

General Biology 1

BIO1201 RM 1021

Syllabus & Textbook:

<https://openlab.citytech.cuny.edu/oer-biology/lecture-schedule/>

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Grade Breakdown:

Lecture (60%)

Exams (4): 22.5% Each

Pop Quizzes (?): 10% Average

Lab (40%) – Lab Instructor

<u>Letter Grade</u>	<u>Numerical Ranges</u>
A	93-100
A-	90-92.9
B+	87-89.9
B	83-86.9
B-	80-82.9
C+	77-79.9
C	70-76.9
D	60-69.9
F	59.9 and below

<https://youtu.be/Bsn3MT-5Yyo?t=1165>

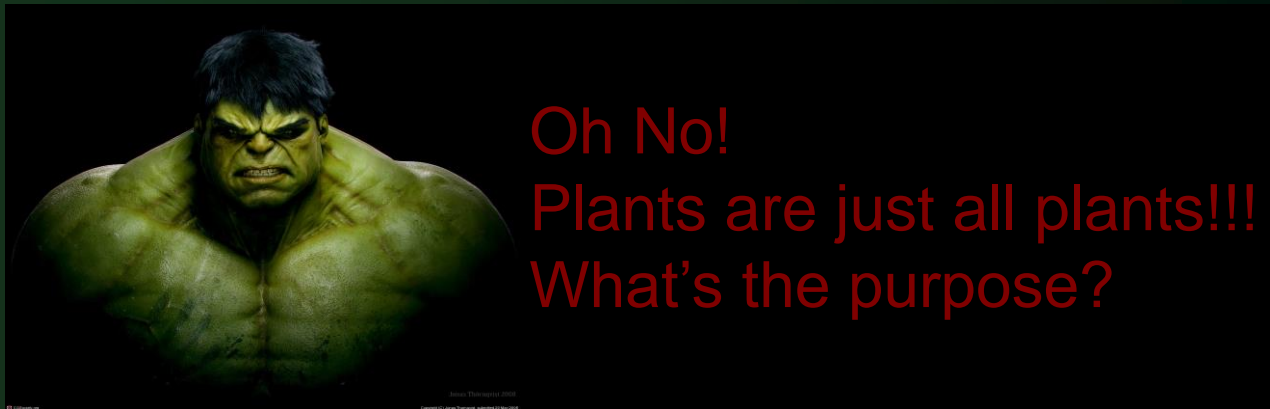
Plants: Evolution & Diversity

Part I: Seedless Plants



Outline

- Evolutionary History of Plants
- The Green Algal Ancestor – Plants Adaptations to land
- Bryophytes: Colonization of Land
- Lycophytes/Pteridophytes: Vascular Tissue





x 215
pairs of jeans

x 250
single bed sheets

x 750
shirts

x 1,200
t-shirts



1x Cotton Bale =

x 3,000
nappies

x 4,300
pairs of socks

x 680,000
cotton balls

x 2,100
pairs of boxer shorts

Fossil fuels

Fuel from deep under the ground

Coal, oil and gas are fossil fuels.



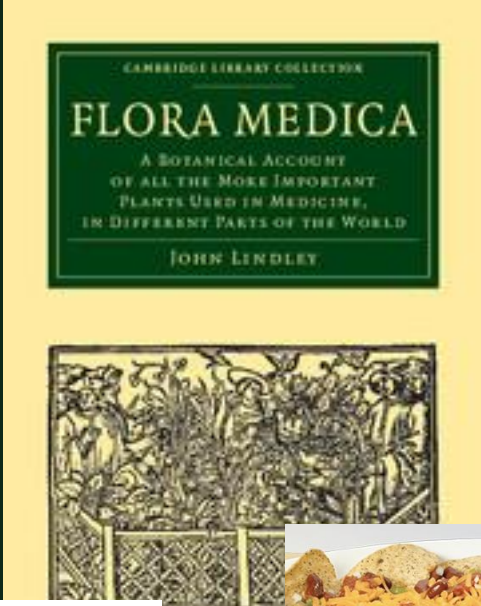
Fossil fuels are used in the home...



Lots of things are made from fossil fuels.



...in industry, and to power transport.



Evolutionary History of Plants

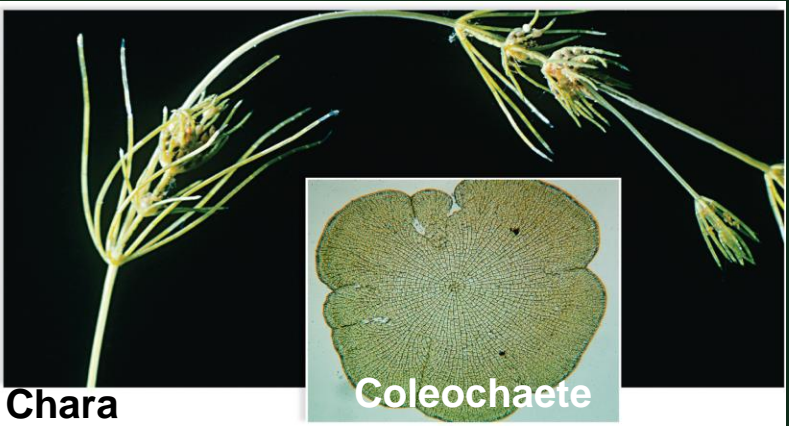
- Plants are multicellular, photosynthetic eukaryotes.
- Plants evolution is marked by adaptations to a land existence.
- A land environment does offer certain advantages.
 - Plentiful light for photosynthesis
 - CO₂ is present in higher concentrations and diffuses more readily in air than in water.

Evolutionary History of Plants

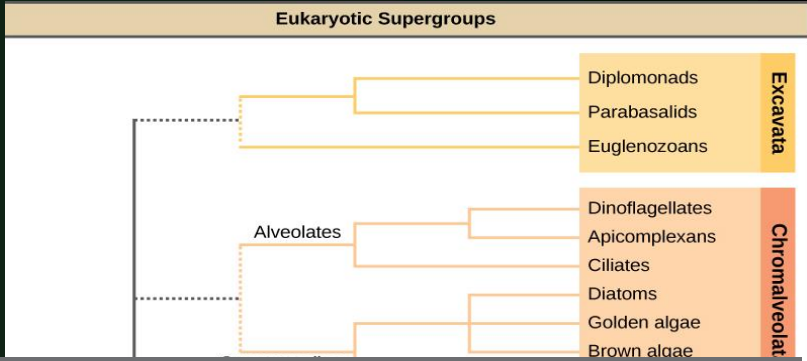
- A land environment does offer certain advantages but
 - **Constant threat of desiccation** (drying out).
 - Protect all phases of reproduction (sperm, egg, embryo) from drying out
 - Seed plants disperse their embryos within the seed, which provides the embryo with food within a protective seed coat.
 - **Gravity**
- The water environment provides
 - plentiful water.
 - support for the body of the plant.

