might take the form of active starvation of rebellious populations into passivity or through neglect. 'Hunger and poor health

can be used to try and keep the powerless powerless, the disenchanted disenfranchised' (Peterson, 1990: 104).

Biology, health and elite behaviour

If biology and health influence mass behaviour as suggested above, then it follows that the behaviour of leaders can also be in part the product of biological factors. Unlike with mass behaviour, public attention has at times focused on the impact of health on the behaviour of particular leaders and there has been a debate over whether persons with health problems should be elected. Most recently, in the US, questions over Bill Bradley's health in effect derailed his attempt to challenge Al Gore for the Democratic Party presidential nomination. Questions of mental health and disability are raised throughout political campaigns and candidates make every effort to demonstrate that they are physically and mentally fit for office.

Despite this public interest, however, few political scientists have shown interest in applying evidence from the life sciences to the study of leadership. Moreover, a biopolitical understanding of leadership itself must include analysis of how biological variables - evolutionary, genetic and neurological - influence the behaviour of individuals in positions of authority. According to Wiegele (1979A: 71), it is 'at the individual level that knowledge from the life sciences will have its greatest impact on our understanding of how political elites, *as human beings,* function in decision-making situations' [emphasis added].

This section looks first at the biopolitical work on how physiological conditions affect elite behaviour. Among the more likely factors are general health, physical or mental illness, stress, fatigue, alcohol, drugs and hormonal imbalance. A brief examination of research directed at the more difficult area of attempting to discover the biological foundations of elite behaviour then follows.

Health, disability and leaders

Unlike the general lack of awareness of the public regarding the impact of health factors on their own behaviour, there has frequently been widespread press coverage and public concern about this issue as applied to particular leaders, including most recently presidents Eisenhower, Nixon and Reagan, and, internationally, Boris Yeltsin. Elections have been influenced by revelations of purported health problems. For instance, Senator Thomas Eagleton was dropped as vice-presidential candidate from the Democratic Party ticket in 1972 after revelations of past mental health problems. Also, as noted above, Bill Bradley's quest for the Democratic Party nomination for President in 2000 effectively ended when it was disclosed he had heart problems, even though they were minor and unlikely to interfere physically with presidential duties. Also, historians have contemplated the extent to which health problems of figures such as Woodrow Wilson, Franklin Roosevelt, John Kennedy, Winston Churchill and Adolf Hitler, among others, might have influenced history.

The episodic and individual-centred nature of the interest in health and leaders, however, has not resulted in a systematic study of leadership from a biopolitical perspective. As is the case in much of biopolitics, the work here has largely been concentrated in a small group of highly competent but relatively isolated researchers. Political scientist Robert Robins and medical doctor Henry Rothschild have written seminal articles on disabilities of presidents (1981) and about the responsibilities of president's physicians (1988). Hugh L'Etang's work on the effect of drugs on political decision-making (1988) provides a good base for more in depth and systematic analysis and demonstrates through case studies of world leaders the troubling situations it raises. Such research is even more essential in light of the ever expanding range of psychotropic drugs available in the coming decades.

Other areas where scattered work has been done is on how alcohol abuse affects decision-making (Glad, 1988), how illness affects decision-making (Gilbert, 1988; Park, 1986 and 1988) and how dementia and ageing itself might influence the ability to make decisions. The disclosure of Ronald Reagan's Alzheimer's disease after leaving office has raised concerns over the extent to which this progressive disease affected his performance during his second term in office (Park, 1988).

Another area that has sparked some interest, but which needs more systematic analysis, is the impact of the public office on the officeholder. Few persons have not heard the statement that the presidency prematurely ages the occupant, and that presidents in general do seem to show the cumulative effects of a high stress job. But what scientific evidence is there? If so, is public office more or less stressful than corporate leadership? Are offices other than the national leader similarly stressful? Are persons who achieve high office more capable of adapting to a high stress environment on the basis of their biology? Are they somehow psychologically predisposed to seek out high stress positions? At what stage does stress adversely affect decision-making? What can and should be done to reduce the stress? None of these questions have been studied, although it is acknowledged we live in an increasingly stressful world in many ways. They also lead us into the second dimension of elite behaviour: are leaders biologically different from followers and, if so, how?

Biological bases of leadership

Based on what was said earlier in this chapter regarding the linkages between our evolutionary roots, our genes and our brains, it would be surprising if there was no biological influence on which persons in society seek to be leaders and ultimately achieve it. What specific traits it takes to be an effective leader of course depends heavily on the specific situation (it is generally understood that a person who might be a good president under one set of circumstances might be a disaster under different conditions) as well as learned skills. The debate over the appropriate mixture of natural and nurtured leadership capabilities has been with us at least since Plato posed this question in *The Republic,* but unfolding

understanding of neuroscience and genetics promises to support scientifically a strong natural base of leadership.

The literature and methods of ethology and related disciplines on dominance, authority and attention structure have significant contributions to make to the study of elite human behaviour and there has been considerable effort by a handful of researchers to apply these methods and perspectives. In her path-breaking work on authority among pre-school children, Carol Barner-Barry (1977) used two techniques borrowed from ethology, non-participant observation and event sampling (for an update on these methods see Barner-Barry, 1996). These techniques allowed her to examine asymmetric authority interactions among the children and thus identify those children who exercise authority and those who did not. She found that even at pre-school age, when adults are absent the authoritative children easily assume authoritative roles for the group for the purposes of interpreting and enforcing the rules. Authoritative children intervened in conflict by exhibiting threat displays similar to those among primate studies. Moreover, in most cases, only the authoritative children exhibited nurturing behaviour.

Elsewhere, in separate studies, Barner-Barry (1978) and Masters (1986b) utilised the concept of attention structure, manifested primarily through visual awareness. Attention here is operationalised by determining who is looking at whom and with what frequency. Overall, this research found that attention structures in stable groups of young children were quite similar to those exhibited in certain types of non-human primate groups. In his study of the emergence of leadership in young adults, Ivers found traditional explanations of elite socialisation insufficient. He concluded that 'more tightly focused ethological research in this area could have a profound impact on our understanding not only of leaders and their socialization, but also of the political socialization process more generally' (1997: 224).

Roger Masters has been instrumental in introducing a variety of experimental techniques, drawing on human ethology, social psychology and cognitive neuroscience, to the study of leadership. His work on non-verbal displays, trait attributions, emotion and cognition has done much to expand the study of leadership and political behaviour in general (see Masters and Way, 1996). According to Sullivan and Masters, the extension of a biopolitical approach in this area has a dual effect. First, it adds the dimension of non-verbal cues and emotion to 'the traditional focus on verbally expressed cognition that has long dominated political science,' and second, 'it permits a direct exploration of the way that species-specific nonverbal cues influence viewers' emotions' (Sullivan and Masters, 1994: 238). In another study, Masters and Sullivan provide cross-national findings on non-verbal behaviour and leadership (1989); see also related work in Masters and Sullivan (1993), Sullivan *et al.* (1994), Salter (1996) and Ivers (2000).

Other research related to leadership that make use of biopolitical approaches include Mazur and Mueller (1996), who examine how facial dominance might provide an advantage in ascendancy to leadership positions in a hierarchy. In a

major study discussed in detail in chapter 4, Schubert, Wiegele and Hines (1986, 1987) used a quasi-experimental field research design to study small group behaviour in twenty-four city councils in three American states. They observed over 250 meetings involving over 500 hours of direct observation of conversational behaviour in an effort to see the impact of age and age structure on political decision-making. They found age to be an important though not determinative factor. Older council members were much stronger in their performance than younger members and older groups tended to be more cautious. Elsewhere, Schubert used ethology-based techniques to study verbal, visual and vocal aspects of Bill Clinton's first inaugural address (1996). As with other researchers above, Schubert goes beyond what is said and focuses on voice quality and non-verbal cues.

Research into the biological bases of elite behaviour have also focused on birth order (Forbes, 1971), hemispheric dominance (Kitchen and Peterson, 1996), handedness (LaPonce, 1976) and energy levels (Wiegele *et al.* 1975). Kitchen (1986), for instance, analysed the language used by Richard Nixon and other Watergate figures to determine if they were reflecting left- or right-hemispheric processing. He found that the neurolinguistic patterns of Nixon, Haldeman and Erlichman were strikingly similar in their reliance on language that draws on right-hemispheric operations, while John Dean was more committed to left-hemispheric speech patterns. In their study of birth order, for instance, Somit, Arwine and Peterson (1996) reviewed a cross-national literature of nearly 2,000 publications on the birth order of leaders and concluded that there is no consistent significant relationship between birth order and leadership in Britain, the US or Soviet Union. Elsewhere (1997), however, they did find a definite first-born effect among female US federal judges.

Judges have also been the subjects of one of the most extensive attempts to bring ethological and biosocial research methods to the study of elite behaviour. Glendon Schubert's seminal work on the open deliberations of the Swiss Federal Tribunal (1985) paved the way for the oral argument project of the US Supreme Court, which led to numerous papers and articles by the co-investigators (see Schubert, 1997, for a description of these). Most observers of judicial behaviour focus on written briefs at the exclusion of oral arguments. Although this makes for easier analysis, according to members of the Court itself (Harlan, 1955), this exclusion is a mistake. The oral argument study was designed to be the first systematic study of the substance and process of US Supreme Court behaviour utilising acoustical as well as verbal record of the participant's speech. Schubert notes that non-verbal observation would have added significantly to our understanding of the dynamics of the process, but was not possible because of the Court prohibition on observers. With funding from the National Science Foundation, the project led to a wide range of publications (see Schubert, Peterson, Schubert and Wasby, 1992). Sixty-four conclusions that emerge collectively from these studies are found in Schubert (1997: 44-9).

Unfortunately, as with much elite-related behavioural research, despite intriguing their findings, there has been little follow-up to many of the above

studies. It is hoped that recent research on appearance effects in candidate appraisal (Schubert, Curran and Strungaru, 2000), sex and leadership (Masters and Carlotti, 1994; Balash, 1999; Ivers and Balash, 1999) and universals of command (Salter, 2000) will be followed by expanded research efforts. Replication of the studies in different contexts and extensions to related areas in order to build a systematic research base are essential.

One area which initially gained much academic and media attention in the 1980s centred on research findings which claimed to demonstrate that certain kinds of personalities appeared to be peculiarly disposed to seek out roles that result in high stress, because these roles are perceived as enhancing personal power. The simple Type A-Type B personality dichotomy presented at that time (see work of Madsen, 1985 and 1986) has not been sufficient to explain the wide range of variation in behavioural manifestations of leaders and followers (see Vatz and Weinberg, 1991). However, the assumption that the drive, ambition and aggressiveness needed to achieve high public office is tied to biological variables is strongly supported by research on the role of neurotransmitters (particularly serotonin) in explaining high-risk behaviours as well as genetic research on personality. From a decision-making standpoint, it might be asked whether persons with biological and psychological predispositions toward risk-taking and attaining positions of authority make the best leaders?

Summary: biology and political behaviour

There is considerable evidence from the life sciences that human behaviour is influenced and shaped by evolutionary and biological factors. Although the evidence of genetic and neurological components to behaviour is accepted by those who study human behaviour in other disciplines, political scientists, with rare exceptions, have failed to even mention biological variables in their attempts to explain the political behaviour among either the masses or the leaders. Moreover, despite strong support for inclusion of physiological variables such as general health, physical fitness, nutrition, stress, illness, disability and ageing in an interactive model of political behaviour, they have been all but ignored by mainstream political science. With few exceptions (Knutson, 1972 and Manheim, 1982), textbooks on political behaviour have not taken a biopolitics approach, and most have failed to even include mention of potential biological determinants of political behaviour. Most still treat the political person as an empty organism.

The studies from biopolitics summarised here, although often preliminary and fragmentary, demonstrate that, with some initiative and creative thought, biological variables can be included in the study of the political behaviour of both the masses and the leaders. Moreover, when they are included, they appear to be potentially valuable independent variables. The pattern of dismissing such variables from analysis has isolated political science from the more inclusive study of human behaviour. As a result, much of what has been offered as explanations of political behaviour is suspect to persons with knowledge of biology and behaviour and dismissed as misguided.

6 Biopolicy I
Decision-making and societal issues

As noted in chapter 1, there are critical and fundamental implications of the life sciences for public policy. Like the study of political behaviour, however, political scientists who specialise in public policy have largely ignored biological factors and, except for some areas of environmental policy, have been conspicuously absent from the scholarly, and public, debate over biologically-based issues. This chapter first discusses the failure of conventional policy making models to account for biological influences. Despite their differences, these models assume that decisions are a product of environmental determinants.

The chapter then presents a wide array of biopolicy issues to which political science, as a discipline, has not been attentive. These include individual, societal and globally oriented issues of increasing importance in the twenty-first century. Finally, the chapter examines in detail some of the policy issues emerging directly from genetic and neurological research on human behaviour. These highly volatile issues centre on the biological bases of criminality, addiction, sex differences and sexual orientation.

Biology and political decision-making

The biological paradigm directly challenges contemporary models of decision-making. Although many theories of decision-making have been advanced and they vary as to emphasis, none adequately accounts for biological dimensions that have been found to affect human behaviour unduly. As a result, the ongoing debate over which model is the most explanatory one is misdirected. A brief review of conventional models is followed by an analysis of the impact of excluding the biological dimension on our understanding of policy making.

A predominant set of models since the 1950s is the rational actor models that emphasise human rationality based on economic theories. These public choice theories are centred on the notion of economic man who is driven by utilitarian-based, self-interested pursuit of material satisfaction. Under these models, decision-making is a rational process through which: (1) a problem is identified; (2) an objective is selected on the basis of an ordering of individual preferences; (3) the means of achieving this objective are evaluated as to effectiveness, cost

and so forth; and (4) a decision is made through the selection of the means most likely to secure the desired end.

Public choice advocates argue that approximations of rational conduct through calculations of cost and benefit are sufficient to explain the behaviour of individuals in organisations, thus even psychological factors are of little value (Losco, 1994: 49). Although intuitively attractive, the rational actor model is attacked as unrealistic outside an individual because of conflicting objectives that are found in any organisation. Furthermore, in practice decisions are often made without adequate information and comparable benefits. Even when modified to address these limits (see Simon 1983), however, rational models are criticised for failing to account for the values and ideology of the decision makers.

A second decision-making model, incrementalism, attempts to deflate the objective, rational assumptions of rational choice and reflect actual policy making. Under this model, decisions are likely to be made on the basis of inadequate information and low levels of understanding. Policy making then seldom produces bold and innovative course of action, but instead is an exploratory process lacking overriding objectives and clear-cut ends (Braybrooke and Lindblom, 1963). Incremental policy making is a 'muddling through' process where decision makers are inclined to avoid or evade trying to solve problems. As a result, incrementalism has been criticised as highly conservative because it justifies a bias against innovation and comprehensive reforms.

In his classic study of decision-making, Graham Allison argued that while the rational actor model has proved of some use, 'There is powerful evidence it must be supplemented, if not supplanted, by frames of reference that focus on the ... organisations and political actors involved in the policy process' (Allison, 1971: 5). Neither the rational actor nor the incremental model take account of the impact of the structure of the policy-making process on decision-making. Bureaucratic or organisational models emphasise the process. The bureaucratic politics model highlights the impact of bargaining among personnel and agencies each pursuing their own perceived interests. This theory dismisses the notion of the state as united around a single interest and posits that decisions ultimately arise from an arena of contest where balance of advantage is constantly shifting.

In contrast, the organisational process model emphasises the impact of values, assumptions and regular patterns of behaviour that are common to any large organisation. Decisions, then, reflect the entrenched culture of the agency that make them, not the product of rational analysis and objective evaluation. These models have been criticised for allowing little scope for political leadership and assuming that political actors simply respond to the interests of the organisations in which they work. Furthermore, it is suggested that such models fail to adequately account for external pressures from the political, economic and ideological context.

