

GYMNOSPER MS

Core Course IV: Archegoniate

Course Code: BOTACOR04T

Unit 6: Gymnosperms : An overview

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SEED PLANTS

- ▣ **Reproduce by seeds**
- ▣ **Seeds develop from fertilized egg cell**
- ▣ **2 Groups of Seed Plants:**
 - **Gymnosperms**
 - **Angiosperms**

Gymnosperms & Angiosperms

Seed plants are categorized in 2 groups based on whether ovary wall surrounds ovules

Gymnosperms

- “Naked Seed”
- Seeds totally exposed or on female cones
- No ovary

Both

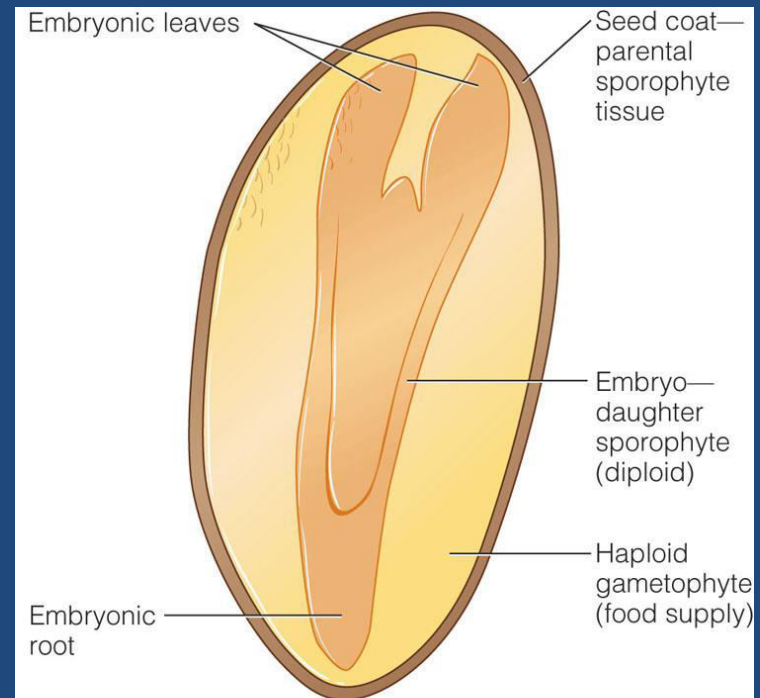
- Have Vascular Tissue
- Alternation of Generations
- Sporophyte Dominant
- No free living gametophytes

Angiosperms

- “Seed Enclosed in Vessel”
- Seeds in fruit

THREE PARTS OF A SEED

1. Embryonic Plant (roots, stem, leaves)
2. Nutritive Tissue (Haploid n food reserves)
3. Protective Coat



(a) Cross section through a pine seed.

SEEDS ARE REPRODUCTIVELY SUPERIOR TO SPORES

SEEDS

- ▣ Multicellular
- ▣ Well developed young plant inside with
 - Roots
 - Stem
 - Leaves
- ▣ Food Supply
- ▣ Seed coat protects seed

SPORES

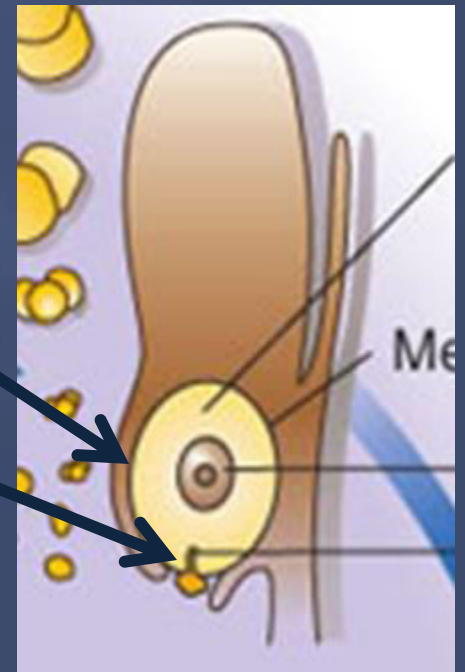
- ▣ Unicellular
- ▣ Unprotected
- ▣ Small food reserves

SEED PLANT REPRODUCTION

- All seed plants are heterosporous
 - Produce 2 types of spores
 - Microspores – spores grow into male gametophyte
 - Male gametophyte = pollen grain (4 cells big)
 - Megaspores – spores grow into female gametophyte