Close Algal Relatives of Land Plants

Plants evolved from freshwater Green Algae (protist)



The representative alga, Chara, is a noxious weed in Florida, where it clogs waterways



Land plants and closely related green algae are placed in **Streptophyta**

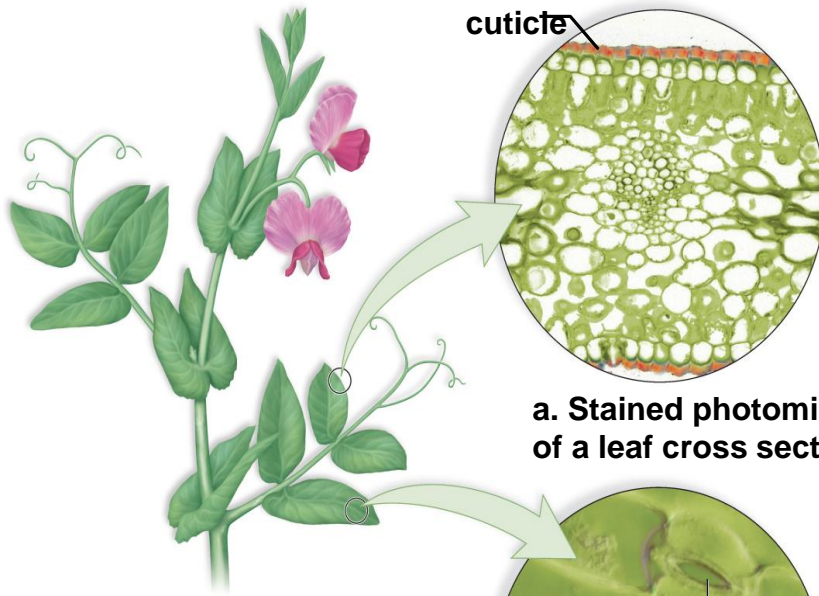
STREPTOPHYTES: THE GREEN PLANTS							
Charophytes	Embryophytes: The Land Plants						
	Nonvascular			Vascular			
	Seedless Plants Bryophytes			Seedless Plants		Seed Plants Spermatophytes	
				Lycophytes	Pterophytes		
	Liverworts	Hornworts	Mosses	Club Mosses	Whisk Ferns	Gymnosperms	Angiosperms
				Quillworts	Horsetails		
		Spike Mosses		Ferns			

Evolutionary History of Plants

- **Some adaptations of plants to life on land:**
 - **Alternation of generations**
 - **Apical growth**
 - **Protection of the embryo** from drying out.
 - **Waxy cuticle** on leaves to prevent drying out.
 - **Internal 'skeleton'** (most plants) to oppose gravity.
 - **Vascular system** (in most plants) to move water internally.

Leaf and Root Adaptations

The cuticle consists of lipid and hydrocarbon polymers impregnated with wax, and is synthesized exclusively by the epidermal cells.



cuticle

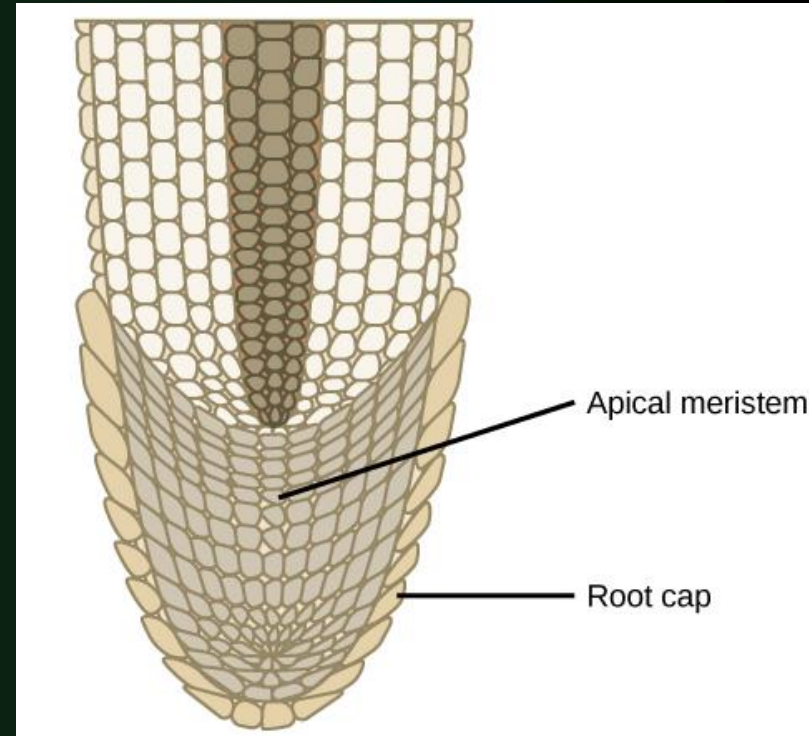
a. Stained photomicrograph of a leaf cross section

Plant leaves have a Cuticle and stomata

Stomata

400 x

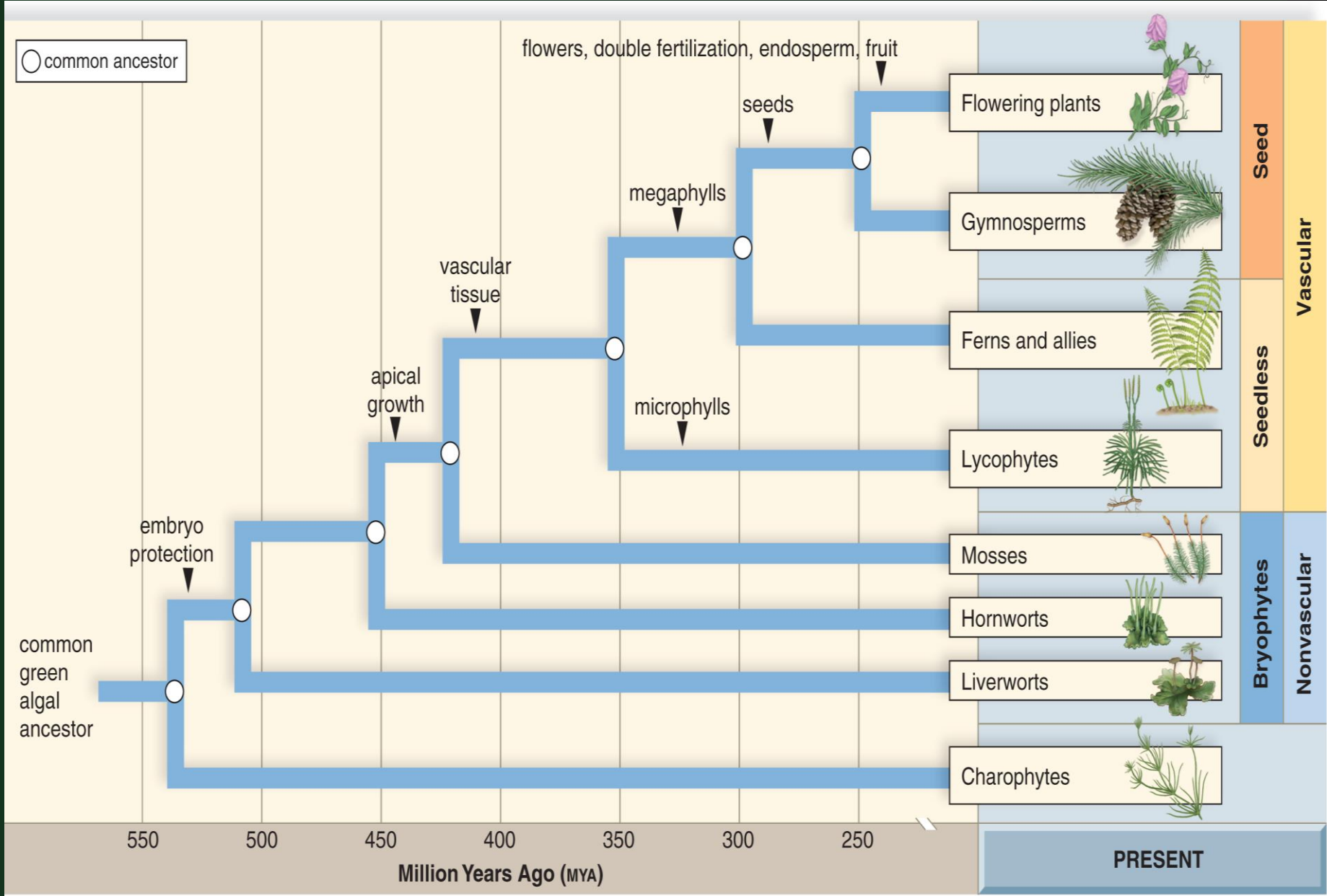
b. Falsely coloured scanning Electron micrograph of leaf surface