While other models have been offered that place more emphasis on beliefs and ideology and address the degree to which behaviour is structured by social and political values that are not rational or impartial (Boulding, 1956), notably absent in all conventional decision-making models are biological factors. For

instance, belief system models clearly challenge rational models by suggesting that decision makers are not rational, rigorous and objective agents; that decisions are shaped by perceptions and concepts often unconscious. What this model fails to account for is the evolutionary dimensions of these preconceptions and beliefs. In other words, it too fails to even consider the biological foundations of decision-making.

Biology and bureaucracy

Luther Gulick, a key figure in public administration since the 1940s, in 1977 called for the 'establishment of a systematic watch for a new thinking and action involving advance in fundamental science relating to human behavior' (1977: 709). He singled out the importance of Sociobiology and the tendency of students of public administration to ignore these developments. Although he did not elaborate on the specific ways in which the life sciences might contribute to the study of public administration, Gulick's call for a renewed effort to draw upon the life sciences to meet the myriad of challenges that confront the discipline raised a critical question: how can an economic or political theory of public administration exist without a demonstrably plausible theory of human nature as a major part of its foundation? Debates over the nature of administrative man, economic man, rational man, active/humanistic (altruistic) man, although often frustratingly slippery, are so central to public administration that they, and all new knowledge claims that bear on them, remain central to the ongoing project of theory development in public administration.

Lynton Caldwell, another key figure in public administration, as noted earlier, has raised the profound question of the viability of large bureaucratic societies in the long run. For Caldwell, 'Present day bureaucracies, especially in government, are being severely stressed by size, complexity, and by the unprecedented nature of conflicts with which they must cope' (1980: 8). This concern is borne out historically by the general tendency for human societies to fission. Simultaneously, however, it is challenged by the directionality in evolution reflected in the synergistic tendencies of human co-operative behaviour and the increased complexity of societies resulting from the capacities of states as cybernetic control or steering mechanisms (Corning, 1983).

In his seminal book, *The Organizational Society {191 &* Robert Presthus complements the views of Gulick and Caldwell by focusing on the behavioural dynamics of complex organisations. Presthus observes that in large organisations, the 'sheer number of participants and the scale of operations prohibit face-to-face relationships among most of their members. Size by itself introduces a pathological element in organisations' (1978: 2). Hierarchy, specialisation and authority produce a distinctive psychological climate in large bureaucratic systems that result in a problematic fit of human organisms within these organisations.

Presthus is especially concerned with the status system in bureaucracies, which he defines as a 'hierarchy of deference ranks' (1978: 123). In support of his arguments as to how individuals try to cope in this highly rationalised setting,

he draws freely upon ethology and animal behaviour studies to suggest there may be important similarities (if only analogies) with the practices of other animals which form dominance-submission hierarchies, manifest group intimacy and reveal highly structured (rationalised) patterns of social behaviour. He goes so far as to suggest that 'the dynamics of bureaucratic authority structures seem to rest firmly upon phylogenetic adaptations' *(ibid.:* 128).

The familiar story is that despite calls from key figures in public administration, there has been little apparent impact on the field. Losco (1994: 48) attributes this lack of interest in the life sciences in part to the diverse and fragmented nature of public administration and the lack of agreement among a multitude of theoretical orientations and approaches. This confusion is complicated by the constant friction among the theorists and the practitioners in public administration. Losco argues, therefore, that the lack of influence of the life sciences here should not be seen as a failure as to what it can offer, and that in fact there is a 'burgeoning' of biopolitical scholarship that is directly or indirectly relevant to the study of public administration. Two of the main areas identified by Losco are the study of bureaucracy and behaviour in organisations.

One area where evolutionary theory can make a contribution is the study of the organisational forms upon which bureaucracies are based. What human need is there for hierarchies that might explain their universality and persistence throughout history? Although the underlying structures and the means of control have changed, the need for such systems of control apparently has not. Evolutionary biology has provided useful theories of inclusive fitness (Hamilton, 1964), group selection (Williams, 1966) and reciprocal altruism (Trivers, 1971) that provide a useful framework for understanding bureaucracies (see Willhoite, 1986 and Masters, 1986a, for excellent summaries of this extensive literature).

According to Masters (1989), very large groups of non-kin individuals require the coercive power of the modern bureaucratic state to establish and maintain collective goods. Moreover, 'the central administrative organization has the consequence, for the bureaucrats and their kin, of providing selective benefits, which constitute effective strategies for enhancing their own inclusive fitness at the individual level' (1989: 197). For Axelrod (1984: 130), bureaucracies use the rule of law and central administrative authority to co-ordinate the use of collective goods and to deter free riders. They are well equipped to carry out functions of co-ordination and control because they are organised into relatively small groups whose members interact with a high degree of regularity, thereby maximising the potential for reciprocal co-operation.

A related area where research in the life sciences is applicable to the study of bureaucracies centres on pathologies that are common in bureaucratic settings. Caldwell suggests that the reasons humans think so poorly of bureaucracies is that they run counter to what biology tells us about human nature (1987: 152). In agreement, Flohr notes that even when bureaucracies appear to be functioning efficiently and rationally, they are almost always held in disrepute. He contends that knowledge of brain functioning is critical to understanding this disconnection. In bureaucratic settings, only the neo-cortex-based rational

aspects of our nature are encountered as we wait in lines, are told to fill out forms and so forth. At the same time, bureaucracies ignore or mistreat the emotional side of the human personality thus causing a negative response (1986: 77). Flohr contends that a biosocial perspective can help reduce these bureaucratic pathologies by helping develop methods to humanise the bureaucratic experience (1986: 103).

Another 'pathology' of bureaucracies which has received attention in biopolitics' literature is the unending problem of nepotism (see Caldwell, 1980). Despite democratic assumptions of equal treatment and access to government services, nepotism is an inherent problem. Kin selection theory offers a powerful perspective for understanding this phenomenon, as individuals try to maximise inclusive fitness by transferring as many resources from the state to kin as possible. According to Losco (1994: 56), this is a particularly noteworthy pattern in the Third World where favours for services are the norm. In more affluent states, democratic practices may be more commonplace solely because of the decreased need for special treatment to meet the demands of inclusive fitness (Masters, 1989: 207).

The contribution of the study of the biological bases of leadership summarised in chapter 5 to the study of behaviour in organisations is significant. Although this continues to be one of the most difficult areas to study, the application of ethological approaches to small groups discussed in chapter 5 demonstrates considerable progress in the last decade. In order to be effective, however, it is important that these research findings make it into mainstream public administration and theories of organisational behaviour.

Areas of substantive concern

There is little argument that issues emerging from the biological sciences represent some of the most complex, intense and urgent issues humankind has yet faced. They challenge fundamental values regarding human existence and raise vital questions concerning the role of the individual vis-a-vis society. The range of issues subsumed under biopolicy is extensive and expanding. These issues will not dissipate: they are certain to intensify as developments in biology accelerate.

At least three centres of biopolicy concern must be addressed. Although any particular technology has implications for all three, each tends to have a clear emphasis that allows it to be meaningfully categorised as either: (1) individual; (2) societal; or (3) global in nature. A few of the myriad of biopolicy concerns in each are listed below.

I *Individual oriented biopolicy issues*

A *Human reproductive and genetic intervention*

1 Genetic counselling
2 Carrier screening
3 Genetic therapy

4 Assisted reproduction
5 Stem cell research
6 Genetic enhancement

B Prenatal issues

1 Abortion/sterilisation
2 Prenatal diagnosis
3 The foetal environment
4 Foetal research
5 Characteristic selection
6 Sex predetermination

C Issues within the life cycle

1 Organ transplantation
2 Intensive care
3 Intervention in the brain
4 Drug therapy and usage
5 Heroic life saving measures
6 Human experimentation

D Death-related issues

1 The ageing process
2 Irreversible coma/persistent vegetative state
3 Treatment of terminal patients
4 Critically ill new born infants
5 Doctor assisted suicide
6 Alzheimer's disease and other dementias
7 Futile care
8 Definitions of death

II Society-oriented biopolicy issues

A Genetic diversity and human equality
B Population control
C Malnutrition
D Sex differences
E Race differences
F Ageing populations
G Sedentary lifestyle
H Crowding
I Genetic determinants of behaviour
J Biohazards

K Nature-nurture debate
L Genetically engineered organisms

III Globally oriented biopolicy concerns

A The environment in general
B Global warming
C Acid rain
D Depletion of ozone layer
E Contamination of biosphere
F Climatic manipulation
G Poisonous bacterial substances
H Biological terrorism
I Radiation pollution
J Conflict-global stress
K Overpopulation

These areas represent but the surface of an extensive array of biopolicy concerns that should be of interest to political scientists. In each case, the political ramifications are widespread and complicated. It seems reasonable that every one of these policy areas requires substantial policy research in the near future before it extends beyond the boundaries of controllability. This chapter focuses on the former two categories, while chapter 7 places emphasis on global issues tied to survival of the species.

Betrand de Jouvenal in 1965 pointed out that a political scientist has critical contributions to make to society by providing *prevision* of future policy issues. Nowhere is this more important than in an area of rapid growth such as biopolicy. De Jouvenal specifically argues that a political scientist ought to:

1 Seek to co-ordinate anticipations by identifying multifarious impacts of forecasted developments;
2 Be a detector of trouble to come, the very basis of policy;
3 Be competent to appreciate priorities and consistency in policies even though not competent to judge the details;
4 Foretell the adjustments suitable to improving the adequacy of the institutional system to cope with changing circumstances.

Although this is an exceedingly ambitious challenge to accept, political scientists have a unique perspective and orientation to offer to meet it. Furthermore, policy involvement should not be the exclusive domain of those formally trained in policy analysis. A comprehensive and meaningful policy perspective must include a solid foundation in political philosophy as well as in the substantive areas of political science, including both an institutional and a behavioural orientation. Public law, public opinion, international relations and comparative

government as well as public administration all have crucial contributions to make to the study of biopolicy.

Wiegele urges social scientists not to become overly concerned with the boundaries of the disciplines in which they received their formal training. 'Those boundaries should be ever-changing and actively moving in unexplored directions. Without such movement the social sciences risk becoming stagnant, arrogant, inward looking and protective' (Wiegele 1982a: 7). This same conclusion applies just as well to sub-fields within the discipline. Those not trained primarily in public policy nevertheless have significant contributions to make in biopolicy.

If political scientists are to transcend disciplinary boundaries, it is imperative that our discipline offers the biological sciences something tangible. It seems unlikely that we can maintain a meaningful dialogue with any other discipline if we continue selectively to extract what we need from them without offering something in return. Supposedly, political scientists have a useful perspective as well as substantive knowledge about the political system to offer to those in the life sciences. Somit (1976: 317), for instance, notes that biopoliticians in particular could be most useful in devising ways to make desired scientific objectives politically acceptable. The political issues raised in recent biological developments are most challenging to the political process. They raise a multitude of policy-oriented questions that political scientists ought to address. To be useful, however, the political scientist must be aware of the developments in biology itself.

Basic policy questions to be addressed include whether or not the current political institutions are capable of dealing with new issues produced by biological applications. Lynton Caldwell for one suggests that this new knowledge in the life sciences might be more than existing political institutions can accommodate:

> Can we deal effectively with the new issues of biopolicy using the old conventional politics? The answer appears to be no, we cannot, and for the following reasons. First, the values and assumptions underlying our conventional politics are incongruent with and contradictory to many of the inferences to be drawn from the new biology. Second, the structure and procedures of politics are at present poorly adapted for dealing with the kinds of problems that are latent in emerging bioscience. Biopolitical issues will in some manner be disposed of through politics, but unless they are processed with greater comprehension and foresight than seems probable under present conditions, the consequences of biomedical innovation may be severe social disruption and the possible loss to society of the benefits of the new knowledge.
>
> (Caldwell, 1981:45)

Certainly, the issues of biopolicy seem to be of a different magnitude from traditional political concerns, but are they? Political scientists must be prepared to

clarify the legal and political framework of biological developments and to speak for the inclusion of traditional political questions in the debate. What ought to be the role of public opinion, of interest groups and other social institutions in making biopolicy? How does this tie to normative theory and to our conceptions of rights, obligations, justice and so forth? We should also be able to clarify what public policy is, as well as what the proper response of the government to these developments ought to be.

There is already a fairly well-developed debate over biopolicy issues, and political scientists, those supposedly trained to deal with such concerns, are largely absent. Resolving these issues requires sensitivity to the political dimension. The literature is rife with confusion, often consciously imposed, over what is meant by government intervention, what the policy process is and how the political system works. Again, it seems logical and necessary that those political scientists who are most familiar with the biological developments at hand have an obligation to clarify the policy dimension and enunciate the policy implications. Until now, efforts to that end have primarily come from biological scientists themselves and from bioethicists. Although some political scientists have begun to deal with biopolicy issues, to date the efforts have been fragmented and uncoordinated.

Caldwell (1979: 23) emphasises the impact of biobehavioural findings themselves on policy and demonstrates how a biobehavioural approach might lead to a new politics of survival. 'In sum, the implications of biopolitics for the development and implementation of public policy are numerous and ramifying'. Certainly, biological models question the environmentalist assumptions upon which current policy is based. The 'biobehavioural sensitivity' that Wiegele (1979a) urges, applies as well to biopolicy concerns and the policymaking framework as it does to the study of political behaviour. Political science has, indeed, failed to incorporate information and methods based in the life sciences. No where is this more evident than in policy analysis, particularly on issues of a biological nature.

Attention must be directed to the significance for policy formulation of the wide-ranging theoretical and basic research activities of the politics and life sciences movement. For Caldwell (1979: 34) 'the elements of biocratic policy are already present, but they have not converged to form a coherent self-conscious, goal-directed movement'. Although that step will not be easy, it is far from unattainable. Also, if we firmly believe that the incorporation of biobehavioural knowledge is essential to a comprehensive understanding of political phenomena, then we cannot dismiss or disregard the need to apply it to the policy process. The obligation to use our knowledge to transform the very process of making policy seems self-evident to us, especially as applied to critical problems intrinsic in biopolicy issues.

In addition to influencing biopolicy decision and clarifying the political context of the life sciences, several more direct benefits would accrue from a renewed policy orientation. Internally, it is unlikely that basic research can continue without evaluation of the policy implications of that research. There is

a need for a policy perspective since ultimately issues in politics and the life sciences convert to policy questions. From a funding standpoint, policy seems to be where much of the action currently is. Furthermore, many of the most dramatic new policy areas are emerging from research in the life sciences. Assessments of technology, which include the social, ethical and political ramifications are a fertile area of research where biobehaviouralists have a special expertise to bring to the problem.

Three biopolicy levels

In dealing with biological innovations, there are three potential policy levels. Decisions first must be made concerning the development and application of the technology. Since most biomedical research is supported either directly or indirectly with public funds, public input is required at this state. A second policy level relates to the individual use of technologies once they are available. Although direct government control of individual decision-making ought to be limited, the government does have at its disposal an arsenal of more subtle devices to either encourage or discourage individual use. These include tax incentives, provision of 'free' services, 'education' programmes and so forth.

The third, and perhaps the most critical level of biopolicy, centres on the aggregate societal consequences of widespread use of technology. Adequate policy making here requires (1) a clear conception of national goals; (2) extensive data to predict the consequences of each possible course of action; (3) an accurate means of monitoring these consequences; and (4) mechanisms to cope with the consequences if deemed undesirable. At each of these levels, policy input from a variety of perspectives is crucial. Again, researchers with sensitivity, both to the biological developments and the policy process, are indispensable to the resolution of these problems. Preliminary to making a specific biopolicy decision, there is a critical need to delineate broad societal goals for biomedicine and public health. Only by explicating such goals can the direction of biological research and development and the priority attached to each potential application be ascertained. In addition to setting national goals, a future-oriented, anticipatory public agenda for achieving these objectives must be established. Coates (1978: 36) stresses the need for forecasting, feedback and flexibility in designing public policies. Nowhere is the need for intense evaluation of alternatives *prior* to the development of the innovations more crucial than in biological technology.

