Debre Tabor University

Faculty of Natural and computational Sciences

Department of Biology

Course: Survey of Seed Plant Families (Biol. 612)

3 Cr. Hrs. (7 ECTS)

Course Instructor: Endale A. (MSc., PhD Candidate)

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Two major groups of vascular plants:

A. **Seedless plants -** reproduce via spores

B. **Seed plants -** reproduce via seeds

1. **Seed** = a structure in which the embryo (the young sporophyte) is shed from the parent plant, enclosed within a resistant coat, together with a supply of food that aids its establishment
2. The majority of extant plants are seed plants

Seeds

- Consist of an embryo
- Stored food
- Seed coat
  - Modern seed plant the ovule consist of a nucellus envelope by one or two integuments with a micropyle (apical opening)
  - When fertile the nucellus contains a megagametophyte composed of nutritive tissue and archegonia
  - After fertilization the integuments develop into a seed coat; a seed is formed

Characteristics of seed plants:

A. Megaphylls

B. Heterospory

C. A reduced megagametophyte retained within the megaspore

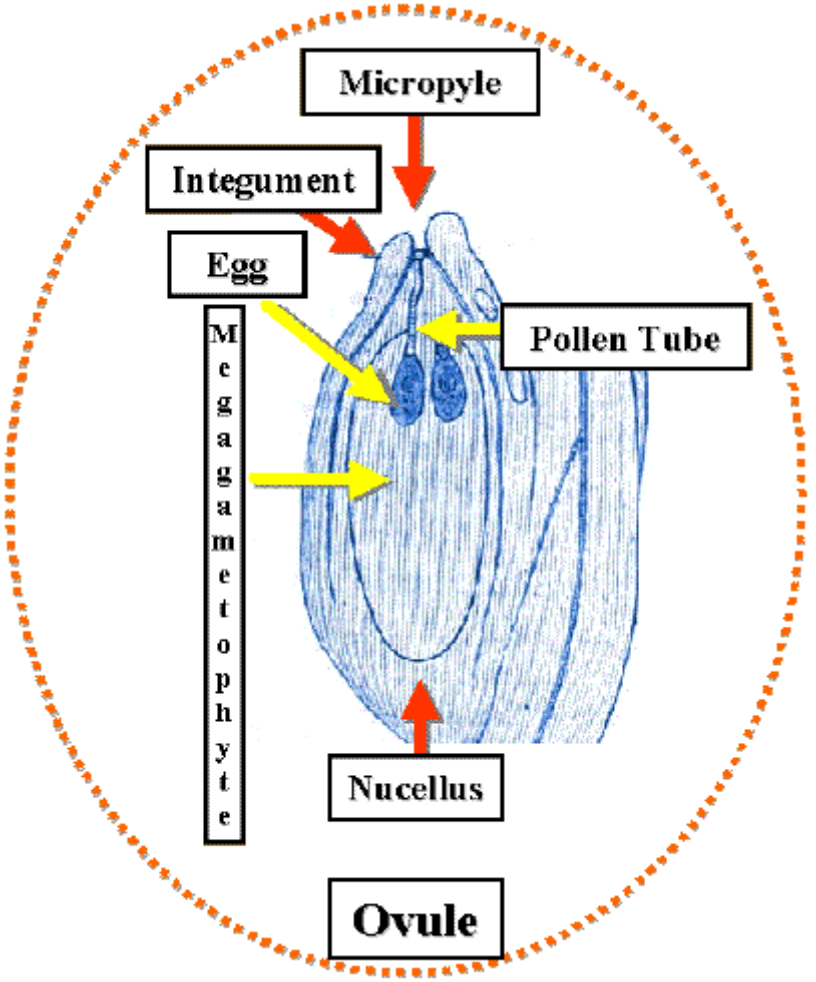
D. A megaspore retained within a fleshy megasporangium called a **nucellus**

E. **Pollen -** a structure which carries the male gamete to the female gamete

Seed plants do not require water for fertilization

Evolution of an ovule

- Retention of the megaspores within the megasporangium (fleshy nucellus)- the megasporangium no longer releases the spores
- Reduction of megaspore mother cells to one functional megaspore in the megasporangium
- Formation of an endosporic (within the wall) megagametophyte that is no longer free-living- retained within the megasporangium