Apical meristem

Root cap

Addition of new cells in a root occurs at the apical meristem. Subsequent enlargement of these cells causes the organ to grow and elongate. The root cap protects the fragile apical meristem as the root tip is pushed through the soil by cell elongation.



Highlights of Plant Evolution

Evolutionary History of Plants

Evolution of plants marked by four evolutionary events associated with four major groups of plants

- **Nonvascular Plants**
 - Advent of nourishment of a multicellular embryo within the body of the female plant
- **Seedless vascular plants**
 - Advent of vascular tissue
- **Gymnosperms**
 - Produce seeds
- **Flowering Plants = Angiosperms**
 - Attract pollinators with flowers that give rise to fruits

Four Major Groups of Plants

female moss head



egg

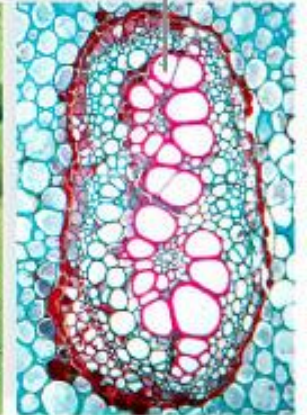


a. In nonvascular plants (e.g., mosses), multicellular embryos are protected and nourished within the structures that produce an egg.

fern leaf



vascular tissue



b. In seedless vascular plants (e.g., ferns), vascular tissue conducts water and organic nutrients within its roots, stems, and leaves.

seed cone



seed



c. In gymnosperms (e.g., conifers), seeds produced in seed cones disperse offspring away from the parent plant.

cherry blossoms



cherry



d. In angiosperms, flowers produce seeds protected by fruits, which aid in the dispersal of offspring.

Plants

Based on the presence or absence of vascular tissue plants are divided into vascular and non vascular plants. Liverworts and Mosses are examples of none vascular plants.

Vascular

Non-vascular (bryophytes)

Based on the presence and absence of seeds vascular plants are classified into plants with seed and plants without seed. Ferns are examples of plants without seed.

Seedless

With seed

Based on the presence and absence of flowers, plants with seed are classified into flowering and non-flowering plants. Conifers, Gingoes are examples of non-flowering plants.

Flowering (Angiosperms)

Non-flowering (Gymnosperms)

Based on number of cotyledons and flower parts, flowering plants are classified into Monocots and Eudicots

Monocots: One cotyledone, flower parts in 3 or multiple of 3, usually herbaceous, usually parallel ventilation...

Eudicotes: Two cotyledon, flower parts in 4 or 5 or multiples of 4 or 5, woody or herbaceous....

THIRD EDITION

Botany

AN INTRODUCTION TO PLANT BIOLOGY

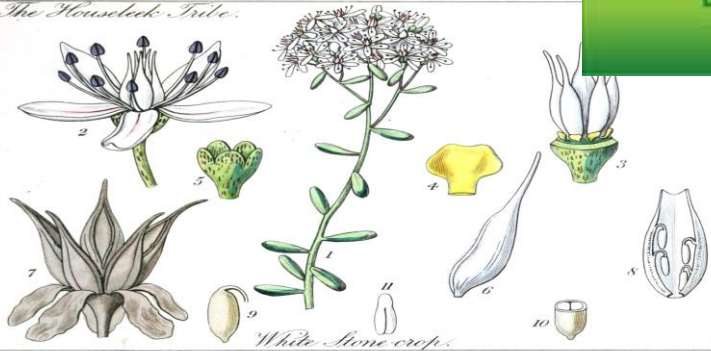
HARVARD UNIVERSITY HERBARIA



IBC 2017

XIX International Botanical Congress
Shenzhen China

The Houseleek Tribe.

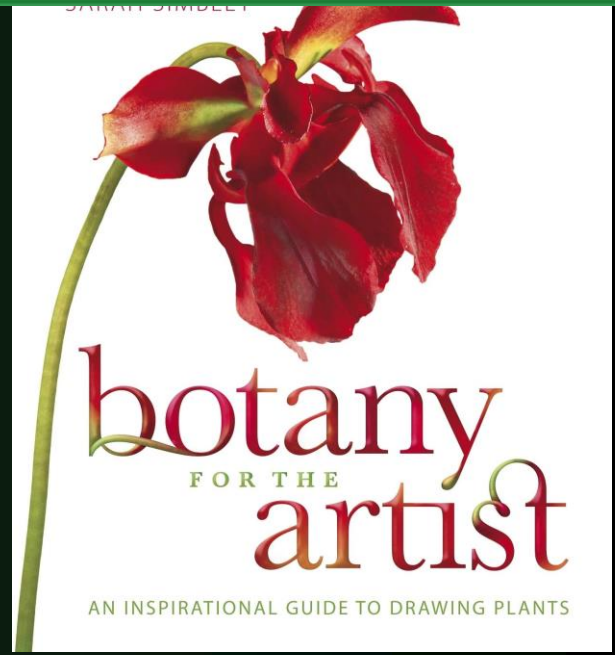


White Stonecrop.

The Saxifrage Tribe.



Three-fingered Saxifrage.