The following sections examine specific applications of the growing understanding of the role of genetics and neuroscience that raise particularly poignant policy issues in liberal societies. Knowledge emerging about the biological underpinnings of violence and antisocial behaviour, addiction and sex differences raise critical questions over how society best deals with a range of policy issues surrounding each of these areas. This knowledge, itself, questions many of our long held assumptions about the criminal justice system, treatment of drug and alcohol abusers, and perceptions of differences by gender and sexual orientation. Together with the evidence on the impact of biology on political behaviour

presented in chapter 5, they ultimately challenge assumptions of individual responsibility for behaviour and the concept of free will which are the foundations of how we perceive ourselves and society.

The brain and violence

No credible scholar today would argue that the causes of violent or aggressive behaviour are either all environmental or all biological. Although in exceptional cases these behaviours might be entirely biologically or environmentally-based, in the overwhelming majority of cases, they cannot be traced to any single factor (Comings, 1996: 84). A vast literature across many disciplines convincingly demonstrates that violent behaviour even of a single person is the result of a combination of overlapping and often reinforcing forces. For Greenspan: 'No controversy about the predominance of nature or nurture in human development should exist. A child's constitutional makeup interacts with his emotional experience in a reciprocal manner so complex that there is no point in debating which factor contributes more' (1997: 133-4).

The most appropriate approaches, therefore, are those which explicate how biology and environment are related - how a complex of biological factors interact with and influence a complex of environmental factors to produce a violent or aggressive behaviour or behavioural pattern. A neurological perspective by itself then is not determinative of behaviour, and in fact is likely to be less explanatory than combined social, economic and genetic factors. Also, because of these complexities, it is risky to generalise from individuals to groups in looking for biological ties to violent behaviour.

It should also be noted that the line between biological and environmental factors is blurred. Many brain deficits that are related to violent behaviour are themselves the result of environmental insults. The use of alcohol has long been known to provoke aggressive and violent behaviour in some people, as have low-cholesterol diets, steroids and drugs of abuse (Kotulak, 1996: 64). Moreover, environmental carcinogens, mutagens and teratogens are capable of producing tumours or developmental injuries. Exposure of lead to foetuses and children is especially risky for neural development. The full impact of workplace and other environmental neurotoxins is far from being recognised and demonstrates the sensitive linkages among disparate influences on behaviour (see Blank, 1999).

With this more complicated context in mind, it is important to look at neuronal contributions to violent behaviour. If we are to understand the complex interactions among the various contributors to such behaviour, the role of the brain and its influence must be clarified. This section briefly examines what is now known about the brain's contribution to this equation. The absence of equal time to the social factors should not infer that the neurons act in isolation.

The constellation of related behaviours including violent, aggressive, criminal, antisocial and impulsive are often studied together despite their varied implications. Although there is no specific gene or neuronal pattern for any of

these manifestations, there is considerable evidence of neuronal disorders that predispose children to impulsive, hyperactive or aggressive behaviours that in some cases persist throughout life. Episodic dyscontrol, the result of seizures in the limbic system, for instance, is a well-documented disorder that can lead to abrupt, unexplained, acts of rage. Violent outbursts, including aggressive behaviour while in automobiles, can be traced to this disorder. Studies have found that 94 per cent of persons with uncontrollable rage have developmental or acquired brain defects (Restak, 1994a: 151).

Brain laterality, for instance, has been found to be associated with antisocial behaviour, with some evidence of a higher incidence of left-handedness among criminals. Moreover, several studies found that 76 per cent of violent offenders and 91 per cent of the psychopaths studied had evidence of left-hemispheric dysfunction in the temporal and frontal lobes (see Jeffrey, 1993: 164). In addition to frontal and temporal lobe abnormalities, violent behaviour also tends to be correlated with abnormalities in the amygdala and other areas of the limbic system.

A very high rate of injuries and brain trauma to these areas has been found among criminals. The causes of the injuries can be the result of birth injuries, childhood illnesses, exposure to neurotoxins, accidents, or, ironically, violent acts to themselves. One study found that 70 per cent of the violent offenders examined suffered from head injuries and another study of fourteen juvenile death row inmates, concluded that all fourteen had brain trauma or neurological disorders. Moreover, thirteen came from families with a history of violence and twelve had been brutalised sexually and physically as children (Lewis *et al.,* 1988), again indicating the social dimensions of neurological ties to violence. Supporting the interactive nature of environment and brain, hair analyses of serial murderers and violent offenders have demonstrated excessive concentrations of lead and cadmium in such individuals (Jeffrey, 1993: 165).

Frontal lobe injury has long been correlated with hyperactivity, impulsiveness and aggressive behaviour. Early EEG research found relationships between abnormal electrical discharges in the brain and behavioural problems and through more sophisticated brain imaging these data are becoming more precise. Such studies demonstrate that abnormalities are identifiable in 15 to 50 per cent of violent people as compared to 5 to 20 per cent of those persons with no history of violence. What this means, however, is not clear because the deficits are often not apparent in behaviour. Also, the range of expression of similar brain injuries is enormous (Restak, 1994a: 152) since no two brains are identical. Furthermore, the brain is remarkably adaptable and may compensate for damage.

The focus of research on the neural influences on aggressive behaviour centres on the neurotransmitter serotonin, although noradrenaline, norepinephrine and dopamine have also been targeted. Serotonin was first implicated in research showing that people who became aggressive under the influences of alcohol had lower levels of this neurotransmitter than those who did not become aggressive. Although low serotonin levels do not compel a

person to be violent, they appear to lower the threshold (Kotulak, 1996: 88). Because serotonin normally acts as a brake on impulses, a deficiency means that the person, in effect, loses full control. For a comprehensive analysis of the role of serotonin in criminal behaviour and its implications for law, see Masters and McGuire (1993).

Hormonal levels have also long been linked with behaviour. Carey and Gottesman, for example, argue that we have already found the genotype that predicts violence better than any gene to be discovered in the future; the XY genotype. As discussed later in this chapter, heightened levels of testosterone have a significant role in sexual differentiation and sexual-typical behaviour. Males on average are more aggressive and potentially violent than females and again the brain plays a critical role in the regulation of hormone production.

Although the brain damage, hormonal and neurotransmitter arguments have been presented as defences against conviction for violent crimes, rarely have such attempts been successful (see Shapiro, 1994). In part, this is because the notion of brain damage or abnormality remains subjective and the links to any specific behaviour are tenuous at best. We are far from understanding how the brain influences aggressive and violent behaviour because each act has multiple influences and because violence is such a diffuse concept. Because of its greater specificity, we are much further along in delineating the neural basis of addictive behaviour.

The brain and addictive behaviour

Addiction is a major social and health problem in all Western societies, and increasingly has been linked to the brain. In the US alone, the financial cost of alcohol abuse is estimated to be over $90 billion annually. Other substance abuse adds $70 billion to this. Over 30 million Americans alive today will experience addiction to alcohol or illegal substances in their lifetimes, approximately one in six. Moreover, 40 per cent of American families are affected by addiction. Although these figures may be on the high end among nations, it is a major problem in all Western nations. Also, it can be argued that the $92 billion spent on alcohol, $44 billion on tobacco and $40 billion spent on major drugs of abuse (cocaine, $17.5; heroin, $12.3; marijuana, $8.8) in 1990 in the US could have been put to better use. The relative figures for other countries with higher levels of alcohol consumption are likely to be even higher.

Furthermore, it is estimated that one-quarter of deaths in the US are caused by the use of tobacco, alcohol and illegal drugs. For DuPont, Addiction is the number one preventable health problem in the United States and throughout the developed nations of the world' (1995: 4). Although the social and cultural dimensions of addiction are complex, attention here is focused on the relationship of addiction to the brain.

Two issues of addiction relevant here are: (1) the biochemical-genetic bases of addiction and (2) impact of addictive substances on the brain and its normal functioning. Findings from neuroscience research in the past several decades

have illuminated addictive behaviour by explicating the role of genetic and environmental factors and their interaction with the biochemistry of the brain. Through expanded knowledge of the roles of specific neurotransmitters and the ability to visualise the brains of addicts through PET (positron-emission tomography) imaging, the neural bases of addiction are becoming clear. As our understanding increases, it is becoming obvious that addiction extends far beyond the physical need for chemicals to a wide range of activities (eating, gambling, sex) that produce feelings of dependency in our neural networks.

Although addiction can affect all organs of the body, the primary target is the brain (Nestler and Aghajanian, 1997: 58). Addictive substances or behaviours are linked to the brain's capacity to experience feelings of pleasure and pain that has evolved to manage fundamental behaviours such as feeding, reproduction and aggression. When the brain's pleasure centres are stimulated, the brain sends out signals to repeat the pleasure-producing behaviours. According to DuPont, the brain is selfish and characterised by the 'right now' quest for pleasure. 'When it comes to many natural pleasures, the brain has built-in protections. It has powerful feedback systems to say "enough" when it comes to natural behaviors, including aggression, feeding, and sex' (1995: 5).

The brain is selfish, however, in that automatic brain mechanisms do not account for delayed gratification. Therefore, when the brain comes into contact with an addicting substance, and when this substance triggers the pleasure centres, there is a strong incentive to repeat the exposure. These feelings, of course, are constantly mediated by culture and other environmental forces that can influence the behaviour.

To complicate matters further, there is strong evidence of genetic predispositions to addictive behaviour and possibly to addiction from particular substances such as alcohol. Moreover, people who are genetically oriented toward immediate gratification, or to impulsive behaviour and risk-taking are also at higher risk for addiction. Despite the importance of genetic, cultural and social factors in explaining addiction, at the base our understanding must focus on the brain (Leshner, 1997). Not only is the brain the key to unlocking the causes of addiction, but also the brain must be the focus of study in order to determine how addictive drugs and behaviours affect the functioning of the brain, cause distortions in thinking and change the brain of the addicted person.

Although a wide range of behaviours are potentially addictive (for example, sex, gambling, eating, running and surfing the net), most attention has been focused on drugs because it is with chemicals that the effects are most apparent. All drugs of abuse produce their effects by travelling through the bloodstream to the brain. Once in the brain, each drug alters the function of specific brain cells. Stimulants such as cocaine act as an exciting influence on certain nuclei, while depressants such as alcohol and the narcotics act to inhibit their activity. Some drugs act by blocking the re-uptake of neurotransmitters from the synapse to the sending axon, thus facilitating transmissions by prolonging the time the neurotransmitter remains in the synapse. Other drugs actually mimic particular neurotransmitters by sending their own messages and occupying the receptors.

Moreover, some substances like alcohol interfere with the cell membrane, while others affect the synapse working either as agonists (activating transmission across the synapse) or antagonists (blocking the receptor sites on the dendrites).

Whatever the precise mechanism of a specific substance, tolerance builds because when a particular neurotransmitter is excessively stimulated over a long period, the brain re-establishes equilibrium by reducing the sensitivity of the affected receptors or by decreasing their number. This process, termed down-regulation, means that the more the brain is exposed to chemicals affecting a neurotransmitter, the less the brain responds to a specific dose. Therefore, in order to experience the same effect, the addict must use higher doses. A related effect, physical dependence, is manifested by withdrawal symptoms experienced when use of the substance is stopped. Such symptoms vary by substance and reflect the cellular adaptation of the neurons of that area of the brain to the continued presence of the substance that has influenced its functioning. Withdrawal symptoms manifest the shock to the brain to a rapid alteration of the chemical environment. Frequently, they are interpreted by the addict as the 'need' to resume use of the substance.

A key to understanding the biochemical bases of addiction, then, is at the molecular and cellular levels in the mechanisms of neurotransmitters (Nestler and Aghajanian, 1997). Two prominent theories of addiction focus on the endorphins and dopamine. According to the latter theory, most of the drugs of abuse including alcohol, cocaine, amphetamines and the narcotics stimulate the dopamine-producing neurons in the median forebrain bundle, the neural pathway that connects the midbrain to the forebrain (Wise, 1988). This increased production of dopamine creates the euphoria and pleasure associated with the high, thus reinforcing its continued use. Research has demonstrated that if dopamine production is turned off by dopamine-suppressing chemicals, the stimulating effects of the drug are blocked.

The second theory applied specifically to opiate addiction focuses on a group of peptides, the endorphins of which more than one dozen natural forms are known. The endorphin brain system moderates pain, promotes pleasures and manages stress. Endorphins also act as neuro-hormones and can affect nerve functioning at distant sites in the nervous system through the blood. Endorphine receptors are found in other parts of the body including the intestines, which might explain why these drugs often affect other organs as well.

It has been postulated that endorphins can explain the physiological dependence of heroin, because when external opiates are taken, the brain ceases to produce endorphins. As a result, the person becomes totally dependent on the drug for relief of pain or feeling of pleasure since natural production by the brain of these needed chemicals has ceased. Termination of the drug use results in withdrawal symptoms until resumption of endorphin production by the brain (Bootzin *et al.* 1993: 324). Furthermore, research indicates that the opiate receptor sites can be occupied by antagonists, such as naloxene and naltrexone, which are used to treat overdose and addiction. Even if the opiates get to the

receptor sites first, the antagonists cover the sites thereby blocking the drug's capacity to produce a rush.

Not surprisingly the effect of a particular substance as well as its addictive properties depends on many factors including chemical composition and purity; dosage, timing and frequency of exposure; and the route of administration. Because the most rewarding drug experience is achieved when the brain is hit by a high and rapidly rising level of the chemical, injection directly into the vein is the most effective delivery route for most substances. In turn, smoking is more addictive than snorting or taking the same drug orally.

Returning to the two questions that framed this section, what scientific evidence is there that the root of human addictive behaviour lies in the brain and of the dysfunctional effects of addictive substances on the brain? Although the brain's role in addiction has long been a matter of speculation, research on the neural bases of addiction began with experiments on animals in the 1950s which utilised electrodes implanted in the pleasure and pain centres of the brain. More recently, knowledge of neurotransmitters and improved instrumentation allows for precise chemical probes of specific brain nuclei. The general finding of an extensive body of research from the 1970s and 1980s is that while the various substances act through a wide array of distinct mechanisms, ultimately they all work to stimulate pleasure centres and suppress pain centres (Leshner, 1997: 46). This commonality in result explains why addicts are willing to use diverse drugs in their search for a high.

Specifically, researchers have discovered that several areas of the brain, the ventral tegmental areas and the nucleus accumbens, exhibit high concentrations of dopamine-containing neurons, and that all drugs of abuse trigger the release of relatively large amounts of dopamine into the synapses of these neurons, albeit through varied mechanisms. Critically, this research demonstrates that once exposed to the effects of these substances, these neurons require a repeat exposure to activate release of dopamine and again produce the pleasurable response, resulting in the reward pattern of addiction. As we come to understand better the function of neurotransmitters and receptor sites and the mechanisms by which drugs influence neural activity, we should be able to determine why some people are more susceptible to addiction than others and to offer preventive treatment.

Much of what we are learning about addiction and the effect of these substances on the brain comes from research applications of brain imaging techniques. In 1996, neuroscientists for the first time were able to use PET scans of the brains of cocaine addicts in the throes of craving to identify visually the neural bases of addiction. Imaging shows that when addicts feel a craving, there is a high level of activation in the mesolimbic dopamine system. In one study PET scans were run on patients under treatment for cocaine addiction as they were exposed to cues associated with past craving episodes. The scans indicated activation of the dopamine system in the ventral tegmental area at the moment the addicts expressed intense craving. An Italian study (Tanda *et al,* 1997), found that the mesolimbic dopamine system was also active in nicotine addiction, while

another study (Rodriguez de Fbnseca *et al.,* 1997) found that marijuana affected the same brain circuit. In addition to the ventral tegmental area, these studies discovered similar activity in the outer layer of the nucleus accumbens and in the interconnected amygdala. The latter linkage is supported by evidence that persons with lesions in a section of the amygdala are unable to link pleasure with its causes.