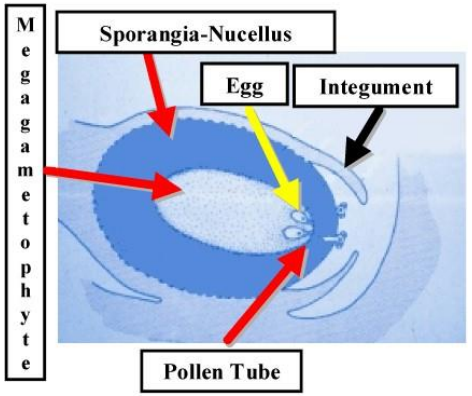


Evolution of an ovule

- Development of the embryo (young sporophyte) within the megagametophyte retained within the megasporangium

Evolution of an ovule

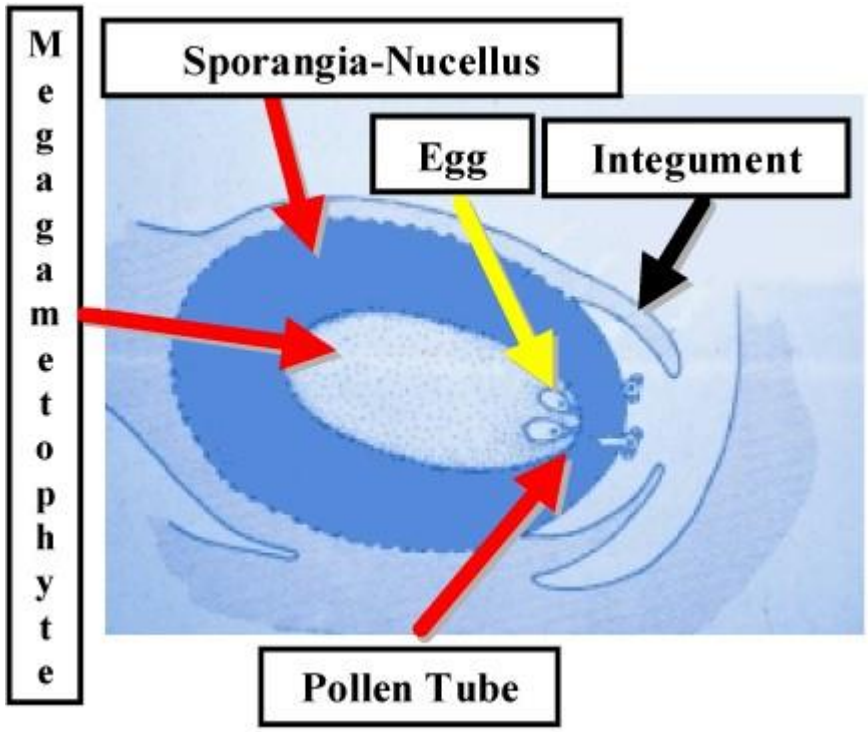
- Formation of an integument that completely envelops the megasporangium except for the micropyle
- Modification of the apex of the megasporangium to receive microspores or pollen grains