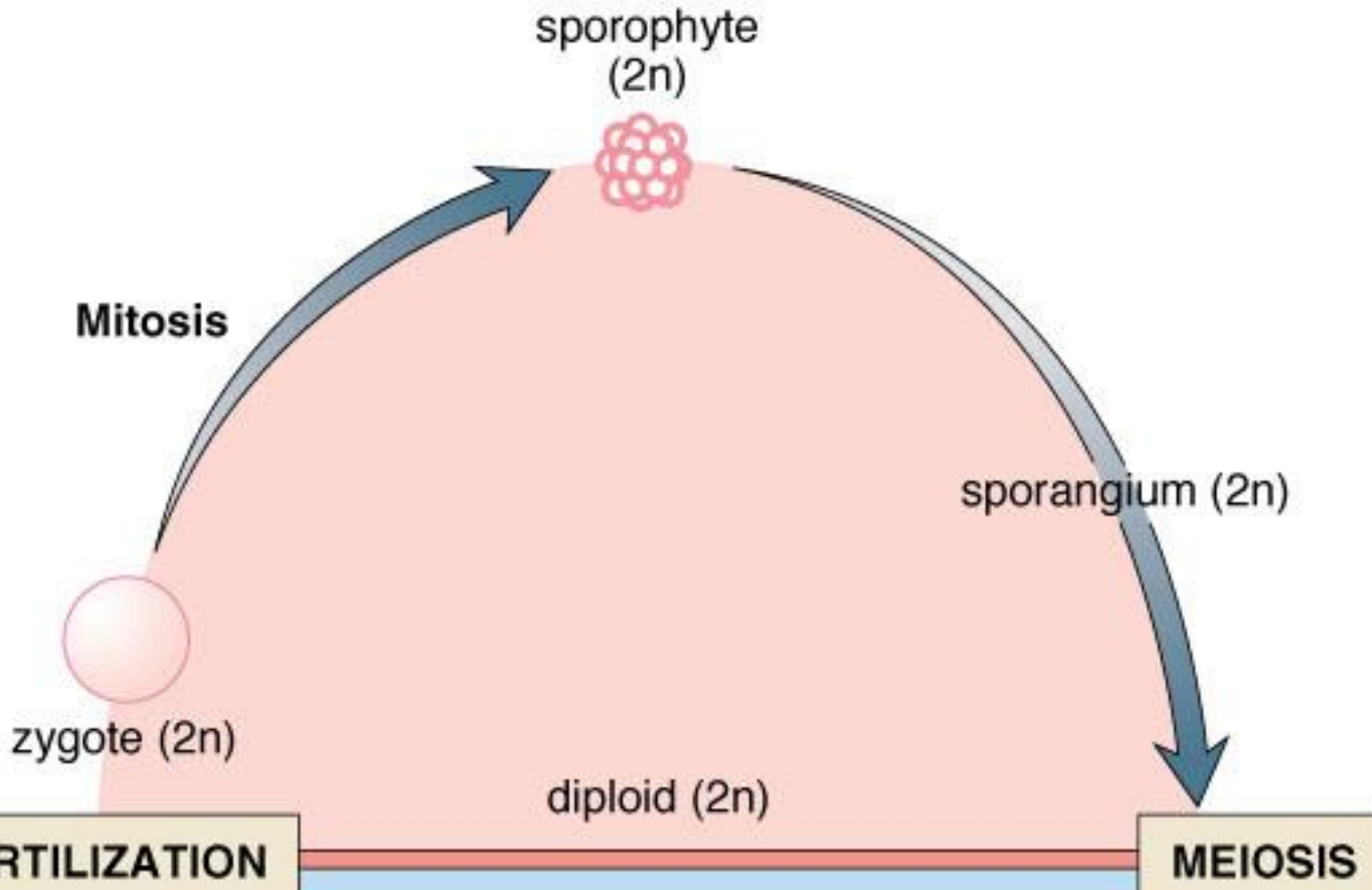
Check Point!

- 1. Trace the evolutionary history of land plants using the phylogenetic tree provided on the first slides**
- 2. What traits do charophytes have that are shared by land plants?**
- 3. List the characteristics that allowed plants to successfully colonize land.**
- 4. The part of biology that studies plants is called _____**

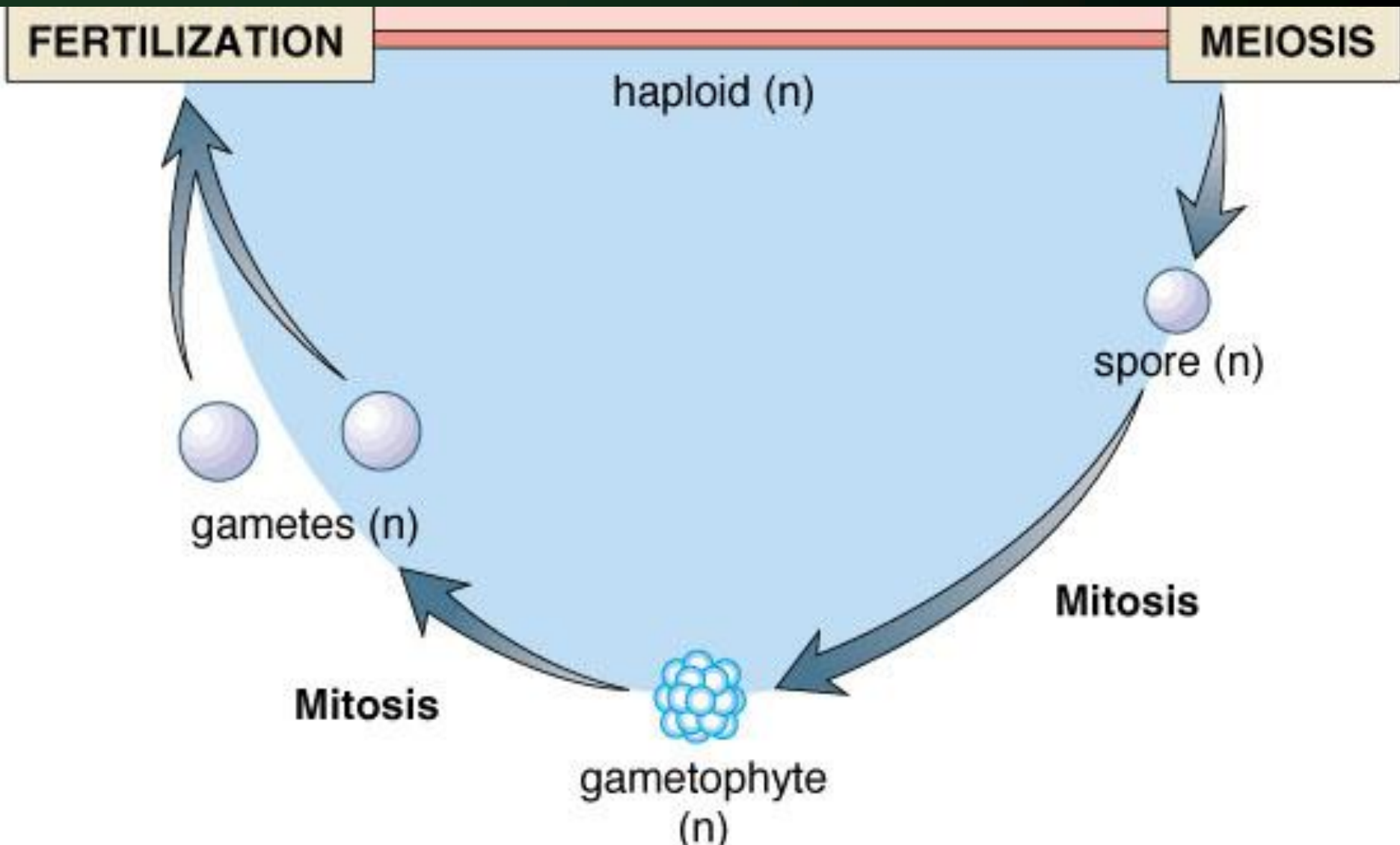
Alternation of Generations

- Plant life cycle(s) include alternation of generations cycle only.
 - **Sporophyte** produces spores by the process of meiosis and represents diploid generation.
 - **Gametophyte** produce gametes and represents haploid generation.