Moreover, this research is beginning to provide insights into how the drugs affect the brain. Studies of brain cells demonstrate that repeatedly exposing the brain to addictive drugs represents a chemical assault that alters the very structure of the neurons in the circuitry for pleasure. Over time these changes starve the affected cells of dopamine, thereby triggering a craving for the addictive drugs that will again activate release of high concentrations of that neurotransmitter (Goleman, 1996). During withdrawal, a different brain circuit in the same brain region releases a small protein, corticotropin-releasing factor (CRF). When a person suddenly stops taking the addictive substance, CRF levels rise and the person experiences withdrawal symptoms. Again, this process has been found to be identical for addictive substances including nicotine, marijuana, alcohol, heroin, cocaine and amphetamines.

In light of the technological advances of brain imaging and the current research on the biological bases of addiction to substances, it is likely that such research will be expanded to other addictions such as gambling, aggression, sex, eating and so forth. Given what we know about the interaction of drugs and neurotransmitters in the pleasure circuits, it would not be surprising if similar effects were present with other pleasure-giving behaviours. The implications of this research for dealing with behaviours that are personally and socially destructive are, of course, considerable, as are the legal and policy ramifications. We might also come to understand why state-run lotteries are so attractive to law makers and how they affect the populations they serve.

There is a danger of extending the notion of addiction to any behaviour that becomes patterned because it stimulates the pleasure centres. This has legal implications and again raises questions concerning free will and responsibility for one's own actions. The courts are going to be faced with novel defences based on scientific evidence of genetic predisposition and neuronal susceptibilities. Evidence that all substances of abuse have similar impact on the brain despite differing mechanisms implies extension to non-substance factors that exhibit similar effects on the neural circuitry.

This evidence also has implications for drug policy that makes distinctions among potentially addictive substances (Pope and Yurgelun-Todd, 1996). Arguments for legalisation of marijuana become more difficult to accept given this evidence (Wickelgren, 1997). Moreover, our society's treatment of nicotine and alcohol may have to be modified if consistency is sought. The evidence of the interchange ability of substances in producing similar effects on the activation of dopamine demonstrates that anti-drug policies, which focus on one drug at the exclusion of others, is unlikely to stem the addiction problem. Rather, this strategy will simply serve to shift the addiction to other substances when the

supply of the first is cut. For the addict it seems no drug is a safe drug, only a substitute. Neuroscience research on addiction, therefore, is likely to undercut some current policy initiatives and treatment regimes but it offers the promise of more creative and effective solutions in the decades to come.

Sexual differences and the brain

Until recently, human sexuality was the domain of psychology, but neuroscience findings are shifting emphasis to biochemical processes. This shift has naturally been criticised by those observers who hold that nurturing, culture and social environment are the most powerful forces influencing sexual behaviour as well as other behaviours and cognitive traits that typically differentiate the sexes. Current biological and neuroscience research, however, demonstrates that variation among the sexes, and in sexual orientation, are inextricably linked to differing hormonal influences on brain development. Although none of these findings eliminate environmental contributions to behaviour, cumulatively they require a shift in balance from nurture to nature as a prime focus of inquiry. As a result, neuroscience is producing intensified conflict and shaking conventional foundations of our perceptions of sex differences and equality.

As with research in addiction, studies based on sophisticated brain imaging systems are providing dramatic evidence that the brains of males and females process information differently. Moreover, recent behavioural, neurological and endocrinologic research indicates that the effects of sex hormones on brain organisation occur so early in life that, from one's birth, the environment acts on differently-wired brains in males and females (Kimura, 1992: 19). Furthermore, the biological factors that contribute to many sex-specific behaviours can be traced both to differing levels of sex hormones and sex-specific differences in the brain. The implications of these findings for public policy force us to conclude that 'men and women have been living for the past thirty years with the absurd expectation that moral and political correctness demands gender sameness' (Nadeau, 1996: 14).

Brain differences by sex

There are three major areas of sexual differentiation: internal genitalia, external genitalia and the brain. Although all three have genetic-hormonal foundations, attention here focuses on sex differences in the brain. The evidence comes from extensive animal studies and more recent studies using PET- and MRI-based imaging research on humans (see Appendix). Attention has centred on two major sites, the hypothalamus and the corpus callosum which connects the two hemispheres, but other regions of the nervous and endocrine systems also exhibit differences by sex. It must be emphasised that the research findings reflect statistical averages and variations, and that causality remains largely speculative, although evolutionary theories abound.

Male brains are on average larger than females, but this is mostly due to body

size differences. However, significant differences lie in the size and functioning of particular brain regions. The hypothalamus is a natural target for such research because it is the regulatory centre of primal activities including feeding, drinking, blood pressure, body temperature, growth and emotional responses. This dime-sized region of the brain controls and modulates sexual behaviour and is rich in androgen receptors. The hypothalamus is symmetrical, containing ten or so nuclei on each side. It is not only interconnected with the functions of the amygdala and hippocampus, but also controls secretory function of the pituitary gland. The sexually dimorphic nucleus of the hypothalamus is associated with sexual behaviour, neural control of the endocrine glands and sexual orientation. When a child is 2 to 4 years old, the release of testosterone promotes cell growth and prevents cell death in this nucleus and as a result it doubles in size in male children.

The region termed the medial pre-optic area has been found to have a vital role in male-typical sexual behaviour. This region has major hormonal inputs, especially testosterone, and incorporates several small nuclei as well as axonal tracts. When this region is destroyed in male animals, there is a cessation or reduction of copulatory behaviour. Conversely, when this region is stimulated electrically it has the opposite effect. Two of the nuclei in this region, INAH 2 and INAH 3 are, on average, larger in males than in females.

In contrast, female-typical sexual behaviour is modulated in a region slightly behind the medial pre-optic area, in the ventromedial nucleus. Although it has been linked to feeding behaviour, this nucleus is associated with female copulatory behaviour and is strongly influenced by sex steroids. Sex-specific experiences have also been isolated in the sirprachiasmatic nucleus in the hypothalamus, which is spherical in males but elongated in females. For both males and females an intact hypothalamus is necessary for generation of sexuality, and puberty for both sexes is under its direct control through its complex circuitry with the neocortex and the amygdala.

Differences in metabolic activity in the brains of males and females have also been discovered through brain imaging studies. One study found seventeen regions of the brain where there were statistically significant differences in brain activity between male and female subjects at rest. Also, men on average have higher levels of activity in the temporal limbic system, a more primitive area of the brain associated with activity. In contrast, women have higher levels of activity than men in the middle and posterior cingulate gyms, areas of more recent evolution associated with symbolic action. Despite significant differences, there remains significant overlap in the sexes, however.

Although the hypothalamus is critical in explaining differences in sexual behaviour between male and female subjects, recent studies have also found substantial differences by sex in other areas of the brain associated with non-sexual abilities, functions and behaviours. The splenium, for instance, which is the back part of the corpus callosum, has been found to be larger in females than males. Because the corpus callosum connects the right and left hemispheres, if the actual number of fibres connecting the two hemispheres is larger

this could explain why female brain function is less symmetric than males. Communication between the hemispheres in females could thus be heightened because there are more routes connecting them. This could also help explain why damage to one hemisphere in a woman has a lesser effect than a comparable injury in a man (Kimura, 1992: 123).

The implications of these findings for the processing of information and for specific cognitive abilities are considerable. Research demonstrates that in part because of the greater interaction between the hemispheres of women, the cognitive tasks of women tend to be localised in both hemispheres. In contrast, in males the two hemispheres act more independently, thus localising cognitive tasks in only one hemisphere.

Language functions, for example, tend to be localised in different regions of the brain for men and women. One MRI (Magnetic Resonance Imaging) study found that the male brain performs language tasks in the inferior frontal gyms of the dominant hemisphere, while in females it takes place in both hemispheres (Shaywitz *et al.,* 1995). Because females have a stronger concentration of left-hemisphere linguistic function as well as more reliance on the right, they have a superior ability to learn complex grammatical constructions and learn foreign languages. The heightened interaction with the right hemisphere appears to enhance the range and complexity of linguistic representations in women. It might also help explain women's relative advantages in associational, expressive and word fluency (Hyde and Linn, 1998).

The question of why male and female brains vary continues to be speculative although the differences have been linked to exposure to sex hormones during the prenatal period. Kimura terms these effects as 'organisational' because they appear to alter brain function permanently during a critical developmental period. Moreover, administration of the same hormones at later stages of development has no such effect, although cognitive patterns may remain sensitive to hormone fluctuations throughout life. 'Taken altogether, the evidence suggests that men's and women's brains are organized along different lines very early in life. During development, sex hormones direct such differentiation' (Kimura, 1992: 125).

The prior question as to why such developmental differences exist is even more speculative, but one evolutionary perspective is widely discussed in the literature. Under this theory, sex differences in cognitive patterns arose because they proved advantageous. The assumption is that our brain, essentially unchanged over the last 100,000 years or so, reflects a division of labour in hunter-gatherer societies that put different selection pressures on males and females. Males were responsible for hunting which required skills in long-distance navigation, the shaping and use of weapons, and spatial acuity. Women, on the other hand, had responsibility for raising children, tending the home area and preparing food and clothing. This responsibility would require short-range navigation, fine-motor capabilities and perceptual discrimination sensitive to small changes in the environment, skills that are consistent with findings of cognitive research. Moreover, men would need to be more aggressive for hunting

and defence while women would require co-operative and consensual skills in the home and community.

Behavioural differences by sex

Whatever the ultimate cause of sex differences in the brain, they are reflected in varied cognitive capabilities and behavioural tendencies. In addition to the language skills differences discussed above, men on average perform better than women do on certain spatial tasks, particularly those involving mental rotation. They also out-perform women in mathematical reasoning tests, route navigation and target-directed motor skills like throwing a baseball. Men and women in general construct three-dimensional space differently. Although women are stronger at verbal reasoning in mathematics, men are stronger in abstract mathematics. Other research has demonstrated that women, on average, are more skilled at hand-eye co-ordination, have better sensory awareness, have better night vision and wider peripheral vision, have longer attention spans and are less likely to be either dyslexic or myopic.

Studies of infants have found that males are more interested in objects than people, are more skilled in throwing objects, and are better in following objects in space. By contrast, female infants are more interested in people's faces and their voices and appear to be significantly more adept at assessing mood based on visual or voice cues. The games of girls place emphasis on co-operation and physical proximity, and they are anxious to integrate newcomers into the group play. Interaction is favoured over specialised roles. Boys' games emphasise competition and action and favour clearly defined winners and losers. They are indifferent to newcomers and accept them only if they are useful. Girls have also been found to be better auditory listeners while boys are better spatial-visual listeners.

Brain research casts doubt on the wisdom of school systems eliminating recesses on grounds they are sexist. It is very possible that males particularly need physical outlets and that breaks from the classroom allow for dispersal of energy that otherwise will be manifested in the classroom in the form of hyperactive behaviour. An interesting study would be to examine the relationship of Ritalin use to school district policy on recess.

One of the most studied differences between the sexes is aggression. Aggression has been found to be highly dependent on prenatal androgen exposure. Most research attention has focused on the role of the amygdala, especially the corticomedial and basolateral nuclei which contribute to behaviour that has a strong emotional loading such as aggression or fear-driven behaviour. Destruction of the amygdala in animals leads to docile behaviour. Moreover, studies of girls exposed to excess androgens during the prenatal period, who as a result have congenital adrenal hyperplasia, show that they grow up more aggressive than their unaffected sisters (Kimura, 1992: 122).

Male-typical behaviour, therefore, demonstrates a strong bias toward action, heightened aggression and command-oriented hierarchical structuring. Female-typical behaviour, conversely, places more emphasis on consensus, co-operation

and interaction. While the male brain constructs reality in terms of vectors marking distance and space, and is thus very segmented, the female brain tends to construct reality in terms of more extensive and interconnected cognitive and emotional contexts. As a result females are more likely to feel a need to be included and attached, to share mutual feelings and to receive confirmation of these feelings. Men, on the other hand, remain more distant, unattached and independent.

Neuroscience research, then, gives us new insights into why male and female interests, abilities and worldviews are often at odds. It demonstrates that the influence of hormones on neural development is a powerful explanatory aid for patterns that have long been centres of controversy. Although considerable caution must be used in interpreting any of these data, the cumulative impact of this research on our understanding of human sexuality and of non-sexual differences between men and women is significant. While these findings do not negate the importance of nurture to any individual's behaviour or capabilities in these areas, they undoubtedly place learning in a much different context than has been the norm. For Nadeau:

> When men and women tend to solve problems differently, perceive different sets of relevant details, and display different orientations toward objects and movements in three-dimensional space, this is not merely learned behavior. These habits of mind are conditioned by sex-specific differences in the human brain.
>
> (Nadeau, 1996: 12)

Given this type data emerging out of neuroscience, it is little wonder that the findings of neuroscience and of our knowledge of the brain's influence on behaviour are not universally welcomed.

The brain and sexual orientation

One of the most controversial findings of neuroscience centres on the role of the brain, in combination with the genes, on sexual orientation. In 1991, Allen and Gorski found differences in the size of the anterior commissure, the axonal connection between the left and right hemispheres. While the major finding was that on average it is larger in women than men, they also found that it is on average larger in gay men than either straight men or women, indicating that cerebral functions are less lateralised in gay men than straight men.

In a highly publicised extension of this study, LeVay (1991) scanned the cadaver brains of gay and straight men and women assumed to be heterosexual. He focused his attention on the INAH 3 nuclei in the medial pre-optic region of the hypothalamus which is known to be sexually dimorphic, larger in males than females. As noted earlier, this region has major hormonal inputs and is characterised by high levels of androgen and oestrogen receptors. LeVay found that on average the INAH 3 nuclei of gay men was the same size as that of the women

and two or three times smaller than that of straight men. This finding suggests that gay and straight men may differ in central neuronal mechanisms that regulate sexual behaviour. LeVay suggested two possibilities as to how this might come about. First, it could result from differences in levels of circulating androgens among gay and straight foetuses at the critical period for development of the INAH 3 nuclei. Or second, it could be that while levels of androgens are similar, the cellular mechanisms by which the neurons of INAH 3 respond to the hormones are different (LeVay, 1994).

LeVay concluded that, while both inborn and environmental factors influence the anatomical and chemical structure of the brain, there is much to recommend the theory that there are 'intrinsic, genetically determined differences in the brain's hormone receptors or other molecular machinery that are interposed between circulating hormones and their actions on brain development' (1994: 127). Although the factors that determine sexual orientation are not yet known, LeVay posits that it is 'strongly influenced' by events occurring during early developmental period when the brain is differentiating sexually under the direction of gonadal steroids.

If there are indeed differences in the brains of gay and straight men, it is not unlikely that a gene or genes exert an influence on this process. It has long been known that homosexuality runs in families, but only recently has this been confirmed by twin studies. Bailey and Pillard (1991), for instance, found that if one identical twin is gay the other is three times more likely to be gay than if the twins are fraternal. Having a gay maternal twin makes your likelihood of being gay about 50 to 65 per cent while the corresponding figure for a fraternal twin is about 25 to 30 per cent. Other studies have found that having a gay brother increases one's chance of being gay to about 25 per cent as opposed to the male proportion of the general population of 2 to 4 per cent. In a comparable study of female twins, 48 per cent of maternal twin sisters of lesbians were lesbians, while the figure for fraternal twin sisters was approximately 16 per cent (Bailey, Pillard and Agyei, 1993).

There are three models that might explain these data of a genetic component of homosexuality; the direct, the indirect and the permissive effect models. In the direct effect model, the genes influence the brain structures that mediate sexual orientation. In one approach of the direct effect, a gene directs a specific pattern of RNA synthesis, which in turn specifies the amino acid sequence of a particular protein that in turn influences the behaviour. Under the indirect effect model, genes code for personal factors such as temperament, which influences how the individual reacts with his or her environment. And finally, under the permissive model genes influence neural substrates on which sexual orientation is shaped during the formative years. Although none of these models excludes an environmental component and the importance of many intervening pathways between genes and behaviour, the direct model allows for less intervening influence (Schuklenk *et al.* 1997: 8) by assuming a more direct linkage between genes, hormones and sexual orientation. In each model, however, the operative genes must be identified if they are to move beyond speculation.