Evolution of seeds

A. The seed habit arose by 365 million years ago via fusion of vegetative tissues around the megasporangium

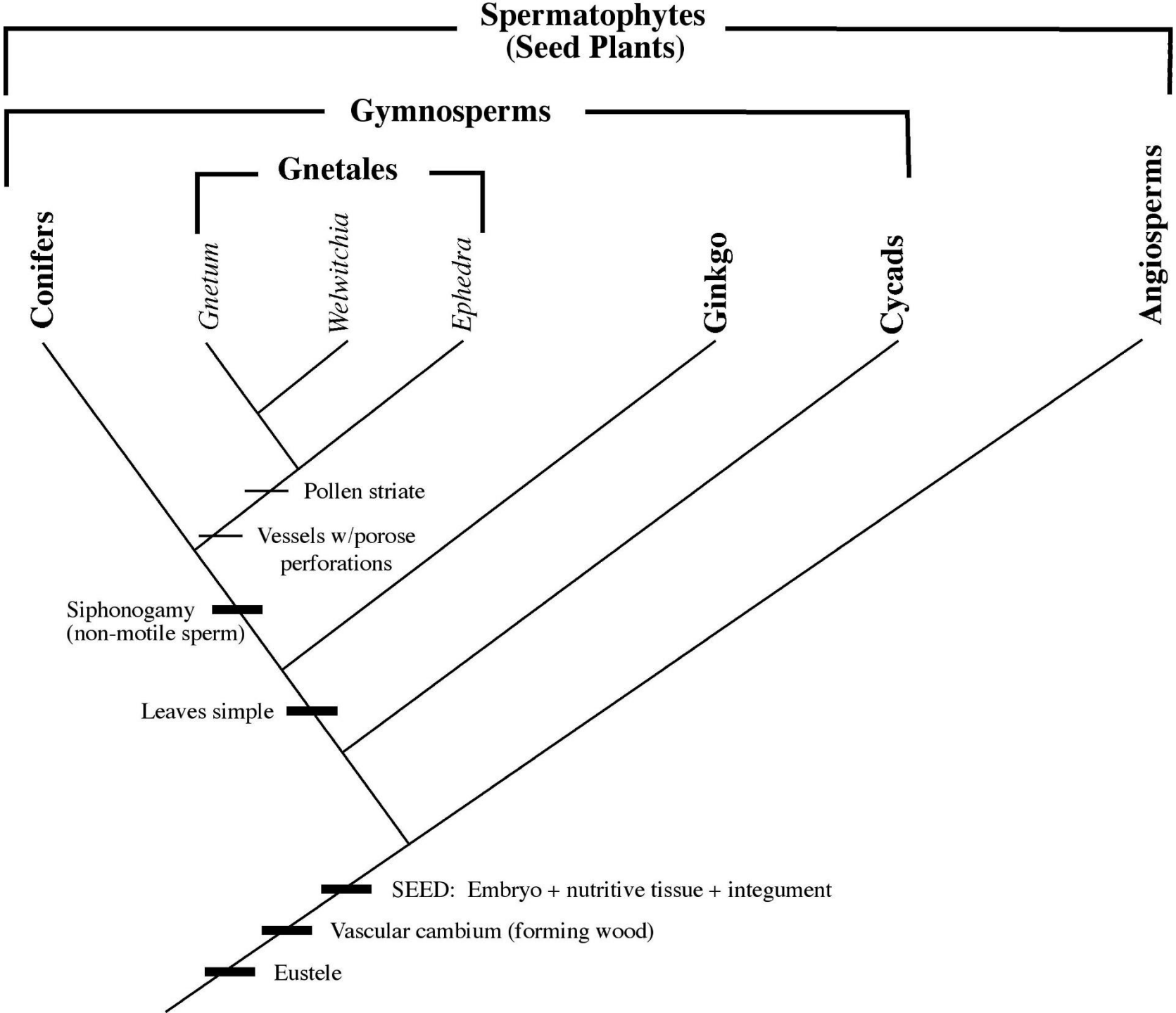
1. This additional protective layer is called an **integument**
2. The integument has a small opening, the **micropyle**, through which fertilization takes place
3. **Ovule =** an integumented megasporangium
4. Following fertilization the integument will become the seed coat



Classification

A. There are five phyla of extant seed plants:

1. Four of the phyla have **naked** ovules borne on modified sporopylls. These are called "**gymnosperms**" = “naked seed”
2. In the remaining phylum (Anthophyta) the ovules are enclosed within a protective structure called an **ovary (flower like reprodcutive structures)**


Spermatophytes
(Seed Plants)
Gymnosperms
Gnetales
Conifers
Gnetum
Welwitchia
Ephedra
Ginkgo
Cycads
Angiosperms
Pollen striate
Vessels w/porose
perforations
Siphonogamy
(non-motile sperm)
Leaves simple
SEED: Embryo + nutritive tissue + integument
Vascular cambium (forming wood)
Eustele

Gymnosperms

•A seed plant that produces naked seeds – not enclosed by any protective covering.

•Most have deep growing root systems.