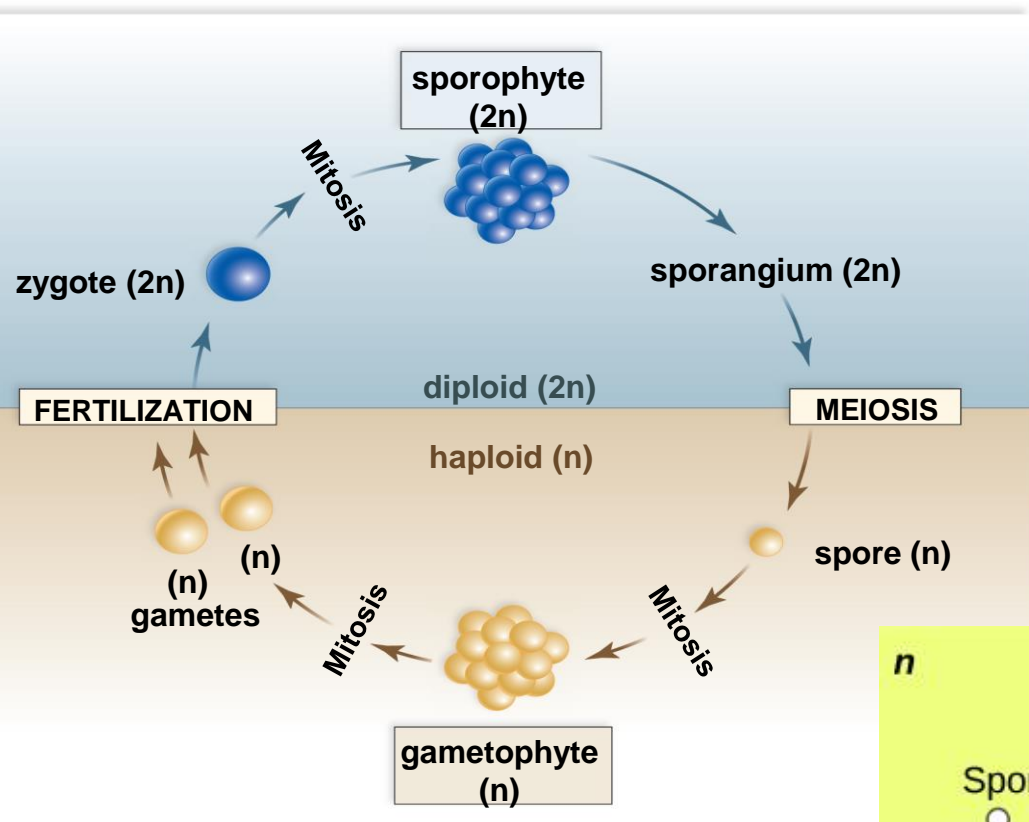
Alternation of Generations



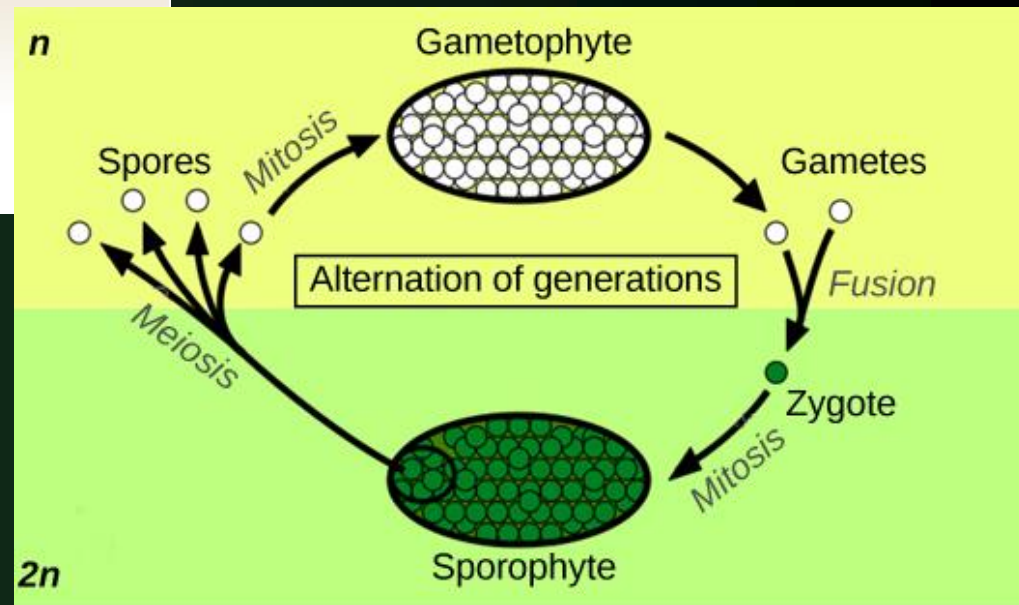
Alternation of Generations



Alternation of Generations

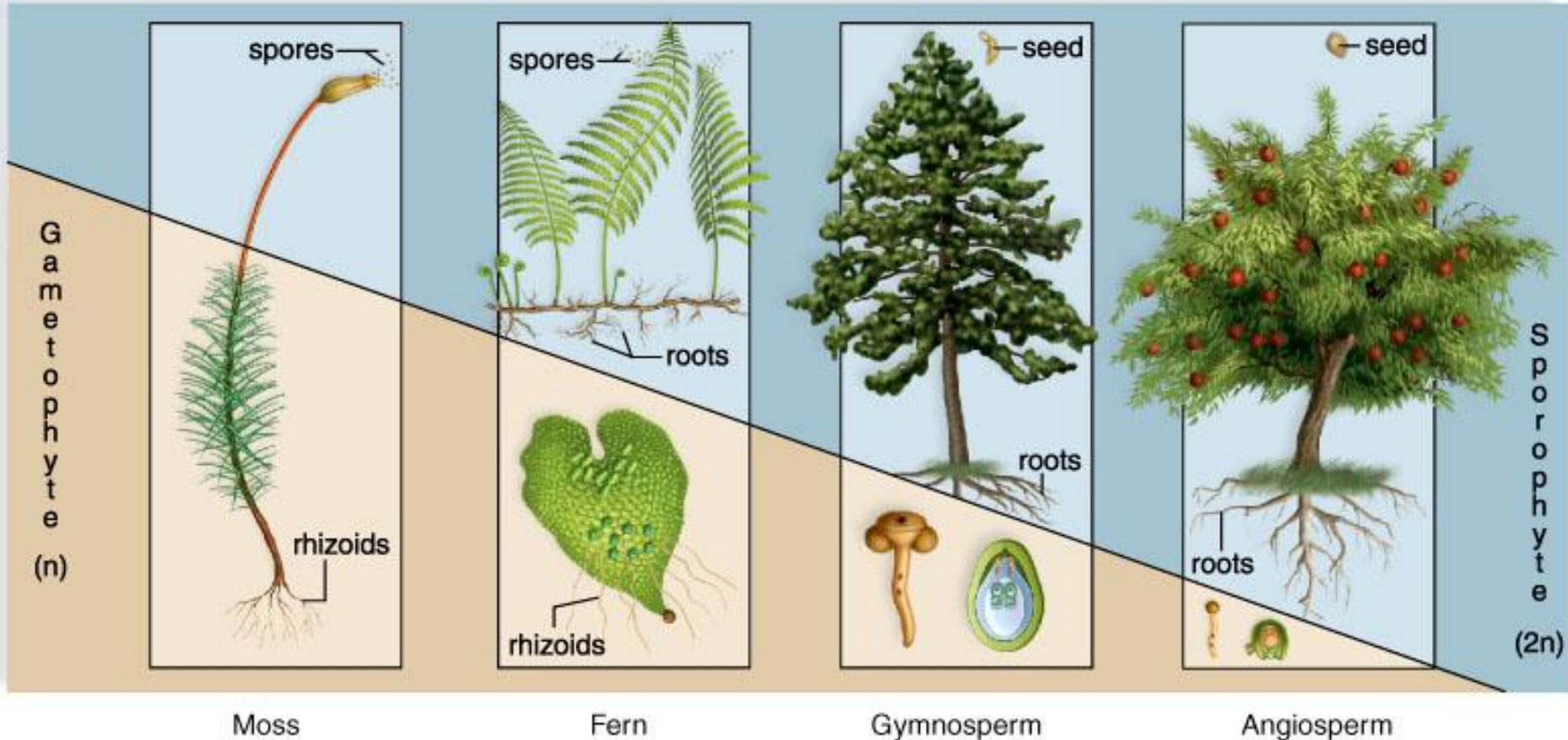


Always the same but different figures



Reduction in the Size of the Gametophyte

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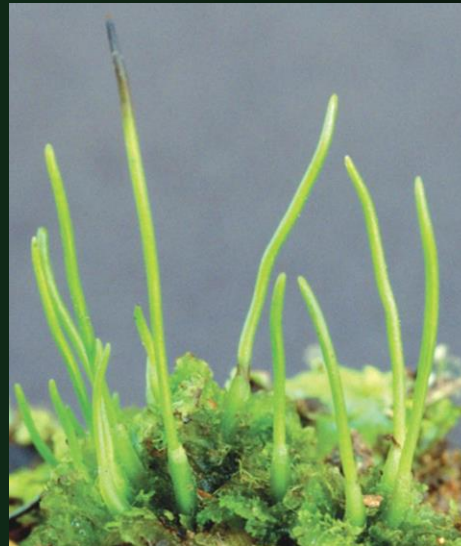
Gametophyte (n) dominant \longrightarrow Sporophyte (2n) dominant

Clarifying ...

- 1. What is meant when it is said that a plant alternates generations?**
- 2. Distinguish between a sporophyte and a gametophyte**
- 3. What does 'dominant generation' mean?**