In 1993, Hamer and associates found hereditary linkages of gay patterns in the maternal line. This sex-linked pattern of inheritance suggested that a gene on the X chromosome might influence sexual orientation in men. They examined DNA from the X-chromosomes of gay men and found a cluster of DNA markers at one end of the chromosome in a region called q28 that was statistically linked. Although a gene was not isolated, this evidence suggests that somewhere in the Xq28 region there is a gene or genes that predisposes a man to be either gay or straight. There would be a 50 per cent chance of getting two X-chromosomes from the mother. This study has spurred even more interest in finding the gene, although its findings have been strongly challenged by Marshall (1995) and others and it has not yet been replicated.

Although many gays, including LeVay and other researchers, welcome the evidence that homosexuality has a genetic and neurological base, some observers contend that in a homophobic prejudicial society it will have a strong negative effect on gays (Schuklenk *et al.,* 1997: 12). As with other areas of genetic screening, there is a danger that presence of a gay gene or DNA marker will stigmatise the carrier or institutionalise the use of prenatal diagnosis and selective abortion of foetuses identified with the gene. Should such policies or practices be adopted, any potential gains that gays have in arguing that homosexuality is an immutable characteristic, a natural state like left-handedness, will be overshadowed by these practices.

Moreover, some have argued that the very research that attempts to find a gay gene or gay brain has a homophobic framework that will emphasise these traits not as natural polymorphisms but as dysfunctions or abnormal brain development (Schuklenk *et al,* 1997: 9). Even the motivation for seeking the origin of homosexuality is suspect, they argue. In the end, how society perceives and uses this information is political and it will evolve in the broader social context to the extent there remains a latent or expressed homophobia in a society. Knowledge of the genetic-neural bases of sexual orientation will do nothing to stem discrimination against gays even though it demonstrates that homosexuality is a natural state. Whatever findings emerge from science, the response to this knowledge by society depends on society and thus only indirectly through our collective neural connections. These findings regarding biological foundations of behaviour, however, do raise concerns over the capacity of humans to have free will and its implications for individual responsibility.

Biology, free will and public policy

Free will as a concept has concerned philosophers for centuries and remains a problem to this day. This is not surprising since this concept, along with responsibility and freedom, plays a central role in the way we view ourselves. The belief that we act freely and are morally responsible for our actions is at the base of retributive justice systems and provides a rationale for legal responsibility. Without free will it is meaningless to blame the person for his or her actions, thus free will is necessary to justify punishment, blame or moral condemnation

(Double, 1991: 4). Moreover the personal stance we take towards each other is based on a belief that humans are capable of moral responsibility and deserve moral consideration. The view we take on free will largely directs our attitudes towards personal accountability and reward and punishment.

Free will is also associated with human dignity. Humans are to be treated as ends in themselves because they are the originators of their own ends or purposes. Free will and rationality are thus intractable. Free will is the power to originate choices, 'the power of agents to be the alternate creators (or originators) and sustainers of their own ends and purposes' (Kane, 1996: 3). A belief in free will thus presumes a special status in the world for humans. We choose to believe that what we will, what we desire and what we decide are determined by oneself; that each self is a rational agent, not subject to physical laws, but influenced by reason (Trusted, 1984: 3).

Moral responsibility

In turn, our concepts of justice, punishment and deserts are based on our notions of individual responsibility. Without responsibility, it is meaningless to use those terms. Likewise, without free will moral responsibility is vacant since, in a deep sense, it requires that we are truly deserving of praise or blame because it is up to us what we do. It is a deep and essential feature of life in modern Western society that normal human beings who have reached some level of maturity regard themselves and one another as responsible beings (Wolf, 1990: 3).

Although we make exceptions for those who lack free will, we take responsible beings more seriously than non-responsible ones. We treat them as persons, not objects; we credit them and hold them to blame, and attribute qualities and events to them more deeply than to others. Responsible beings are rational beings with free will. 'Rational judgement, like rational action, presupposes freedom. If there is no free will, we are not independent rational beings reaching reasoned conclusions on the basis of evidence and arguments, but mere automata' (Lucas, 1993: 29). Not surprisingly, it therefore seems natural and reasonable to grant oneself and those like us the status of responsibility and free will.

Determinism and free will

Although instinctively free will generally reflects our views of our self and others and is central to our view of the world, this belief has come under attack from many quarters.[1] The earliest and most persistent challenges to free will have come from an array of theories which assert that all our intentions and actions are determined or necessitated by factors beyond the control of our will. Determinism is the doctrine that all events including human actions are the consequence of external forces and that as a result we cannot be the originators of our thoughts or actions. Therefore, free will is but an illusion. The earliest

external forces were fate or divine intervention, but these were eventually joined by every kind of determinism imaginable.

At present the most widely believed form of determinism is physical in nature. In its generic form this determinism concludes that all events including human behaviour are the consequence of prior physical events operating in accordance with established regularity, thus producing a predictable effect. In turn each prior event would be caused by a prior event. Physical determinism argues that human action can be explained by physical events themselves while ideological determinism appeals to some conscious purpose, but argues that thoughts and intentions themselves are produced by physico-chemical events in the brain.

Kane finds it interesting that deterministic thinking about human behaviour has been on the rise in the twentieth century at the same time that quantum theory has reintroduced in-determinism in physics (1996: 10). He suggests that developments in the biological and behavioural have convinced many people that behaviour is determined by causes unknown to us and beyond our control. It seems the ideological and scientific have merged to support determinism. Research on the human genome, biochemical influences on the brain, cognitive sciences involving artificial intelligence, psychoanalysis and other theories of unconscious motivation, behaviour modification and psychological conditioning, ethology and upbringing together provide formidable support for external determinants of human behaviour. While the rapid advances in these areas certainly point to more complete explanations of human behaviour, the question is whether they necessarily lead to the conclusion of Richard Double that free will and moral responsibility, 'as they are viewed in philosophical discourse and everyday life, are not to be counted as candidates among the class of real entities' (Double, 1991: 5)?

If, as Double argues elsewhere, free will is nothing but our 'venting of non-truth-related attitudes', and thus there can be no such thing as free will or as moral responsibility (1996: 3), where does this leave us? While the notion of free will has always been problematic and will be more so in light of genetics and neuroscience, the debate over free will cannot end because the idea of free will, though instinctive and subjective, is itself useful in understanding human behaviour.

Free will and individual responsibility

The notion that individuals have the capacity to make choices free of any deterministic force beyond their control is central to rational models of human behaviour and a critical tenet of democratic theory. It is assumed in classical democracy that citizens have the ability to make decisions free of external and internal constraints. Justice systems also depend on free will in assigning responsibility to individuals for their actions and must make specific exemptions in cases of insanity or diminished capacity. The evidence of genetic and neuronal contributions to criminal action has been used in many cases as a defence against

guilt, based on the lack of free will on the part of the defendant. The 'devil made me do it' defence of the past has now become 'my genes made me do it' or 'my neurons made me do it'. This argument has also been used to excuse other antisocial behaviours as well as unhealthy lifestyles.

One area where neurological findings might be on a collision course with rational policy initiatives, for example, deals with crimes motivated by hate for members of particular groups. These 'hate' crimes have become prominent in legislation and central to a Clinton administration initiative. The assumption is that the perpetrators of such acts are conscious of the reasons they hate and capable of controlling their hatred and fears. In a word they are responsible. However, if, as suggested by Restak (1994a: 148), that fear is organised deep within sub-cortical memory circuits in the amygdala that arouse strong emotional passions at levels inaccessible to consciousness or willed deliberation, can we blame the individual for acting on these deep-seated emotions? Although early socialisation to mitigate these emotions might be effective in individuals, uncontrolled hatred and fear by groups seems impervious to change by persuasion or compromise.

These mechanisms might explain why long-standing problems in the Middle East, Bosnia, Northern Ireland, Somalia and Cambodia, for instance, seem unresolvable no matter how much effort is expended. If neuroscience findings are correct, it is not likely that foreign policy in these areas based on shaking hands over principles by leaders will end generations of fear and hate. If at by age three or four the brains of the children are programmed to react with fear and hatred beyond the realm of rational neo-cortical brain activity, it seems that only early intervention in children will be effective in the long run.

What are we to make of biological findings which demonstrate that human behaviour is dependent on gene and neuron-based proclivities? Does this relieve society of responsibility for changing circumstances that would reduce anti-social behaviour? Does it mean that efforts by society to resolve individual and group problems are a waste of effort? Are Nelkin and Lindee accurate when they state:

> The notion of biological predisposition can relieve personal guilt by implying compulsion, an inborn inability to resist specific behaviors. Biological explanations deflect attention away from the social and economic circumstances that may drive people to violence, depression, overeating, or drink, but they also provide an excuse for those who, driven by their predispositions, their irresistible biological drives, need not blame themselves.
>
> (1995: 144)

Given the intractable interaction between biological and environmental-social factors and the strong evidence as to how the environment influences brain development and function, there is nothing in neurological research that suggests abrogating social responsibility. In fact all evidence suggests the need for early

stimulation of the brain in a positive, rewarding environment and for the protection of pregnant women during the critical neural development period for the foetus.

Where then does this leave us concerning individual responsibility? Does our new knowledge of genetics and neurology mean that individuals no longer can be held responsible for their actions because they lack conscious control? Does this knowledge in effect negate the concepts of free will and individual responsibility, which serve as the foundations of our legal and moral systems of justice? Although we believe the answer to these questions is no, they are issues that are certain to frame the debate in coming decades as the human genome project and the fruits of neuroscience combine to link human behaviour to genes and neurotransmitters. Despite evidence of brain-behaviour linkages, it should be noted that neural functioning remains a weak predictor of behaviour. Even obvious cases of brain damage to the frontal lobes do not always lead to behavioural abnormalities or deficits. Magnetic Resonance Imaging (MRI) routinely identifies abnormalities, which have had no discernible effect on the person's behaviour. Moreover, most individuals with antisocial behaviour exhibit normal brain functioning as measured by current technologies.

The fact that we are now aware that all expressions of what we view as the mind, including free will, are affected by the biochemical, electrical state of the brain should not force us to abandon the notion of a free will, although it does require a refinement of it. For all the growing evidence on the crucial roles of the brain and genes for behaviour, rarely are they determinative. Alcoholics under twelve-step programmes can and often do refrain from drinking. Although they do not attribute this to will, certainly it plays a critical role in some form. Even some paedophiles have been known to control their compulsions. Despite the knowledge of neuroscience, humans do retain the capacity to make conscious decisions - this is what continues to separate us from other mammals. The notion of free will is still functional, although the traditional notion based on *tabula rasa* has long been outdated. Although the demise first of the soul and then of the mind are troubling to many, they do not signal the end of ultimate individual responsibility for actions.

That we are not the fully rational, entirely conscious creatures whose actions are determined solely by logic and reason should come as no surprise. The ever-rational Mr Spock of Star Trek fame is not of the world of humans even though Descartes might have wanted it so. Humans are constrained by brains that have evolved from primitive times where emotions of fear and aggression were crucial to survival. Although free will in an absolute sense is, and most likely always was, a philosophical artefact with little grounding in reality, it remains relevant though qualified at least at the margins. With few exceptions, individuals ultimately bear responsibility for their actions.

The concepts of free will and individual responsibility face pressures, not only from emerging knowledge in genetics and neuroscience, but also from changes in social values that would isolate individuals from personal responsibility for their decisions. Although genetic and neurological findings are likely to contribute to

this process they, themselves, must be placed in the broader perspective of changes in social values which appear to have a momentum of their own. The biggest danger is that genetic and neurological arguments are used to reinforce this view that free will is no longer relevant and that moral responsibility is thus impossible.

Biopolicy: a summary

Whether at the individual, societal or global level, biopolicy issues are increasingly becoming crucial to our survival. The issues overviewed in this chapter represent some of the most volatile and problematic social policy issues facing humans in all societies in the twenty-first century. It is critical that political scientists be involved in the policy dialogue over these issues and bring their unique perspectives to it. It is just as critical, however, that they become informed about appropriate research in the life sciences in each case or they can not be taken seriously as policy analysts. As noted earlier, in many of these policy areas political scientists are either conspicuously absent or they are not taken seriously because they lack the necessary biological knowledge to be taken seriously by other participants.

The implications of life science research and the rapidly expanding knowledge of human behaviour coming from the biological sciences can no longer be dismissed by political scientists trained in public policy. Furthermore, models of policy making must be modified to include the emerging knowledge of the impact of biology, genetics and neurology on decision-making and thus on the policy process itself.

Note

1 The goal here is not to provide an exhaustive review of the philosophical debate over free will. There are almost as many positions on free will as there are persons who have written about it. Major categories of free will thinkers include libertarians, determinists, compatibilists and incompatibilists, but the variations are endless. For useful contemporary works on free will, see Dennett, 1984; Churchland, 1988; Honderich, 1988; Strawson, 1986; Double, 1991, 1996; Kane, 1996; Trusted, 1984; Lucas, 1993; and White, 1993.

7 Biopolicy II

Ecology and environmental issues at the global level

> The world in which we now live is a world of very obvious danger and potential extremity, the first epoch in human history in which it was readily open to millions of human beings to see the earth over time as a natural habitat perilous for the entire species to which they belong and, above all, the first epoch in which men and women could soberly confront the possibility of a natural end to their own species brought about through human action itself. These dangers, to be sure, for most of us bewilder more than they enlighten. The passion of fear on which Thomas Hobbes hoped to build so much is here woven too deeply into the occasions for experiencing it to lend us any very enlightening guidance on how to lower it to more tolerable levels. The classical preoccupations of political theory with legitimate rule, a domestic social good, and the casuistry of just or unjust warfare are not comprehensively irrelevant to this menace. But they fall rather obviously short of showing us how to confront it.
>
> (John Dunn, *Interpreting Political Responsibility,* 1990: 196-7)

Introduction

Whether they prove to be timeless or not, most political theories originate as a response to a particular crisis or problem (Wolin, 1960). We begin this discussion of environmental and population issues in global politics by emphasising the direct relevance of the life sciences and evolutionary theory to the macro-level issues associated with the current global environmental crisis. Our contemporary crisis, variously described, is fundamentally (though not exclusively) an ecological one, and what most needs criticism from a life science perspective (biopolitics) at the present time are those political and economic strategies that no longer appear to serve as successful, long-term survival strategies for our species.

Advocates of Green politics have characterised our current crisis in the following way:

> The starting point of Green politics is the recognition that we find ourselves in a multifaceted, global crisis that touches every aspect of our lives: our health and livelihood, the quality of our environment and our social relationships, our economy, technology, our politics - our very survival on this planet. The nations of the world have stockpiled more than 50,000 nuclear

> warheads, enough to destroy the entire world several times over, and the arms race continues at undiminished speed. While world-wide military spending is more than one billion dollars a day, more than fifteen million people die of starvation annually - thirty-two every minute, most of them children. Developing countries spend more than three times as much on armaments as on health care. Thirty-five per cent of humanity lack safe drinking water, while nearly half of its scientists and engineers are engaged in the technology of making weapons. Economists are obsessed with building economies based on unlimited growth, while our finite resources are rapidly dwindling; industrial corporations dump toxic wastes somewhere else, rather than neutralizing them, without caring that in an ecosystem there is no 'somewhere else.' Modern medicine often endangers our health, and the Defence Department itself has become a threat to our national security.
>
> (Spretnak and Capra, 1985: xv; cited in Carter, 1999: viii)

To drive this point home as we write, infectious disease is on the rise in Russia as the health-care system deteriorates. Without effective health care, cases of hepatitis, syphillis, tuberculosis and HIV are skyrocketing. Where formerly under the Soviet Union TB was nearly under control, it has now become epidemic (Zuger, 2000). Kaplan (1998) describes the devastating conditions of poverty and disease in Africa and other parts of the world. And Hertsgaard's *Earth Odyssey* (1999) portrays in stark detail the depressing realities of environmental degradation, illness and poverty. The unevenness of this global problem is underscored by Hertsgaard (1999: vii). If poverty is the biggest environmental challenge of our time, however, wealth is the biggest environmental burden. The consumption patterns of the nearly one billion people who live in the affluent world of Europe, North America and other industrialised countries cause much more environmental damage - more greenhouse gas emissions, more forest cutting, more soil, air and water pollution - than do the strivings of the impoverished human majority. China again illustrates the point. Measured by population, the Chinese outnumber Americans nearly five to one. Yet the United States dwarfs China's total environmental impact because Americans consume fifty-three times as many goods and services per capita.