-Wood (except Gnetaceae) with **no true vessels**.

•Trees and shrubs, mainly with needle like leaves.

-Flowers unisexual & polllination mainly by wind

e.g *Podocarpus*, *Juniperus*, *Cuppressus*.

PHYLA OF GYMNOSPERMS

Cycadophyta (cycads)

Ginkophyta (maidenhair tree or Ginko)

Coniferophyta or Pinophyta (conifers)

Gnetophyta (gnetophytes)


nosperms
© Joh

Coniferophyta

I. Coniferophyta - commonly called conifers

- Cone bearing plants
- Largest and most diverse gymnosperms
- Keep their needles year round

A. About 50 genera and 550 species

B. Common members include the pines, hemlocks, spruces, firs, yews, cypresses, junipers and redwoods

C. Conifers are most common at the higher higher latitudes, towards the poles

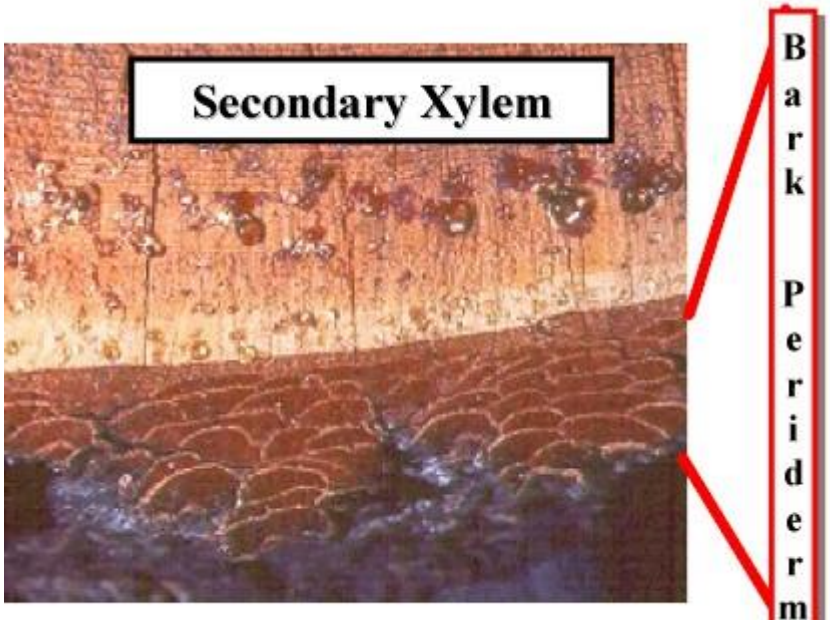
D. Conifers arose by 300 million years ago

E. Conifers include some of the largest organisms on earth,

- ✓ e.g. Coast redwoods may reach 380 feet tall and giant sequoias may reach diameters of 36 feet.
- ✓ A bristlecone pine, dated at 4,900 years old, is one of the oldest organisms on earth.

F. Conifers are one of the most economically important groups of plants. They supply building materials and paper pulp.

All conifers are woody and they have a **bifacial** vascular cambium that produces xylem to the inside and phloem to the outside



1. As the tree grows the center xylem becomes **lignified** to provide additional support
2. Lignin is a chemical deposited in the secondary walls

a. **Heartwood** = center, nonfunctional, lignified secondary xylem

b. **Sapwood** = outer, functional, non-lignified secondary xylem

3. With initiation of secondary growth the epidermis is replaced by a **periderm** produced by the cork cambium

a. **Bark** = all tissue external to the vascular cambium.