Bryophytes - Nonvascular plants (mosses, worts)

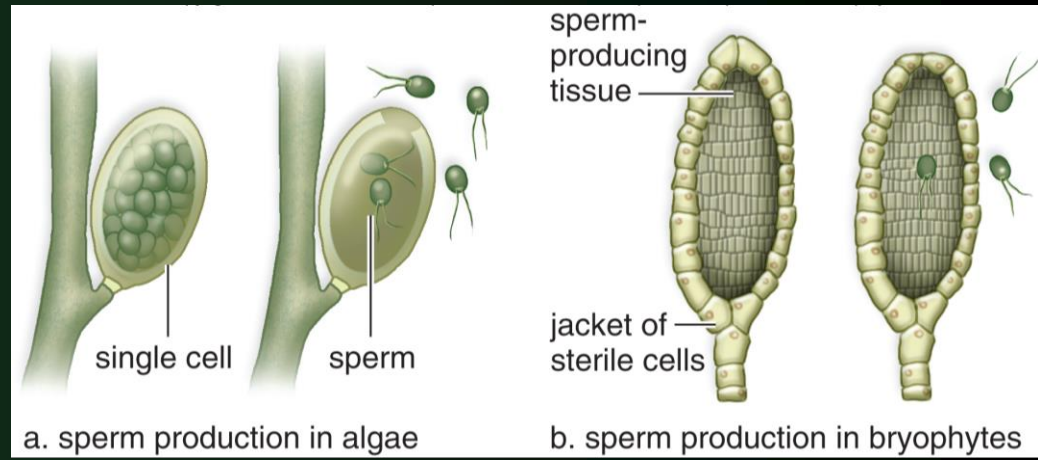
- Bryophytes are represented today by three phyla of small herbaceous (nonwoody) plants:
 - Liverworts, phylum Hepatophyta
 - Hornworts, phylum Anthoceroophyta
 - Mosses, phylum Bryophyta





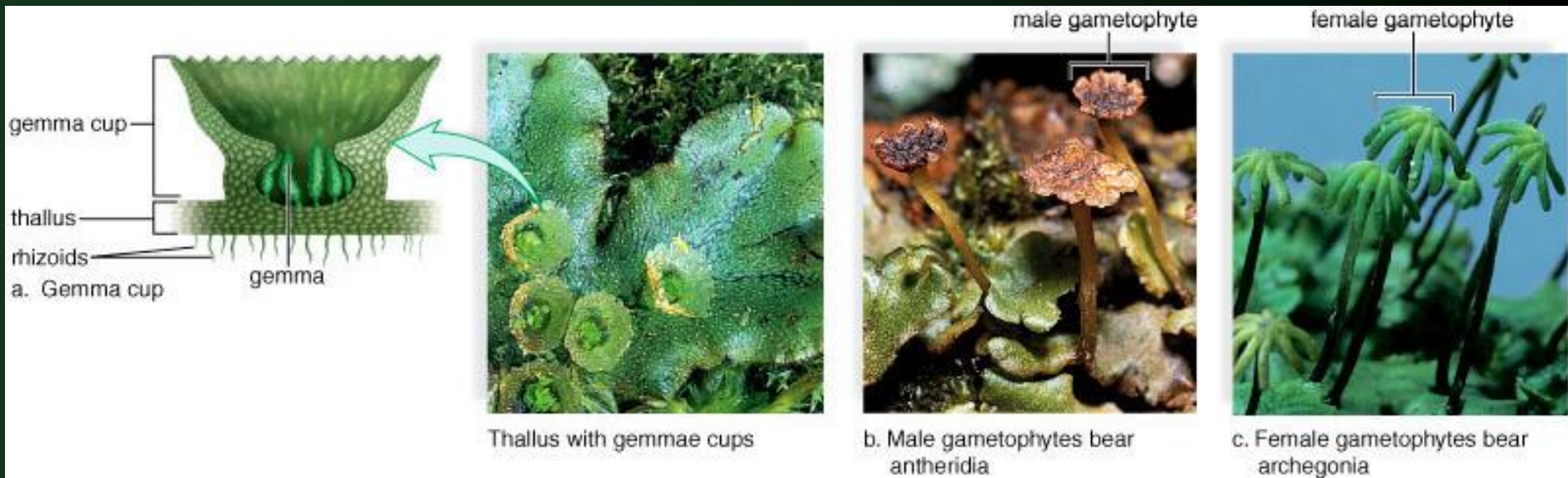
Nonvascular Plants

- = **Bryophytes** - lack specialized means of transport for water and nutrients.
- Gametophyte is the dominant generation
- No true roots, stems, and leaves. **Rhizoids** anchor the plants
- Heterosporous
- Eggs made in the **archegonium**
- Flagellated sperm in antheridium
 - Sperm needs to swim to egg in film of water to make zygote