FEMALE STRUCTURES

- ▣ **Ovule – structure in seed plants that develops into seed after fertilization**
- ▣ **Integuments – outer layer of an ovule that develops into a seed coat after fertilization**
 - ▣ **Has a micropyle – tiny opening where pollen tube enters**



SEED PLANTS ALSO PRODUCE SPORES

- ▣ **Gametophyte Generation:**
 - **Microscopic structures in cones**
- ▣ **Pollination:** transfer of pollen from male cone to ovule in female cones.
 - Male cones produce thousands of pollen grains (immature male gametophyte)
 - Pollen is carried by wind to female cones
 - Pollen grains adhere to sticky droplets produced by female cones

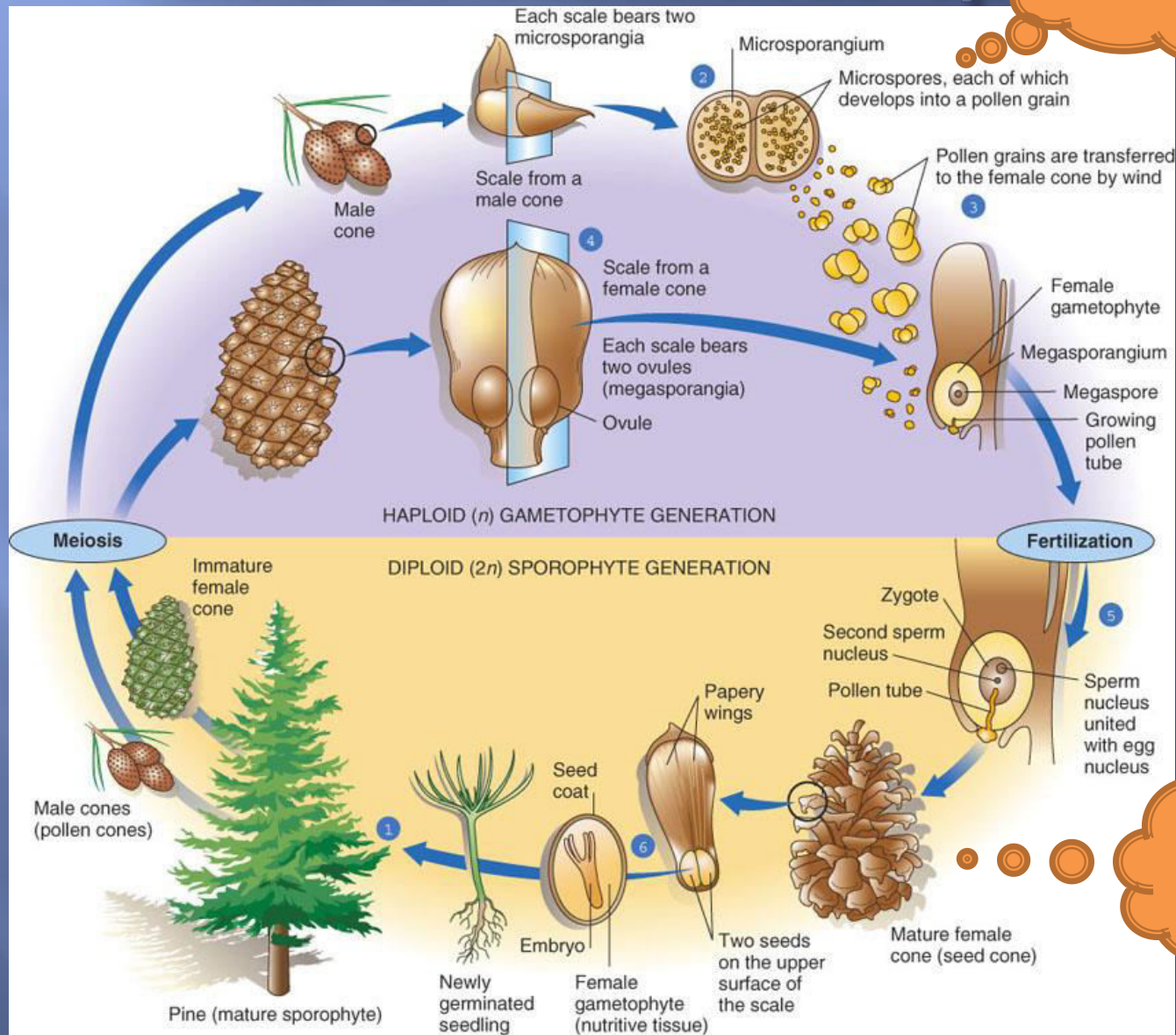
Why so many pollen grains?