Longleaf pines

Foliar unit


Open seed cone


Pine seedling

G. Most conifers are evergreen, but there are a few deciduous species, e.g. bald cypress and larch

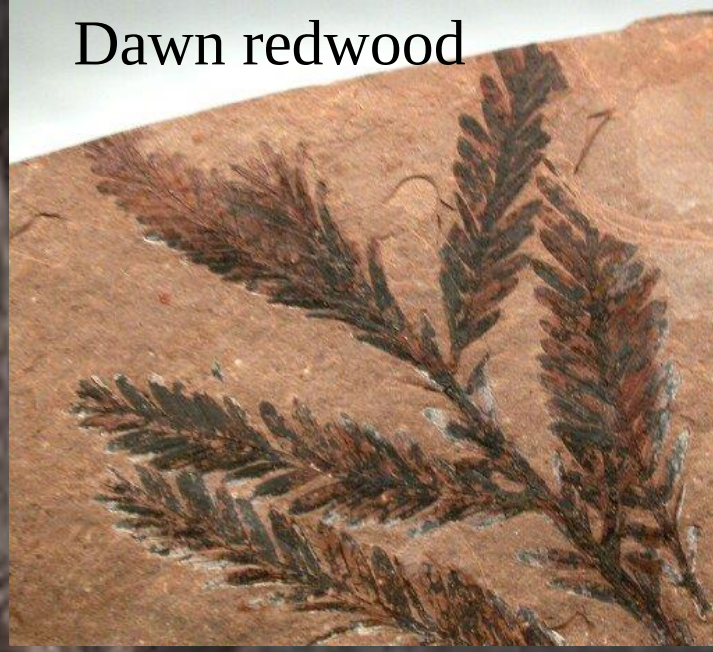
Swamp bald cypress

Common bald cypress


Larch meadow

Juniper

Dawn redwood



Conifer reproduction

Megasporangia and microsporangia are borne in separate megastrobili and microstrobili (cones).

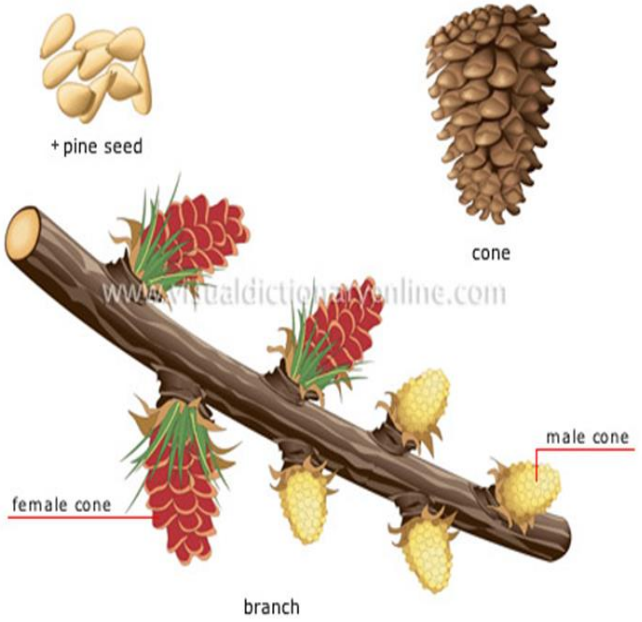
Male cones

– smaller than female cones

– produce pollen that later become sperm

Female cones

- Larger than male
- Contain one ovule at the base of each scale
- Ovule – structure that contains egg cell