William Ophuls (1977, 1997) has argued that the liberal foundations of modernity, as they have influenced modern politics, must now be found wanting in the context of our current predicament. Liberal democratic capitalist systems' over-reliance on individual strategies of consumption (Wachtel, 1998; Leiss, 1972, 1976) and the resultant exploitation of the natural environment are proving to have profoundly negative consequences for the natural world, and thus for our species as well as other species resulting in a loss of biodiversity. Tim Hayward (1998), in advocating a political theory informed by ecological values, has taken the position that we must find ways to integrate ecological values expressed as interests into our already self-interest driven policy processes. These two theorists, Ophuls and Hayward, might be taken to represent examples of

what Stavrakakis (1997) distinguishes as ecologism and environmentalism. The former refers to a more extreme and thoroughgoing ideology (that for some supports an expanded role for state control and even authoritarian politics) and the latter reflects the incrementalist model of politics where environmental concerns are addressed, but piecemeal over time through liberal democratic capitalist systems and in contention with other goals and values (see also Eckersley, 1992).

We shall be less concerned here with debates about the important differences in these ideological positions (but see Ferry (1992) for a critique of 'deep ecology' and its ideological implications) and more concerned with the significance of persuading political scientists and policy makers of the need to 'think ecologically'. This requirement means thinking more synthetically, holistically and systemically than thinking analytically based on a mechanistic worldview or, more importantly, a worldview that sees the natural environment as subject to the control of human beings and as a limitless resource that is ours to exploit. (See Masters (1977) for an attempt to develop a typology of political theory in relation to man's position relative to the natural world and man's attitude toward the natural world.)

The British political theorist John Dunn (1990: 200-1) would have us develop a modern sense of prudence that goes well beyond instrumental rationality to embrace the need for a reconceived political community. We certainly agree with Dunn and would assert that we are especially in need of that quality of vision that has so often been associated with the most time-honoured works of political theory (Wolin, 1960). We must have a new biopolitical theory of a global ecopolitical community that is both compelling and rooted in a contemporary understanding of evolutionary biology and ecology. We desperately need ecological prudence throughout the world today. As Masters, G. Schubert and Corning all support in their biopolitical theories, a life-science-based approach to political science must address all levels of reality and must be capable of studying those phenomena with various methodologies. The interactional paradigm requires that we give our attention to genes, the body *and the environment,* and ignore none of them.

Although we cannot hope in this chapter to contribute significantly to the larger project of articulating an ecologically based policy agenda set in the context of biopolitical theory, we do hope to be able to delineate several lines of inquiry and areas of priority for public policy that are essential to that endeavour. At the outset, let us say that there are three distinct lines of contemporary inquiry, each popular in the social sciences, that we could draw upon to explicate the political issues raised by current environmental crises and the 'climacteric' (see p. 136). The first of these is the biopolitical, which has been presented earlier and will be used in this chapter. The second is rational choice theory and economic theory, joined with utilitarianism and liberal democratic capitalism (see Kassiola, 1990) which are representative of mainstream Western political ideology. And the third is post-modern critical theory, which generally reduces to subjectivism and is not discussed at any length here. Nor will we consider Marxist-socialist theories,

although contemporary work by proponents has much to say about the defects of liberal democratic capitalism and the impact of the wealthiest countries on the poorest countries, but with far less emphasis on environmental issues. We shall argue that a biopolitical perspective, informed as it is by evolutionary theory and ecology, is preferable and offers real possibilities for characterising the problems we face and challenging many of the prevailing assumptions that guide policy.

The ecological critique of modernity

Any attempt to characterise, much less critique, modernity is fraught with extreme difficulty (see Toulmin, 1991). Nonetheless, some characterisation is necessary.[1] The most fundamental component of modernity to come under scrutiny will be the 'Idea of Progress' and the assumptions contained within that powerful idea. Those assumptions are that progress - of all sorts including material, intellectual, moral, political - is inevitable and that through the application of human rationality (characterised as disembodied, instrumental reason) all problems can be solved. In our view, it is the acceptance of the idea of inevitable, linear progress that undergirds both the liberal democratic capitalist tradition and the other main current of modern political thought, socialism-communism. As well, all the variations on those main currents that have taken the form of theories of modernisation-development-dependency are fundamentally rooted in the commitment of modern political theorists to the proposition that things are and will become better, and that largely through the application of human reason through science and technology the fundamental problem of scarcity will be solved, or at least 'rationally managed'.

If the research in biopolitics to date has revealed anything, it has revealed the impoverishment of the belief in inevitable progress. Proponents of biopolitics argue for the replacement of that view with a view of evolutionary change that is informed by the life sciences, especially by contemporary evolutionary theory, including the possibility of a theory of punctuated-equilibrium that postulates abrupt and transforming change rather than gradualism (Somit and Peterson, 1992; Schubert, 1989; Corning, 1983; Masters, 1989). These theorists all realise that progress, however it may be defined, is relative to a particular set of environmental conditions and that the ongoing process of adaptation to changing environments, while (following Corning, 1983) tending to involve greater complexity, is inevitably contingent, and complexity at one level may lead to simplicity at another level (see also Laszlo, 1991 and Sutherland, 1973). Above all, these theorists recognise the interconnectivity among all levels of reality and the multi-causality that characterises living systems.

All the prevailing ideologies of the modern age, then, have embraced to varying degrees a fundamental belief in the Idea of Progress. We must replace the idea of inevitable progress with a life sciences based knowledge of evolution and human behaviour if we are to be able to address the problems associated with a deteriorating natural environment. As we have shown in chapter 2, contemporary biopolitical theory must be built upon a life-science approach that

includes, following Schubert (1989: 324), ethology, ecology and evolution. All three of those components are essential to our ability to understand man in nature.

We have been arguing for a framework for political inquiry that rescues political science from a very particular set of problems - problems that primarily result from the desire to achieve maximum freedom for individuals, especially freedom to pursue their individual economic agendas, based on the erroneous assumption that this development is inherently progressive and that it inevitably contributes to the common good. From a biopolitical perspective, it is species survival that is the ultimate goal. A glimpse of what concerns us is reflected in William Connolly's suggestion that 'perhaps modernity is the epoch in which the destruction of the world followed the collective attempt to master it' (Connolly, 1988: 1). Still following Connolly, our task is to 'call the modern project of mastery into question' *(ibid.).* Incidentally, this critique of modern rationality is well represented in the essay on 'Rationality' by the English political theorist Michael Oakeshott (1962; see p. 133).

We argue here that biopolitics provides a better vantage point than other frameworks in contemporary political science to avoid the fundamental problems of what might be called 'hyper-rationalism' and 'hyper-individualism.' Both represent extreme views closely associated with modernity in the West. Biopolitics can contribute to our avoidance of the hubris so often associated with modernism by reinforcing our need to see ourselves as part of a biological continuum rather than standing above and apart from other life forms. In stark contrast to the 'possessive individualism' of liberalism (following MacPherson's use of that expression) and the stifling collectivism often accompanied by authoritarianism of socialism-communism in practice, ecopolitics must seek to promote the collective good by giving priority to the maintenance of a physical environment that increases the likelihood of the survival of the human species. From a political and policy standpoint, more than anything else, perhaps, biopolitics challenges the priority of growth in general and economic growth in particular and the protection in the extreme of individual property rights as primary political and policy goals insofar as these goals begin to become threatening to our very survival. As noted in our discussion of Coming's work (1976; 1983), the policies that are needed are those that contribute to a successful survival strategy today.

Modern rationalism and the liberal idea of progress: threats to survival in the twenty-first century

In 1929 Alfred North Whitehead delivered a series of lectures in which he offered the following as a definition of the function of reason: 'The Function of Reason is to promote the art of life.' Reason is then a tool or process inherent in man which it utilised by man to sustain his existence through the modification of his natural, social and symbolic world. As Whitehead so aptly describes the activity: 'The higher forms of life are actively engaged in modifying their envi-

ronment. In the case of mankind this active attack on the environment is the most prominent fact in his existence.' Further, he categorises the attack on the environment as a 'three-fold urge: (1) to live, (2) to live well, (3) to live better. In fact, the art of life is first to be alive, secondly to be alive in a satisfactory way, and thirdly to acquire an increase in satisfaction.'

As a tool or process or method, reason does not represent the complete armament of man in his quest for life; it is a tool, though certainly a powerful one. However, since the eighteenth century, reason - largely in the form of science and, from science, technology - has come to dominate the range of responses made by man to his environment in the West. It has taken upon itself not only the function of helping man cope with his environment but of passing judgement on the quality of that environment and radically altering that environment.

In politics, it has been argued, the use of reason has largely given way to the intellectual fashion described by Michael Oakeshott as modern rationalism. As Oakeshott sees it:

> The conduct of affairs, for the Rationalist, is a matter of solving problems, and in this no man can hope to be successful whose reason has become inflexible by surrender to habit or is clouded by the fumes of tradition. In this activity the character which the Rationalist claims for himself is the character of the engineer, whose mind (it is supposed) is controlled throughout by the appropriate technique and whose first step is to dismiss from his attention everything not directly related to his specific intentions. This assimilation of politics to engineering is, indeed, what may be called the myth of rationalist politics. And it is, of course, a recurring theme in the literature of Rationalism. The politics it inspires may be called the politics of the felt need; for the Rationalist, politics are always charged with the feeling of the moment...
>
> How deeply the rationalist disposition of mind has invaded our political thought and practice is illustrated by the extent to which traditions of behavior have given place to ideologies, the extent to which the politics of destruction and creation have been substituted for the politics of repair, the consciously planned and deliberately executed being considered (for that reason) better than what has grown up and established itself unselfconsciously over a period of time.
>
> (Oakeshott, 1962: 4, 21)

Thus the rationalist, from this view, combines infatuation with method with an undying optimism, which leads him to believe that he can devise a solution for any problem confronting him. The only problem confronting the rationalist politician is the one of choosing the proper form of manipulation, a problem that is then solved with the identification of the dependent and independent variables and the elaboration of a causal model followed by the application of technology. As Simon (1983a) has shown repeatedly, this view of rationality is a fiction, and ignores the human behavioural tendency to 'satisfice' or settle for

something less than perfect rationality, but which is consistent with human nature.

Such an approach to politics is clearly sustained by a faith in progress (Lasch, 1991; Caton, 1990), the inevitability and desirability of change. This is a Western attitude, according to Oakeshott, and is especially prevalent in America, which Oakeshott calls a 'classic case' of rationalism in politics. Parenthetically, and in keeping with biopolitical theory, one might ask what ever happened to the conservatism of Edmund Burke, who told us that 'politics ought to be adjusted, not to human reasonings, but to human nature; of which the reason is but a part, and by no means the greatest part.' The rationalist myth, which Burke struggled against in the person of the theorising of John Locke and as manifest also in the work of the liberal Utilitarians, persists today in only slightly different conceptual guise. In its most contemporary manifestation this view undergirds the ideas of modernisation and political development (see chapter 3). The problem may be reduced to the problem of limiting the pursuit of individually defined goods when the collective good is endangered, following Garrett Hardin, this results in the well-known problem of the 'tragedy of the commons'.

We are not suggesting that the idea of individual liberty or the expansion of human freedom are undesirable - absolutely not. Our view is that of Corning when he says that

> survival is at once an individual and a collective affair - the two levels of adaptation are neither wholly distinct nor wholly concordant. To a considerable extent, the satisfaction of individual needs also furthers the interests of the collective survival enterprise. At the same time, transcendent 'species needs' may directly conflict with individual self-gratification.
>
> (Corning, 1977: 62)

The challenge, of course, is to be able, politically speaking, to assert and guarantee the interests of the collective survival enterprise when that is necessary. Still more important is the issue of what exactly constitutes the collective survival unit. This too is a moving target that must be understood within an ecological framework. Biopolitics reminds us that ultimately the unit is the species. Most recently, with the break up of the Communist bloc, the issue of what is the most important basis (unit) for a political order has thrust itself upon is in the form of virulent nationalistic and ethnic political movements that threaten the stability of numerous political orders, perhaps with good reason (Kaplan, 1996; Moynihan, 1993; Pfaff, 1993). But, whether they will result in successful adaptations remains an empirical question that can only be answered over time.

Ecopolitics: a challenge for political theory

Glendon Schubert, early on in his important work *Evolutionary Politics* (1989), summarises the gravity of the current situation for the human species. For Schubert, the success of humans in the competitive exclusion of other living

species, particularly during the most recent ten to twelve thousand years since we began in a serious way to scarify the natural land with our agriculture, has by no means necessarily been adaptive for our species except from a point of view with as short a range as that. Our increasing technological capacity and tendency to eliminate other living species upon whom we previously had relied for sustenance, as well as ourselves, is an

> index of the extent to which our trophic niche, defined as the functional status of an organism in its community, is being redetermined as much by the indirect as by the direct effects of our predatory activities; and the fossil record is replete with evidence of extinct species whose predation was so successful that they themselves starved to death. The issue goes far beyond the restoration of token vegetation to, and domestic pets from, urban areas or even the apparent trends in the direction of human conspecific predation ranging from licensed hunting in season (under circumstances such that other hunters present more frequent targets of opportunity than the crops of ruminants or rodents available for harvesting). It extends also to the ubiquitous predations now characteristic of all large urban areas in the United States (where only humans can be and are hunted by each other, at least in part because all other prey has been exterminated) ...
>
> The human species cannot destroy the biological community of which humans have been a part without their degradation of that biological community returning as feedback to threaten the human political community.
>
> (Schubert, 1989: 17, 18)

Numerous attempts have already been made (for example, Ophuls, 1977; Ophuls and Boyan, 1992; Ophuls, 1997; Hayward, 1998; Eckersley, 1992, 1998; Kassiola, 1990; Pirages, 1978; Sagoff, 1988; Boulding, 1978; Bryant and Bailey, 1997; Carter, 1999; Dobson and Lucardie, 1993; Earley, 1997; Keil *et al.,* 1998; Mathews, 1996; Potts, 1996; Woodhouse, 1972) to focus attention on the need for an ecological approach and on the limitations of the liberal democratic capitalist model, particularly as that model can be pursued on a global scale in the future. What these ecological critiques lack, for the most part, is a grounding in biopolitical theory of the sort provided by Corning, Masters and Schubert. However, their ecological perspective can easily be accommodated within biopolitical theory. The basic features of an ecological framework are by now fairly well known or are readily accessible to the interested reader. Ecology includes several key principles, which are sometimes presented as laws' (for example, see Odum, 1971; Kieffer, 1977; Ophuls, 1977).

The first of these principles is an ecosystem concept that states that everything is related to everything else. There are vital functional relationships between organisms and their environments. Subsystems of the environment are related to other subsystems and the whole must be understood holistically. Thus, there is widespread interdependence among living organisms and between them

and their physical environments (see Laszlo, 1991). We are only now beginning to appreciate the real significance of these ecological principles as we face environmental problems of the sort presented by global warming or acid rain or the aftermath of a Chernobyl. Yet another version of this first principle is the idea that you can never do just one thing. We simply can't impose rigid parameters on our actions. This is precisely why we so often have to deal with the unanticipated consequences of our actions. Ecology also tells us to value diversity and complexity for those characteristics have been linked with stable ecosystems over time. And finally, ecology denies us the category of 'waste' - everything goes somewhere. Each of these ecological insights presents specific challenges to the current conduct of politics and economics.