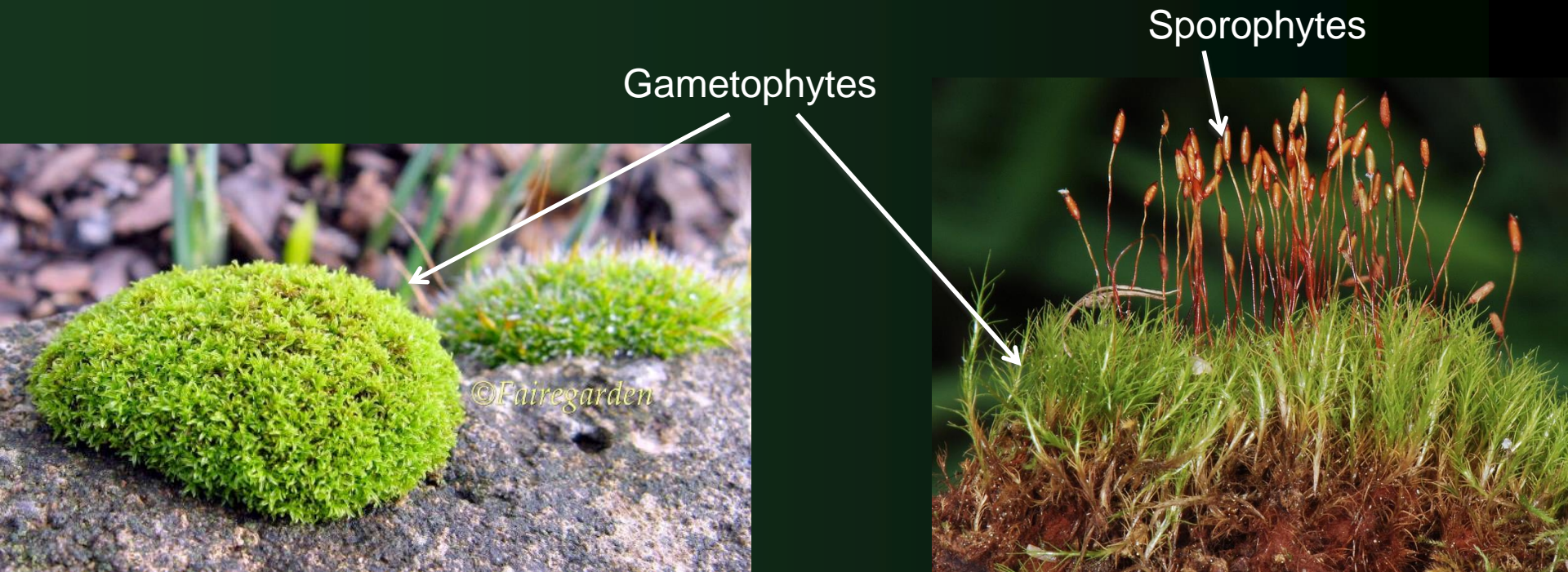
Nonvascular Plants

- Liverworts have either flattened thallus (body) or leafy appearance with no true root, no stem.
- Asexually reproduce by *gemmae* (group of cells that detach from the thallus and can start a new plant)



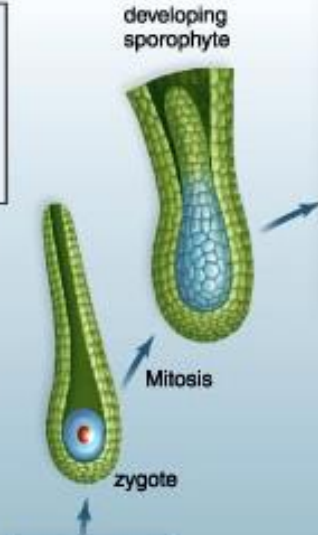
Nonvascular Plants

- Mosses usually have a leafy shoot.
 - Can reproduce asexually by fragmentation.
 - Mosses prefer damp, moist and shaded location, but could survive in deserts too

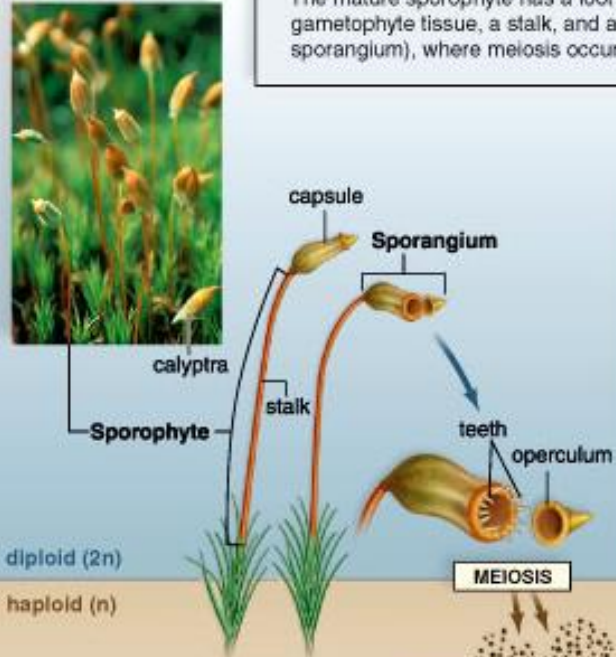


Moss (*Polytrichum*) Life Cycle

3. The zygote:
The zygote and developing sporophyte are retained within the archegonium.

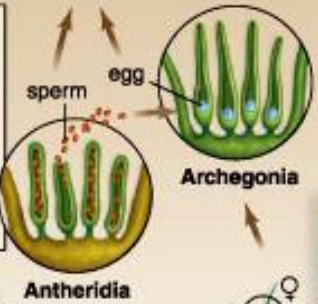


4. The sporophyte:
The mature sporophyte has a foot buried in female gametophyte tissue, a stalk, and an upper capsule (the sporangium), where meiosis occurs and spores are produced.

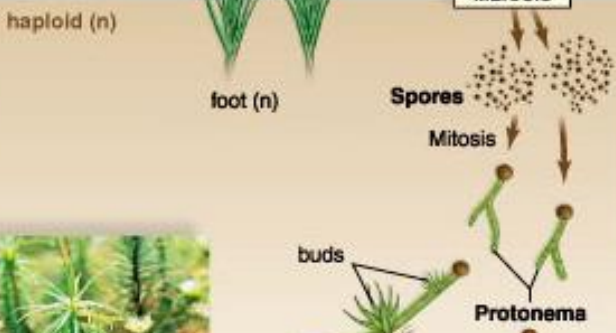
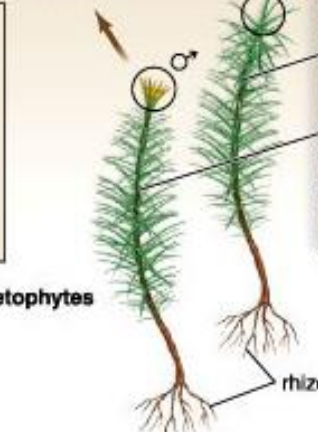


5. The spore:
When the calyptra and lid (operculum) of a capsule fall off, the spores are mature. One or two rings of teeth project inward from the margin of the capsule. The teeth close the opening, except when the weather is dry.

2. Fertilization:
Flagellated sperm produced in antheridia swim in external water to archegonia, each bearing a single egg.



1. The mature gametophytes:
In mosses, the leafy gametophyte shoots bear either antheridia or archegonia, where gametes are produced by mitosis.