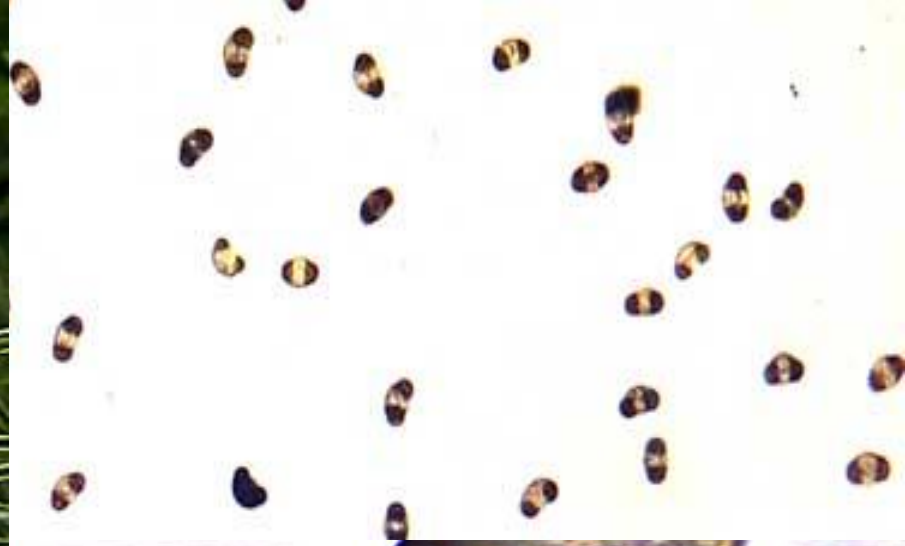


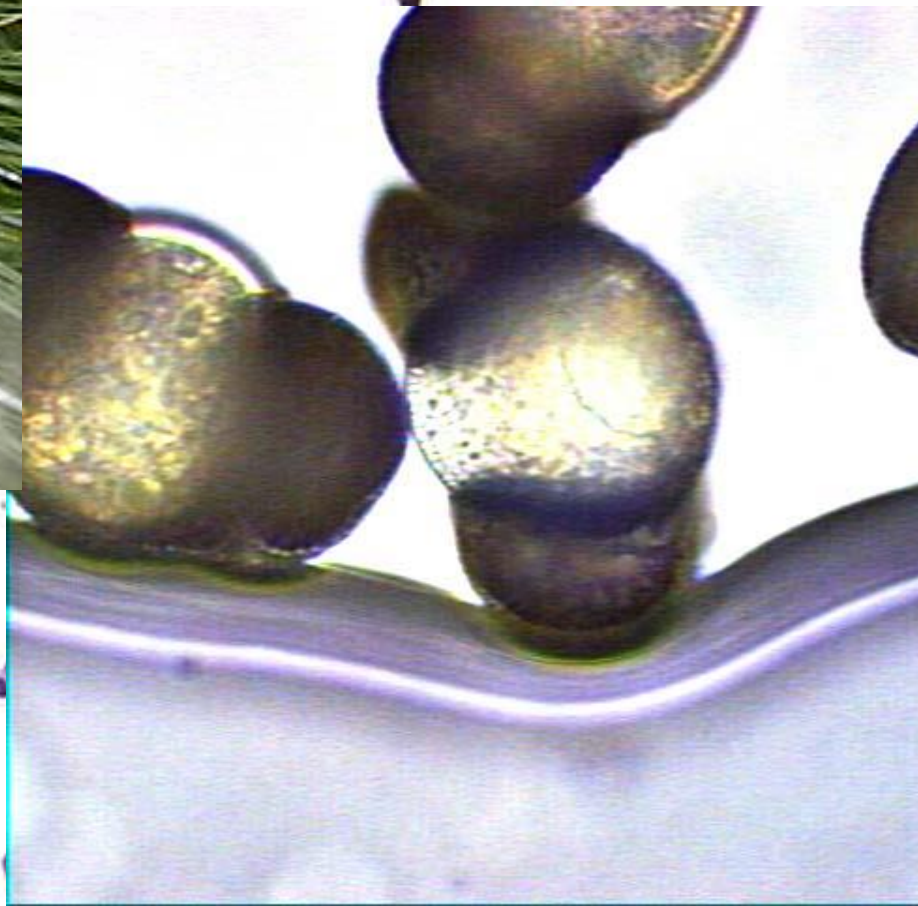
Ovulating pine cones

- Transfer of pollen from a male reproductive structure to a female reproductive structure
  - Wind often carries the pollen
- Pollen collects in the sticky substance produced by each ovule
- Scales of ovule close and trap pollen
- Seed develops on scale

- Female cones stay on tree until seed matures
- Male cones fall off after they shed their pollen