Accordingly, one of the most critical items on the agenda for biopolitics at this time is, in our opinion, the elaboration of the ecological component of a life-science perspective for political theory and for politics. The relative absence of this dimension early on in biopolitics was duly noted by one of us (Hines, 1982a). Among proponents of biopolitics, the work of Caldwell (1964, 1987, 1994, 1999) has been the exception. Political theory and public policy must be brought together to provide a new political paradigm (comparable to the liberal democratic capitalist paradigm of the nineteenth and twentieth centuries) that will reflect the values necessary to promote ecosystem stability and sustainable development for the entire planet.

In a recent article, Lynton Caldwell (1999), long an advocate for environmental issues, poses the question of whether the human species is destined to self-destruct because of our failure to understand the fundamental challenges presented to our survival as a result of the degradation of the environment. Indeed, following Eric Ashby, Caldwell accepts the idea that what we are faced with is not a crisis (which will pass) but a climacteric - an ongoing engagement by the human species with the problems of population, of resources and of pollution. The full dimension of this climacteric is only now being realised. A brief review of the various components will have to suffice to make this important point.

Trends of the climacteric

The Worldwatch Institute has published an annual report, *State of the World,* since 1984 as well as other publications that document the various challenges we face. We shall rely on their publications to summarise the various components of that challenge. Brown, Abramovitz, Starke *et al.* (2000) identify seven trends that must be dealt with if we are to manage Caldwell's climacteric. These trends are: population growth, rising temperature, falling water tables, shrinking cropland per person, collapsing fisheries, shrinking forests and the loss of plant and animal species.

The steady increase in global population represents a formidable challenge indeed. As noted by Brown, Gardner and Halweil:

> During the last half-century, world population has more than doubled, climbing from 2.5 billion in 1950 to 5.9 billion in 1998. Those of us born before 1950 are members of the first generation to witness a doubling of world population. Stated otherwise, there has been more growth in population since 1950 than during the 4 million preceding years since our early ancestors first stood upright.
>
> (1999: 17)

As staggering as this trend is, the prospects for continued population growth, despite declines in population growth in the industrial nations, are foreboding. United Nations' demographers project an increase over the next half-century of another 2.8 billion people. 'In contrast to the last 50 years, however, all of the 2.8 billion will be added in the developing world, much of which is already densely populated' (Brown, Gardner and Halweil, 1999: 18). Clearly this trend has profound implications for all of the other six trends mentioned above. While population, per se, is not a 'problem' for the developed world, the developing world continues to see the economic inequalities that characterise the relationship between the two worlds as a significant contributing factor to the population problems of the developing world. Suffice it to say that the issue of population growth is engaged ideologically, politically and economically on several levels. There is no consensus on how many people the Earth can support and on what should be done and who should do what (Cohen, 1995).

It is important to realise that some countries are likely to triple their population during the next fifty years - for instance, Ethiopia, Pakistan and Nigeria. Clearly these countries are ill-prepared to deal with the full implications of this population increase. They, in particular, will feel the pressure from this population growth in the other areas of challenge, such as cropland per person, water resources and shrinking forests. The economic and health challenges faced in these and other countries are severe. Naturally such conditions place tremendous stress on fragile political systems and suggest the real possibility of instability and a host of related problems. 'Worn down by the struggle to deal with the consequences of rapid population growth, they are unable to respond to new threats, such as AIDS, aquifer depletion, and the flooding that can follow deforestation' (Brown, Gardner and Halweil, 2000: 112.). Perhaps the greatest tragedy is that in some of these countries the result has been and will continue to be an increase in death rates. Whether this will 'solve' the problem remains to be seen. In any event, it is hardly a desirable solution (see Bryant and Bailey, 1997; Dobson, 1998; Guimaraes, 1991; Miller, 1995).

As Caldwell (1987) observed some time ago, the full range of biopolicy encompasses the entire relationship between science and society, most particularly those policy areas that are related to health and the environment. As he put it:

> The building of a better bridge between science and society leads to consideration of four basic elements in the process. These are: first, prevailing

> perceptions of man's relation to nature; second, the meaning of science as interpreted by formalized education; third, communication between scientists and policymakers; and fourth leadership toward a synthesis of scientific knowledge and ethical values. Whatever utility the concept of biopolitics possesses is primarily in relation to this fourth element.
>
> (Caldwell, 1987: 7-8)

As proponents of biopolitical theory and biopolicy construct a theoretical framework or paradigm which is inclusive and links scientific inquiry, political philosophy and ethics, that intellectual edifice can support focused inquiry into biobehavioural research and biopolicy specialisations which draw upon a wide range of disciplines. Political ecology needs the underpinnings of biopolitical theory with its grounding in modern evolutionary biology and the life sciences if it is to realise its full potential. Because environmental policy issues are inevitably joined in a debate over the desire for economic growth and development and the fulfilment of human needs and the collective goal of survival, it is essential that the discipline of economics experience a 'greening' as well. We will conclude this chapter with a brief consideration of the case for an emerging inter-discipline of bioeconomics.

The relationship of politics and economics: the importance of bioeconomics

Most postmodern approaches to political theory have involved a penetrating critique of the foundations of knowledge in modern political theory, in particular the scientism-positivism of modernity with its attendant quest for certainty. Generally, they have focused upon meta-theoretical issues rather than on practical politics. Or, if they have addressed practical politics, they have focused on various aspects of democratic politics or on the socio-economic (social welfare) components of domestic public policy stressing problems of resource distribution. It seems generally to be the case that today's political scientists have not retained the comprehensiveness in their political theories that once characterised classical political philosophy and that does today characterise biopolitics.

Much of the original purpose of political philosophy, as reflected in the writings of Plato and Aristotle, has been cast aside in favour of the fragmentation of political philosophy into a large number of disciplines, including history, political science, anthropology, sociology and economics. As Ophuls observes, 'the perennial, but dormant, questions of political philosophy have been revived by ecological scarcity' (1977: 10; also see Sibley, 1972 and 1977). From our point of view, the contemporary problems of the physical environment such as global warming, desertification, deforestation, air and water pollution, and species extinction understood biopolitically (especially ecologically), cannot be addressed until there is widespread acceptance of the primacy of politics and a survival-oriented policy science over economics, or as Peter Corning recommends, the development of 'bioeconomics' (Corning, 1996b, 1996c, 1997). That is the same

as saying that concern for the collective good (of societies and of the human race) must take precedence in political theory over the self-proclaimed needs of the individual.

Individual freedom is then, of necessity, to be limited if collective survival is to be guaranteed. Corning defines bioeconomics as 'the study of how living organisms acquire and utilize various resources to meet biological needs' (1997: 250). Paramount among these needs is survival, and Corning (1997: 251) redefines economies as 'survival enterprises'. Clearly, such a view of economics and economies must include adaptation to the environment and reflect a concern for the stewardship of that environment over time to sustain the survival enterprise. Fundamentally, this view is in conflict with the prevailing ideology and sociocultural norms of the capitalist West. As Dietz and van Der Straaten note:

> Labour and capital will offer fierce resistance to the determination of ecological limiting conditions, especially when their short-term interests are unilaterally jeopardized. In fact, a social struggle concerning the distribution of the ecological space available among the various production and consumption processes will be the result.
>
> (Dietz and van Der Straaten, 1993: 139)

Although they conclude that the state will necessarily play a central role in resolving these disagreements, such expansion of state control need not necessarily be incompatible with democratic political practices. However, there will be real problems with finding common ground between liberalism and environmentalism, not to mention more radical environmental perspectives (i.e. ecologism) that may support authoritarian politics in the service of the environment. This point relates back to our discussion of Somit and Peterson's examination of the role of human indoctrinability as a necessary, but not sufficient, condition for the possibility of democratic politics.

Interestingly, the origins of both the terms *economics* and *ecology* lie in their root concern with the management of the household, *oikos*. We believe, as does Corning, that what is needed now is a merger of biopolitics and a bioeconomics to create biopolitical economy. The holism and contextualism of ecology needs to be a counterbalance to the extreme individualism of economic as well as a narrowly understood sociobiological man. And the contextualism of ecology and evolution must be reflected in the epistemological foundations of science and social science (see Hines, 1979 and 1982a). A biopolitical economy must be based upon the original concept of a political theory that recognised the problematic features of the relationship of man to nature and to his fellow man. Because of the relevance to this issue, we quote the political philosopher Joseph Cropsey (1960) at some length on this matter of the subsumption of economics to politics:

> Aristotle saw at the same time that acquisitiveness was 'natural,' that it was deplorable, and that it was indispensable to civil peace. What is most

> conspicuous in his discussion is that he conceived it to be deplorable. Aristotle deplored retail trade, usury, and 'acquisitiveness' in the name of virtue, a quality of man which is perpetually threatened by his nature as that shows itself in his necessitousness. And yet his virtue and all his manifest possibilities are unintelligible except in the light of his nature. The public or political function of political philosophy is to turn attention toward the meaning of nature as end and to divert attention from nature as the beginning; or to turn attention toward nature as provident and friendly to human excellence, and away from nature as polemic and divisive, which it is. The classics seem to have believed that excessive emphasis upon man's neediness would blind him to the reason for not becoming a self-regarding atom.

Cropsey goes on to note, however, that the

> self regarding man is, as such, the opposite of the citizen, whose peculiar virtue is patriotism or regard for country and countrymen first and foremost - say institutionalized altruism. Without that quality, men cannot take their proper place among the ruled and assume their proper posture with respect to the rulers. It is on this basis that the classical writers could simply comprehend the economic activity within or under the political, and discussion of the economic activities within the discussion of political life more generally. Successful political life depends upon a proper public emphasis upon those irenic elements of nature which are friendly to virtue and hence to political life, and the suppression or warding off of those polemic elements which are neutral or hostile toward the perfection of civil community. The instrument of that prudent emphasis is law, or convention, and its fruit is political society, which is an artifact, the product of provident men who are the great benefactors of their kind. They may be said to rise above nature through the breadth of their understanding of nature: perceiving that nature is in some ways friendly and in some ways indifferent to the perfection of political society, the classical writers declined to deduce political life from the simple laws of nature. Law must proceed from well-disposed intelligence, or from the wisdom of superior men. Law is a phenomenon of the relation between governing men and governed men, the political relation, the improved type of primary inequality. Political philosophy is the comprehensive social, not to say human, science, because it comprehends all the aspects of nature, the friendly, the indifferent, and even the hostile, under law that emanates from human discretion. It is based upon a narrow-eyed scrutiny of nature by discreet men who understood the precariousness with which political life is balanced upon its natural base.
>
> (Cropsey, 1960: 10-11)

The fundamental purpose of a biopolitical economy is the management of the household. But the household of today is the planet. This framework invites the exploration of supra-national and sub-national regional political authorities as

alternative political frameworks for dealing with environmental problems and priorities. Such a framework also depends upon the clear recognition of political theory (and practice) as occupying the higher ground (i.e. being more comprehensive and prior to) rather than yielding that ground to economic theory (and practice). Economic theory should be a derivative of biopolitical theory, properly understood. Now, at the start of the twentieth-first century, it is absolutely essential to reconsider the fundamental purpose of human politics in relation to the rest of the natural world. It is also necessary to appreciate the limitations of human 'polytechnic rationality' (following Caton, 1990) as we seek to achieve our survival through politics.

Paul Kress has offered the suggestion that 'the most profound political (social and cultural) process of the twentieth century has been that which Max Weber called the "rationalization" of Western civilization' (1983: 115). As Kress observed, Weber also used the more sombre phrase *die Entzauberung der Welt,* or 'disenchantment with the world.' After noting the number of critics sympathetic to the warnings by Weber about rationalisation, and advocating relentless criticism of contemporary politics, society and culture as appropriate activities for political theorists, Kress (1983: 119) offers the recommendation that we must confront 'the alleged failure of liberalism'.

We recommend the framework of biopolitics as a vantage point from which to mount a serious critique of the fundamental flaw of classical liberal politics. That flaw is that liberalism has failed to provide the necessary political, social and cultural restraining parameters to ensure the primacy of the collective good, measured ultimately by our survival potential. The manifestations of that failure are everywhere present in the current attempts of advanced industrialised and post-industrialised nations to deal with the problems of economic recession, unemployment, health care, environmental degradation and a host of related public policy issues. At a time when everyone in the West has been so ecstatic about the demise of Communist politics in Eastern Europe and the Soviet Union, it is essential that we should not ignore the real limitations of liberalism as an ideology of modernity and capitalism as an economic system whose viability may be in doubt in the longer run. In addition, it is necessary to examine critically the implications of a sociobiological theory of human politics if that sociobiological theory is itself to be narrowly based on individual strategies for survival and incapable of sustaining a collective, co-operative basis for group (species) survival (see Bloom, 2000).

That there are profound limitations to human rationality, especially our attempts to rationally control the natural world, seems only too obvious (Simon, 1983a). What we need to understand, however, is how we have reached this position intellectually and historically. Toulmin's (1991) recent review of the historical origins of modernity reminds us that there were two separate strains of thought that ushered in the modern age. The first (sixteenth century), which was soon eclipsed by the second (seventeenth century), was a humanist strain associated with the early Renaissance. The second, to which we have already referred, was modern scientific rationality, which Toulmin

dates from approximately 1630. It is Descartes and Cartesianism that best exemplifies the second, and to date, the dominant strain in modernity (see Bluhm, 1984). Modern rationalism is absolutely decontextual. As a result, it stands in direct contrast to ecology and biopolitics, which are absolutely contextual and configurative. The ahistorical nature of modern rationalism makes it incompatible with an ecological-evolutionary approach. It is small wonder that the fundamental nature of post-modernist critiques has been an attack on rationality.

Within evolutionary biopolitics, the sociobiological and the systems level research agendas compete while operating at different levels of analysis. Indeed, these approaches share a common heritage, and seek explanations that are ultimate as well as proximate, but have difficulty agreeing on the claim that evolution can operate at the group or collective level. The work of Peter Corning, discussed in chapters 2 and 3, exemplifies the view that synergism and co-operative relationships represent evolutionary trends that are as consistent with the modern evolutionary synthesis as is Sociobiology and inclusiveness fitness. These claims can be explored through empirical research into the adaptive strategies that are adopted by individuals and groups as they struggle to survive and reproduce under conditions of scarcity and conflict as was suggested in our discussion of political evolution in chapter 3. Corning (1997: 249) describes a number of important theoretical and analytical linkages that are being forged between biology and economics over the past twenty years as documented by Ghiselin (1992) and Hodgson (1993). He also cites a larger body of work and notes the establishment of new journals, *Ecological Economics* and *Evolutionary Economics*. There is even an informal organising group that has developed a newsletter and has sponsored panels at various association meetings and there are plans to create a more formal entity and launch a bioeconomics journal. If these efforts can move economists away from a closed-system model to a living, open-systems model that reflects the realities of ecology, then the hoped for inter-discipline may actually emerge, hopefully in conjunction with the further elaboration of biopolitical theory.

Conclusions

We hope we have been able to demonstrate the range of environmental policy issues that demand attention within biopolicy and to point to the direction in which enquiry should be shifted to bring about bioeconomics and a robust biopolitical theory. Hopefully others will find the challenge of developing a biopolitical alternative for political theory that can address the 'climacteric' compelling, and together we can succeed in moving beyond the limitations of 'modernity' to a vision of a postmodern ecopolitics that is worthy of pursuit.

The climacteric presents an enormous challenge to our species from a survival standpoint. If we fail to appreciate the environmental meaning of 'globalisation' - a popular but debated idea today - we may not be able to live to regret it. Of course, there is some evidence that we have begun to achieve a level of recognition

of the problem and are attempting to devise strategies for adapting ourselves to the task at hand (Hajer, 1995). An important intellectual achievement in support of this effort will be the synthesis of biopolitical theory with work on political ecology. These two important strands of contemporary political theory share much in common and, especially when combined with bioeconomics, can present a formidable theoretical perspective for the articulation of a life-science-informed biopolicy for the environment in the new millennium.