MALE AND FEMALE CONES



LIFE CYCLE: *Pinus* sp.

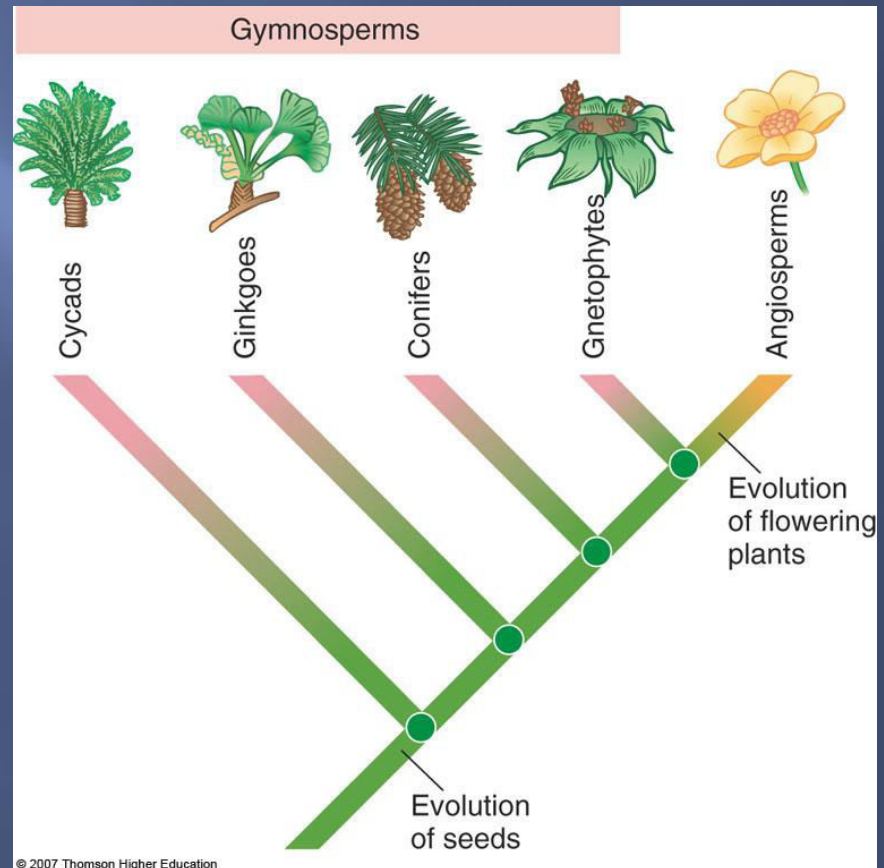
Pollen/Spores
(haploid n)



Seeds
(diploid $2n$)

FOUR GROUPS OF GYMNOSPERMS

1. Coniferophyta
2. Cycadophyta
3. Ginkgophyta
4. Gnetophyta



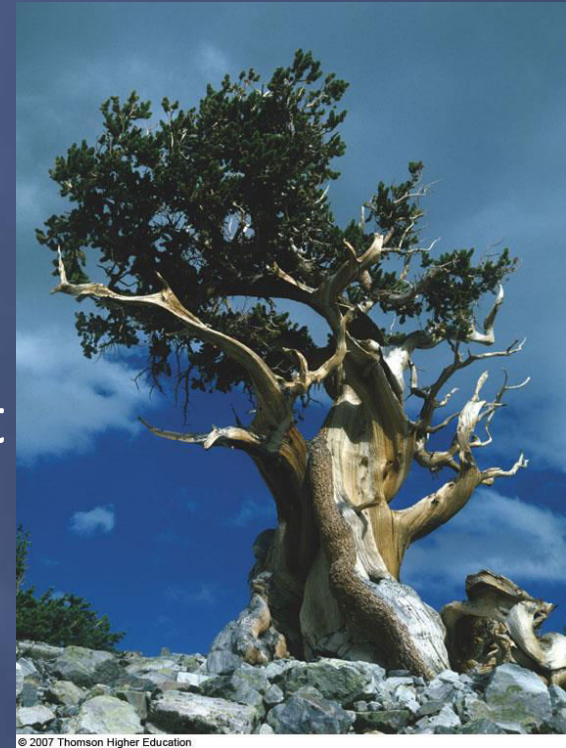
CONIFEROPHYTA



- ▣ Phylum Coniferophyta
- ▣ Secondary tissues produced annually
- ▣ None herbaceous
- ▣ Produce resin – viscous clear substance with organic compounds that protect from fungal/insect attacks
- ▣ Most have needles – (megaphylls)
 - Long, narrow, tough, leathery