Pinus sp.
Pinaceae
Gerald D. Carr



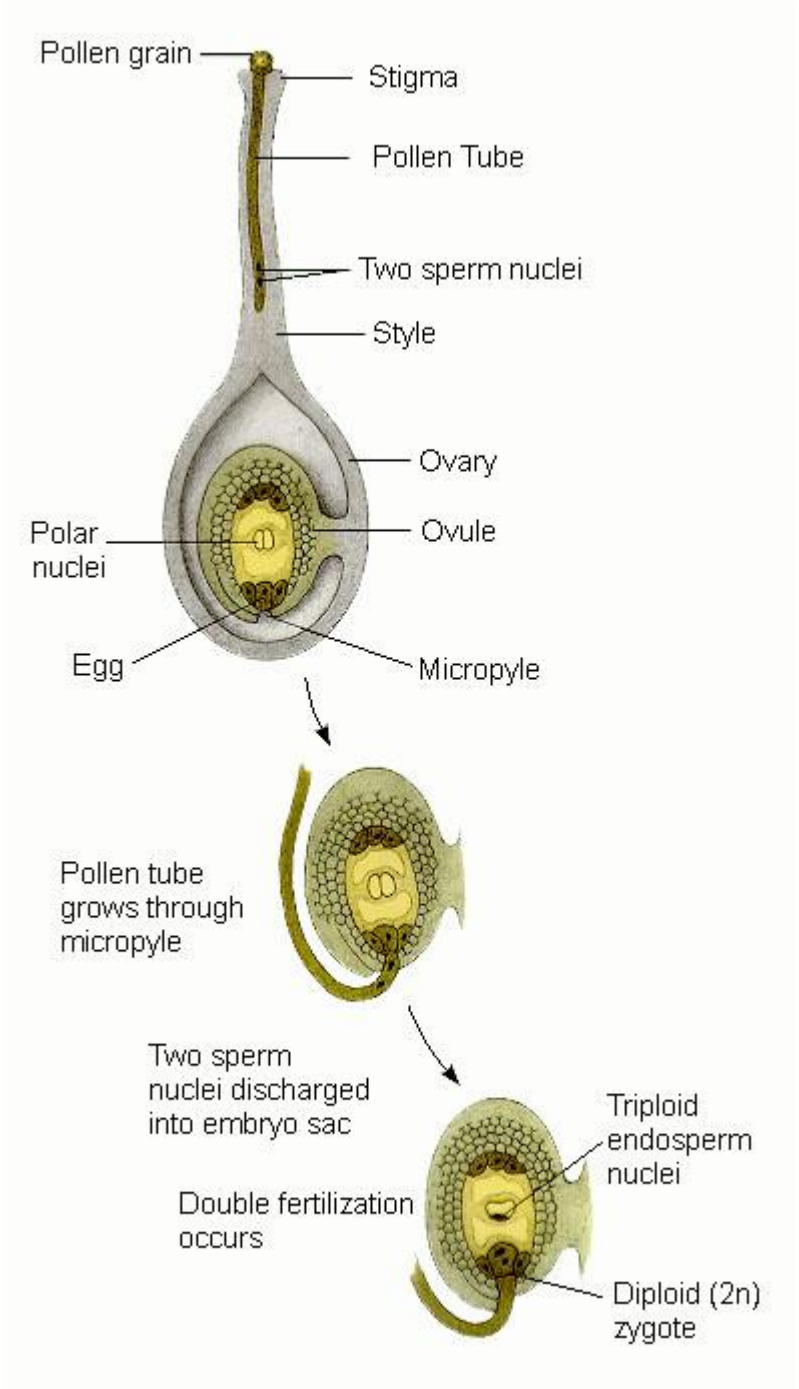


Pollen cone

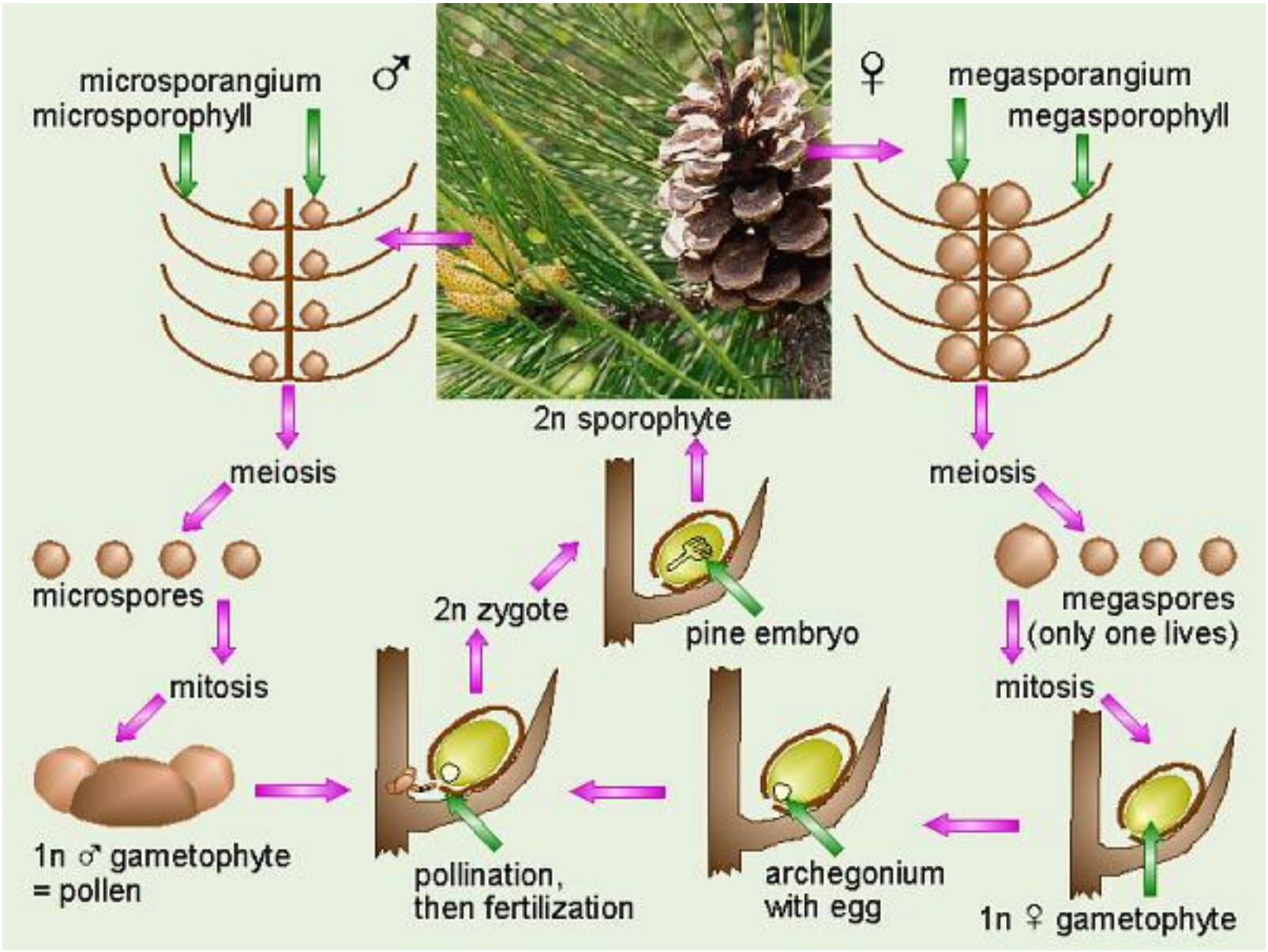
Microsporangiate Cones

Mature Megasporangiate Cone

- ✓ The pollen tube begins to digest through the nucellus towards the developing megagametophyte



Another Pine life cycle figure



Seed Dispersal

- As seed develops female cone increases in size.
- Cones with immature seeds point upward.
- Cones with mature seeds point downward.

Gnetophtya

- Least likely to see
- Live in hot dry desserts of southern Africa and Western US as well as rain forests.

Welwitschia mirablis

Gnetophyta

- Liana

Gnetum Leaves

- Gnetophyta can have opposite or whorled type leaves also here is an Example of Strap like leaves

  Welwitschia Mirablis

Leaves continue

- **Angiosperm-like Leaves of *Gnetum***
  - ***Gnetaceae***

- Scale-like Leaves of *Ephedra*

Ginkophyta

- Extremely old plant
- Only one species survives today
  - ✓ Chinese and Japanese cared for this species in their gardens
- Used today to on city street.
- Very resilient to pollution from city traffic

Cycadophyta

- 175 million years ago the majority of plant on Earth were cycads
- Grows only in tropical areas now
- Looks like a palm tree with cones
  - Cone can grow to be as large as a football
  - Seeds used to make flour for flour tortillas