Note

1 Our characterisation of modernity draws upon the following sources in particular: Stephen Toulmin (1991), *Cosmopolis;* William T. Bluhm (1984), *Force or Freedom?;* Hiram Caton (1990), *The Politics of Progress;* William Connolly (1988), *Political Theory and Modernity,* Paul Kress (1983), 'Political Theorizing in the Late Twentieth Century'.

8 Towards human-centred political science

Two decades ago, Thomas Wiegele in his seminal work on biopolitics concluded that political science must begin to consider the subjects of its investigation as biological beings with intellectual capabilities. Unfortunately, he was forced to write: 'At the present state in the development of the discipline, we can characterize ourselves as having ignored an enormous amount of information about humanity and its real nature, that is its nature *as it is lived* (1979a: 145). He goes on to state that because our vision has been narrowly focused down safe, well-travelled tunnels, we have been inattentive to the powerful findings of the life sciences. A decade later, Roger Masters, similarly, concluded 'the social sciences remain largely untouched by research in the biological sciences' (1989: xii). Despite the significant work in biopolitics since their writing, in large part their conclusions remain accurate.

What has changed over the last two decades is that the insufficient attention paid to explanations of political phenomena through biological variables in political science is even more striking. Within the context of what has happened in other social sciences, particularly anthropology and psychology where evolutionary perspectives and biological grounding of behaviour have become well established, political science is lagging further and further behind. Only sociology appears to have been as hostile toward recognising Darwinian ideas and integrating the life sciences into the mainstream of the discipline. There has, however, been at least one systematic treatment of a biologically informed sociology that makes a strong case for the kind of paradigmatic framework that we advocate (Walsh, 1995). And, even though opposition has been strong in some quarters, evolutionary theory has a long-standing history in the development of sociological theory (see Turner, 1998). More than ever, then, to ignore evidence that human political behaviour is shaped or influenced by biological considerations isolates political science from the debate over the foundations of human behaviour in general. This last point is especially important because the social sciences are overlapping to such a degree that disciplinary boundaries are altogether permeable.

Like Wiegele two decades ago and Masters a decade ago, we argue here that political science scholarship would benefit immensely by incorporating variables from the life sciences into the study of political phenomena. Moreover, we

conclude with Weigele, that, in the spirit of intellectual honesty, political science cannot exclude this knowledge no matter how much it challenges the conventional paradigm. The 'fallacy of arbitrary exclusion' is still very much alive in political science. According to McManus *et al.* the 'fallacy is committed whenever we, through ignorance or through adherence to a normative rule, exclude from consideration material efficiently present in the phenomenon being studied' (1979: 345). Although it might be too strong a criticism to say that biological variables have been 'arbitrarily excluded' by political scientists, mainstream political science has in the least dismissed them as unimportant. In part this might be because the methodologies and terminology from the life sciences are foreign to the average political scientist and seen as not useful or at least not worth the effort to study. Although the inclusion of life-science concepts and methodologies into political science is challenging and does complicate research, 'if we aspire to precision and scientific credibility in our work', it will be worth the effort (Wiegele, 1979a: 2).

In order to address these shortcomings, we must adopt a more comprehensive definition of human nature which includes in an operational way the biological dimensions as well as the natural and psychological. As argued here, this requires a re-evaluation of the basic assumptions that underpin the discipline. Ironically, this will move us back closer to the roots of our discipline of Merriam, Munro and, more recently, Harold Lasswell, who in his 1956 APSA presidential address urged a reintroduction of biological concepts and stressed the need to keep up to speed with new technologies in the life sciences (see Dryzek and Schlosberg, 1995: 134-5). We agree with Master's assessment that the unwillingness to accept a biological perspective to human nature and politics is not likely to survive the onslaught of rapid advances in the life sciences. 'The political process must sooner or later be fundamentally affected by the power to change not only the environment but also the behaviour and genetic composition of humans themselves' (Masters, 1989: xii).

Biological determinism

Although it is essential to integrate a strong biological base to our study of politics and political behaviour, this does not mean we must accept a biological determinism that pays no heed to human purpose activities (Wiegele, 1979a: 145). We have tried to demonstrate this in chapter 2 and in the discussion of free will in chapter 6. Nothing in the research of political scientists in biopolitics reported here suggests this, and, in fact, most such scholars have gone to great lengths to dismiss biological determinism as contrary to fact. As noted by Segerstrale (1998), it is important to 'explode the misconception' that biology is something that automatically precludes or excludes culture.

Although there is a biological basis as to why and how we respond to environmental cues, the focus is on biological capacity not biological prescription, possibilities not determination. We agree with Francis Fukuyama who states:

dates from approximately 1630. It is Descartes and Cartesianism that best exemplifies the second, and to date, the dominant strain in modernity (see Bluhm, 1984). Modern rationalism is absolutely decontextual. As a result, it stands in direct contrast to ecology and biopolitics, which are absolutely contextual and configurative. The ahistorical nature of modern rationalism makes it incompatible with an ecological-evolutionary approach. It is small wonder that the fundamental nature of post-modernist critiques has been an attack on rationality.

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cations for the study of leadership, decision-making, organisational behaviour and conceptions of our human nature, it has significance as well in public law and legislative and judicial behaviour.

To state that biopolitics has significance for all sub-fields, of course, does not mean that it must always play a central role, but rather that to ignore its implications will guarantee exclusion of potentially important variables. It may be that in some areas biological variables have limited explanatory value. It is likely, for instance, that health and nutrition are not the most important variables in political behaviour. As demonstrated earlier, however, by excluding their consideration for political or other reasons we are unable to make that determination in either direction.

Political socialisation is a notable example of the dangers of an environmental bias. The concept of political socialisation views children as malleable and passive, existing in a patterned, one-dimensional process through which they are led to conform to the standards of society. For White, these assumptions 'effectively deny "the animal" in us, that is, the genetic predispositions that we all begin life with and that may resist or even contradict environmental pressures' (1993: 1). The result is that, after major investments in extensive surveys of children in the 1960s and forty years of study, political socialisation has failed to provide adequate cross-generational and cross-cultural explanations and as a sub-field has lost much of its early enthusiasm and promise. To assume that the political socialisation process works in an evolutionary, genetic and neurological vacuum better fits the dominant environmentalist paradigm but it fails to explain behaviour adequately and in fact is often contradicted by work in other disciplines.

A biopolitical approach to survival

We hope we have demonstrated that, while the development of empirically-based, biopolitical theory on the individual and group level remains the most difficult and demanding area where methodological issues continue to affect the research agenda, 'biopolicy' is flourishing. Although much of the work in environmental and health policy is not cast in a formal evolutionary or biopolitical framework, it has clear connections, which must be clarified. Linking evolutionary theory and strategies for survival to policy issues (for example, population, energy, pollution, deforestation, global warming, etc.) will provide greater justification for the salience of these issues and for their importance relative to policy issues that pertain to economic growth and development and political development. The latter areas have tended to attract far more attention in the short run, but it is the longer run that reveals how tentative and problematic many of these short-term growth strategies may turn out to be.

One example of this problem of the lack of a long-term perspective is in the area of energy policy. The challenges that face a continued reliance on traditional sources of energy and on strategies of economic development that are based on the use of those traditional sources to achieve economic well-being,

particularly in those areas of the world that are least competitive in the global economy, are substantial. In the case of Africa, for example, the relationship of health (consider the problem of AIDS) to life expectancy (which has dramatically declined on the continent) and, in turn, to policy priorities shows the need for life-sciences-based social-science research and theory. It also illustrates how a strong biopolicy component is inextricably linked to survival and to economic development strategies in those extremely vulnerable areas of the world.

In a discipline that prides itself on being a science, prior exclusion of independent variables of proven importance in other behavioural sciences because they fail to fit our paradigm is short-sighted and potentially self-destructive. As Wahlke, Caldwell and others have argued for decades, we ignore or dismiss biological evidence at the risk of losing respectability as a science discipline and relevance in a fast-changing world where survival and quality of life of our species cannot be taken as a given. In order to meet the demands of these threats to survival, we must adapt paradigms of political order and institutions that have been necessary for survival tactics in history and pre-history.

Any paradigm that fails to consider the evolutionary history of the human species in a changing environment will ultimately fail. Research using an interactionist model of genes, body, consciousness and environment understands their complex interrelationships and excludes none from consideration. Allowable reductionist moves as well as emergent properties are fully integrated into this model of human behaviour. A life-sciences model also elevates the status of health and the environment, both of which are prerequisites as to what society and the good life are. We need a healthy body politic *and* a healthy spaceship Earth. As such, we must take very seriously the challenges that ecologists and environmental scientists warn us constitute severe and urgent threats to human survival.

There are issues that we have not addressed at length in this book that are nonetheless very important and beg for further attention. We only touched briefly upon the growing debate in agricultural policy over genetically engineered foods. Already countries like the United Kingdom and Australia have banned these foods and are taking costly steps to prevent their infiltration into these societies. In part as a response to the outbreak of 'mad cow disease' the United Kingdom has taken a very hard stand on these issues. As this book goes to press, there are announcements that the complete genome of rice has been discovered by researchers, signalling the potential for increased productivity and raising the hope of possible solutions for world hunger in the not too distant future. At the same time, there are deepening worries about the spread of foot and mouth disease throughout Europe and fears of infectious diseases that put human populations at risk. The promise and the perils of a biotechnology century are in the news daily.

As the potential applications of our knowledge of the human genome become available, there will be numerous controversies surrounding those applications. The issue of patenting alone will become a major controversy. As the policy agenda becomes increasingly filled with environmental and health issues,

the importance of a life-science approach to political science will become more and more apparent. And the absolute necessity for expanding our knowledge base about human nature and gaining greater understanding of the complex interactional effects of genetics and environmental variables on human behaviour will compel further collaboration among life scientists and social and behavioural scientists. Just such a human-centred science of politics will surely emerge. Our hope is that this book will help to inspire the next generation of political scientists to pursue this life-science-based paradigm of political inquiry.

Summary: looking towards the future

This book is not meant to be an exhaustive review of everything published in biopolitics over the last thirty to forty years. Rather, we have attempted to demonstrate the many areas of relevant literature that, in turn, illustrate the richness and scope of politics and the life sciences. By and large we have focused on work of persons trained in political science who have, primarily on their own, become familiar with the life-science end of things. Where necessary for explanation we have drawn from relevant literature in other disciplines. One of the results of the lack of formal training in biopolitics and the acceptance of such work in mainstream political science is that young faculty who hope to receive tenure often have to forego their interest in the life-science contributions and publish in more traditional areas. Although they might publish some work with biopolitics focus, it is sporadic. The result is that there are short bursts of activity in a specific area of biopolitics research, followed by often long gaps as that person or person's involvement subsides and before others take up the slack. This unfortunate pattern is evident in many policy and behaviour-oriented areas outlined here. This problem can be rectified only by a combination of recruitment of more researchers into politics and the life sciences and by the paradigm shift argued for in this book. We hope we have demonstrated here that both of these moves are overdue and that with such changes political science would be better equipped to survive the twenty-first century.

Appendix

Brain-imaging techniques

The last two decades of the twentieth century saw unprecedented advances in neuroscience research. Major areas of advance included:

1 the identification of increasingly precise anatomical connections;
2 a heightened understanding of the biochemical, molecular and genetic mechanisms that affect brain structure and function;
3 a broadened knowledge of the multifaceted roles and functioning of neurotransmitters and receptors in the central nervous;
4 a heightened ability to measure and visualise brain functioning and to correlate it with mental and/or physical activity;
5 an emerging capacity to monitor brain activity.

In addition to discovering new treatment strategies for a wide array of neurological disorders and brain injuries, these advances in technology promise more precise and effective means of predicting, modifying and controlling behaviour.

Critical to this new understanding of the brain and behaviour are developments in imaging techniques and advances in computer hardware and software, which facilitate their use. Research on the brain structure until recent decades was based largely on post-mortem examinations of the brains of normal persons and those individuals who suffered from mental disorders. New techniques, which provide vivid images of living brains, promise to greatly enhance our understanding of the relationship between the anatomy of the brain and psychological functioning. Increasingly sophisticated use of X-rays, radioactive tracers and radio waves, combined with rapid advances in computerisation, allow for non-invasive and safe investigation of the structure and functioning of the brain. The structure of the brain can be studied by computerised axial tomography (CAT), which uses computers to combine a series of X-rays to provide a precise picture of the brain.

Magnetic resonance imaging (MRI) can detect molecular changes in the brain when the individual is exposed to a strong magnetic field. MRI allows clear and detailed images of brain activity and is used to detect structural abnor-

malities, changes in the volume of brain tissue and the enlargement of cerebral ventricles in patients. The activity within particular regions of the brain can be analysed to determine damage or malfunction and correlate it with behavioural manifestations. Echo-planar MRI (EPI) has enhanced significantly data obtained from standard MRI by using multiple, high-power, rapidly oscillating magnetic field gradients, higher-speed hardware and advanced image processing. Functional MRI (FMRI), which measures the increases in blood oxygenation that reflect a heightened blood flow to active brain areas has higher resolution and faster speed than conventional techniques. Event-related FMRI promises to revolutionise brain research, according to Barinaga (1997a, b).

Technologies specifically directed at the brain include measurement of electrical activity through enhancement of conventional electroencephalographs (EEG) by computer analysis. Electrical activity can be measured while the patient is performing particular cognitive or sensory tasks or at rest, thus permitting investigators to observe changes in brain responses. Using knowledge of normal ranges, they are able to identify variations linked to particular mental disorders or behavioural problems. Magnetoencephalography (MEG) measures small magnetic field patterns emitted by the neuron's sonic currents and provides real time resolution of the image to be studied.

Positron emission tomography (PET) and single-photon-emission computerised tomography (SPECT) are imaging techniques that operate by creating computerised images of the distribution of radioactivity labelled substances in the brain following injection into the blood or through inhalation. As the radioactive substances move through the brain, investigators are able to visualise regional cerebral blood flow and glucose utilisation as well as neurochemical activity. The more active a region is, the more blood will flow through it and the more glucose it will use. These techniques can measure abnormal activity in specific brain regions, in the whole brain, or in the normal asymmetry of activity between the two sides of the brain. Also, because PET scanning can use labelled drugs that attach to specific receptors, it is possible to identify the number and the distribution of receptor populations. For the first time in history, therefore, we have non-invasive techniques that allow for precise mapping of normal brain activity and for identifying variations from it that are related to specific behavioural manifestations.

These imaging systems are rapidly being followed by a new generation of three-dimensional spatial imaging systems. Stereotactic imaging combines a series of two-dimensional scans into a three-dimensional virtual object. One such programme at Brigham and Women's Hospital in Boston gives a doctor the ability of using a few keyboard commands to separate images of the various parts of the brain, making the cerebral cortex disappear to reveal the cerebrum in 'fine detail with unprecedented clarity' (Hamit, 1994: 25). Similarly, the BrainSCAN Radiosurgery System provides three-dimensional imaging by correlating anatomic information from pre-existing MRI with diagnostic data from CAT and angiography by means of automatic image fusion. Further advances in

software are likely to match hardware improvements and provide even more remarkable and precise imaging of the brain.

Although yet in the early stages, associations have been found between abnormal imaging patterns and specific mental disorders. For instance, some PET studies have found an association of decreased activities in the frontal cortex and limbic structures with schizophrenia (Cleghorn *et al.* 1991). Moreover, EEG studies have observed a higher incidence of abnormal electrical activity in the brains of patients with schizophrenia (Levin *et al.* 1989). Likewise, studies using CAT and MRI have found that patients with bipolar disorders exhibit decreased cortical blood volume, indicating the possibility of structural abnormalities (Goodwin and Jamison, 1990). Data show that persons with bipolar disorder exhibit decreased cerebral blood flow and glucose utilisation in the prefrontal cortex and a more general decrease in activity involving the whole cortex and the left frontal lobes. With these data derived from imaging technologies, our understanding of the structural and functional bases, as well as the myths, of mental disorders are being clarified.

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Index

Note: *italicised* page numbers indicate figures or tables