CONIFEROPHYTA

- ▣ Evergreen – bears leaves throughout the year
 - Thick, waxy cuticles with stomata
 - ▣ Water-conserving
 - ▣ Enable to retain leaves year round
- ▣ Deciduous- few conifers shed needles at end of growing season
- ▣ Monoecious – have male and female parts in same plant
 - separate cones on same plant
- ▣ **E.g.**
Pines, hemlocks, spruces, firs

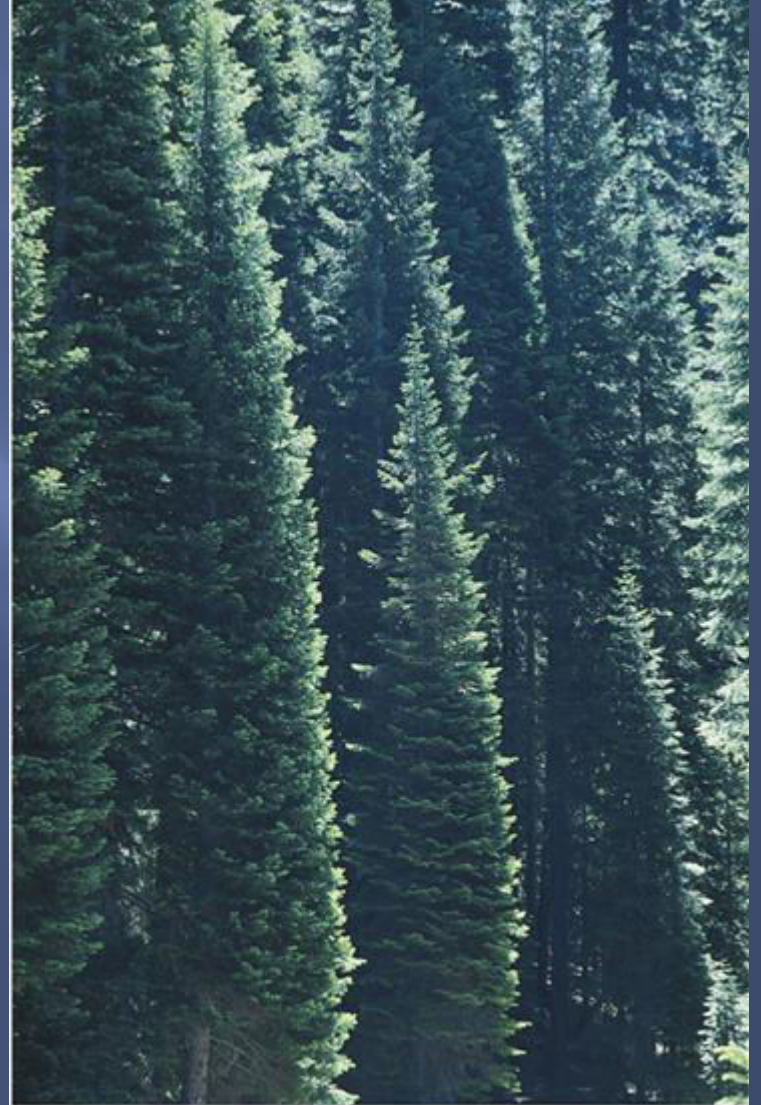


CONIFEROPHYTA



(a) Colorado blue spruce (*Picea pungens*).

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(b) White fir (*Abies concolor*).

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CONIFER LEAVES

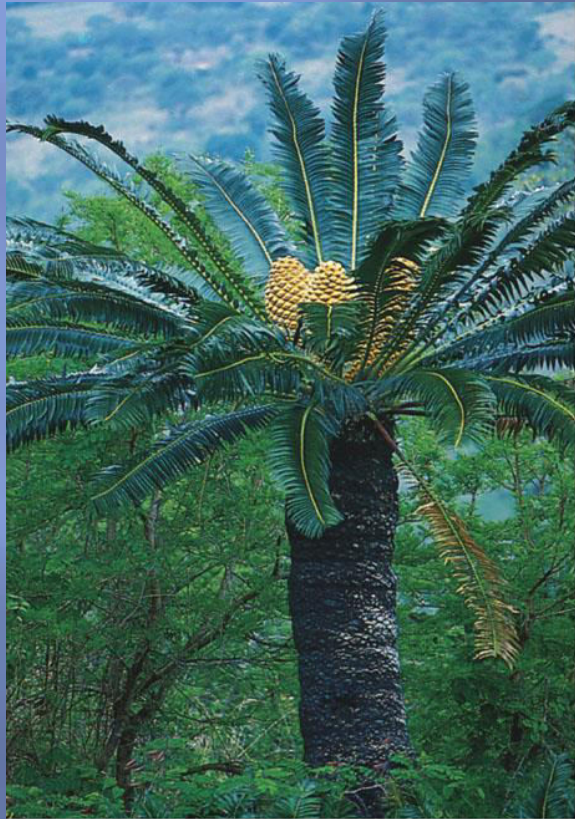


(a) In white pine (*Pinus strobus*), leaves are long, slender needles that occur in clusters of five.



(b) In American arborvitae (*Thuja occidentalis*), leaves are small and scalelike (see inset).

CYCADOPHYTA



(a) This cycad (*Encephalartos transvenosus*) in South Africa grows to approximately 9.2 meters (30 feet) and resembles a palm.

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- ▣ Phylum Cycadophyta
- ▣ Most now extinct
- ▣ Tropical/subtropical
- ▣ **Dioecious**- male and female reproductive parts on separate plants
- ▣ Motile sperm cells
 - Transferred as pollen grain then swim up pollen tube
- ▣ Many endangered
- ▣ Palm/fern-like appearance

GINKGOPHYTA

- ▣ Phylum Ginkgophyta
- ▣ Only 1 Species
- ▣ Oldest species of living trees
 - In China, ginkgo leaves and wood found 170 million years old

Cultivated for edible seeds

- ▣ Somewhat resistant to air pollution and disease



(c) Close-up of a branch from a female ginkgo tree, showing the exposed seeds.

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GINKGOPHYTA



(b) A young branch bearing male strobili. As the leaves age, they become a darker green.

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Enhances memory in
elderly people

GNETOPHYTA

- ▣ Phylum Gnetophyta
- ▣ 3 Distinct Genera:
 - *Gnetum*
 - *Ephedra*
 - *Welwitschia*
- ▣ Most Dioecious
- ▣ More advance than other gymnosperms
- ▣ Efficient water conducting cells (vessel elements)
- ▣ Have cone cluster that resemble flower clusters
- ▣ Parts of life cycle resembles that of flowering plants



Gnetum

- ▣ Tropical Vines, shrubs, trees
- ▣ Simple broad leaves
 - ▣ Opposite arrangement on stem
- ▣ Seeds
 - ▣ Fleshy, bright, outer covering
 - ▣ Resembles fruit



(a) The leaves of *Gnetum gnemon* resemble those of flowering plants. The exposed seeds are yellow to red when ripe.

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Ephedra

- ▣ Shrubs & vines
- ▣ Deserts, dry temperate, and tropical areas
- ▣ One species is the source of ephedrine (stimulates heart and raises blood pressure)



(b) A male joint fir (*Ephedra*) has pollen cones clustered at the nodes. In the 19th century, European pioneers used species native to the American Southwest to make a beverage, Mormon tea.

Welwitschia

- ▣ 1 Species
- ▣ Long, underground taproot
- ▣ Short, wide stem
 - Forms shallow disc from which two long ribbon-like leaves extend
- ▣ Leaves grow throughout life
- ▣ Reproduce by cones at ends of leaves



(c) *Welwitschia* is native to deserts in southwestern Africa. It survives on moisture-laden fogs that drift inland from the ocean. Photographed in the Namib Desert, Namibia.

Which is not a gymnosperm?

- A. Spruce
- B. Cycad
- C. Maple
- D. Gingko
- E. Welwitschia

Ecology



- ▣ Conifers are the predominant trees in about 35% of the world's forests
- ▣ Their roots hold soil in place, reducing soil erosion
- ▣ Conifer forests are important watersheds and provide habitat for many organisms

Economy



- ▣ Recreational uses of forests
 - Camping, backpacking, picnicking, observing nature
- ▣ Products
 - Lumber, medicinal products, turpentine, resins
- ▣ Conifers grown commercially
 - Most economically important gymnosperms
 - Landscape design, Christmas trees

Amber