6. Spore dispersal:
Spores are released when they are most likely to be dispersed by air currents.

7. The immature gametophyte:
A spore germinates into a male or female protonema, the first stage of the male and the female gametophytes.



diploid (2n)
haploid (n)

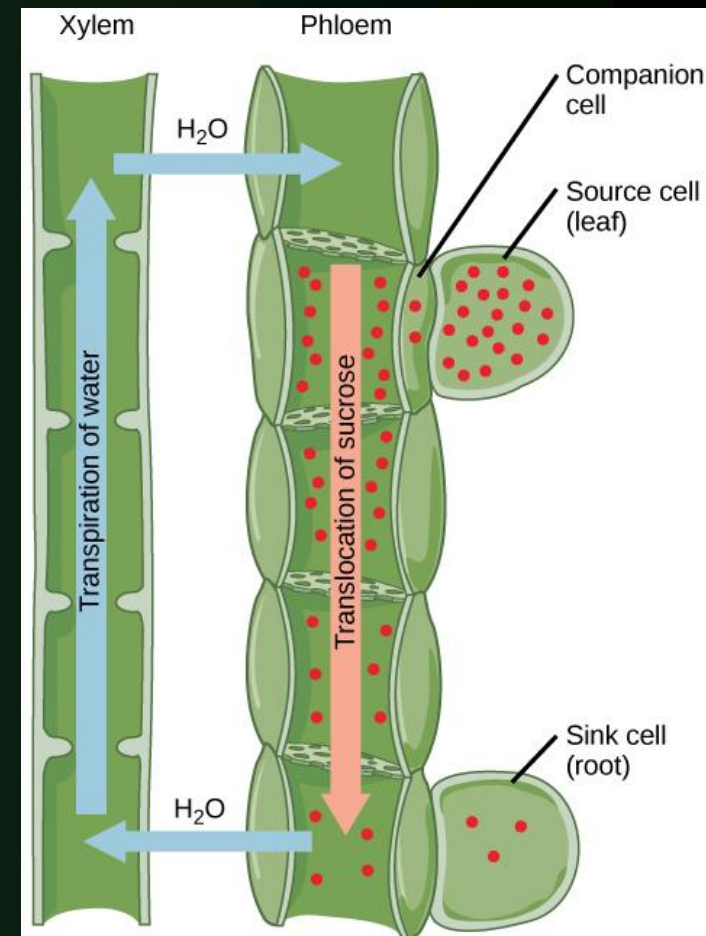
FERTILIZATION

MEIOSIS

Vascular Plants

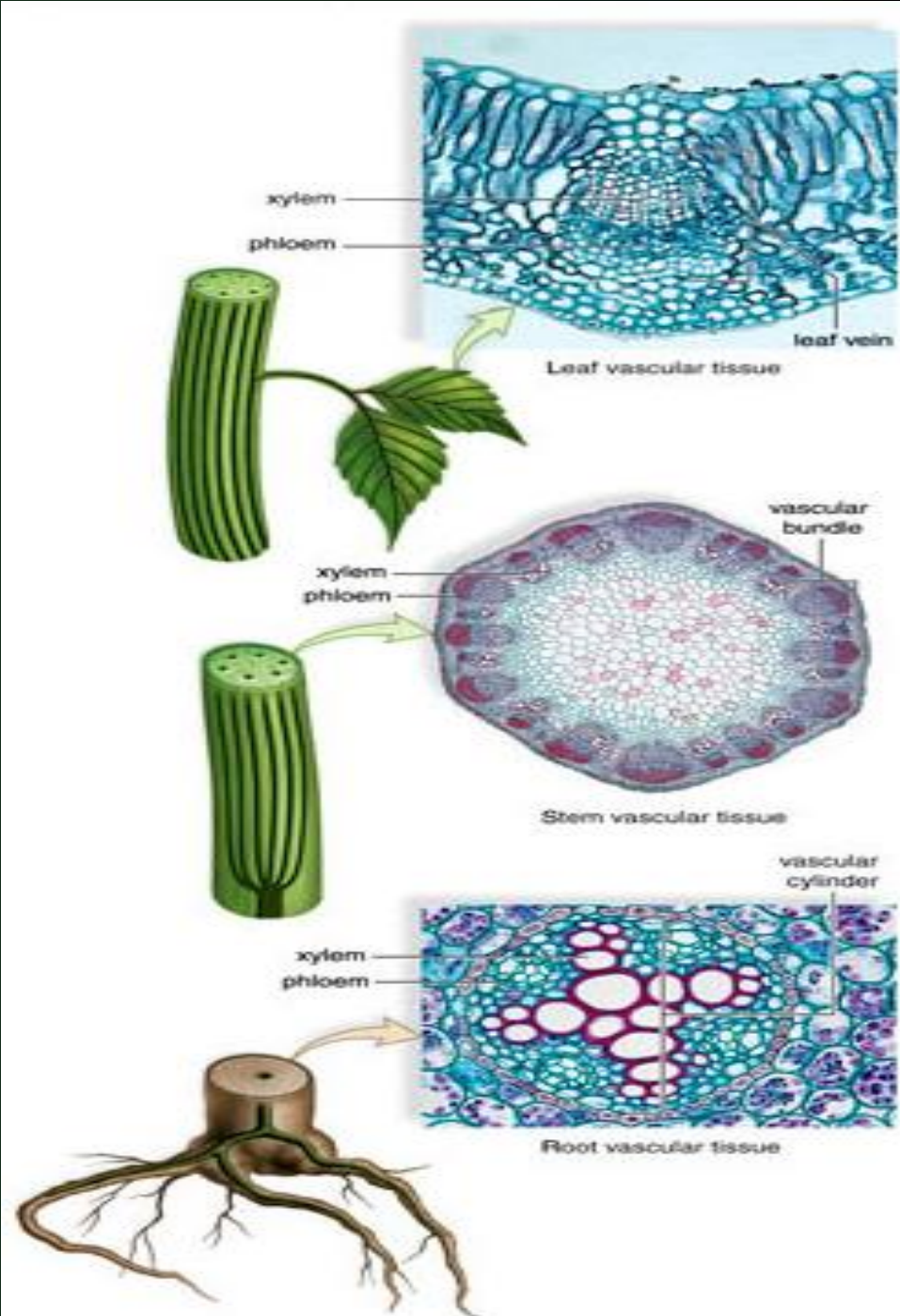
Known as **Tracheophytes**, they dominate the natural landscape

- **Xylem** conducts water and dissolved minerals up from roots
- **Phloem** conducts sucrose and other organic compounds throughout the plant
- **Lignin** strengthens walls of conducting cells in xylem



Vascular Tissue

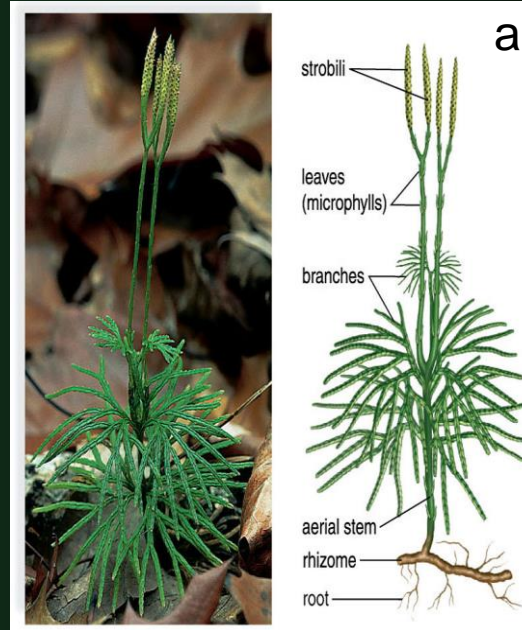
- **Xylem** conducts water and dissolved minerals up from roots
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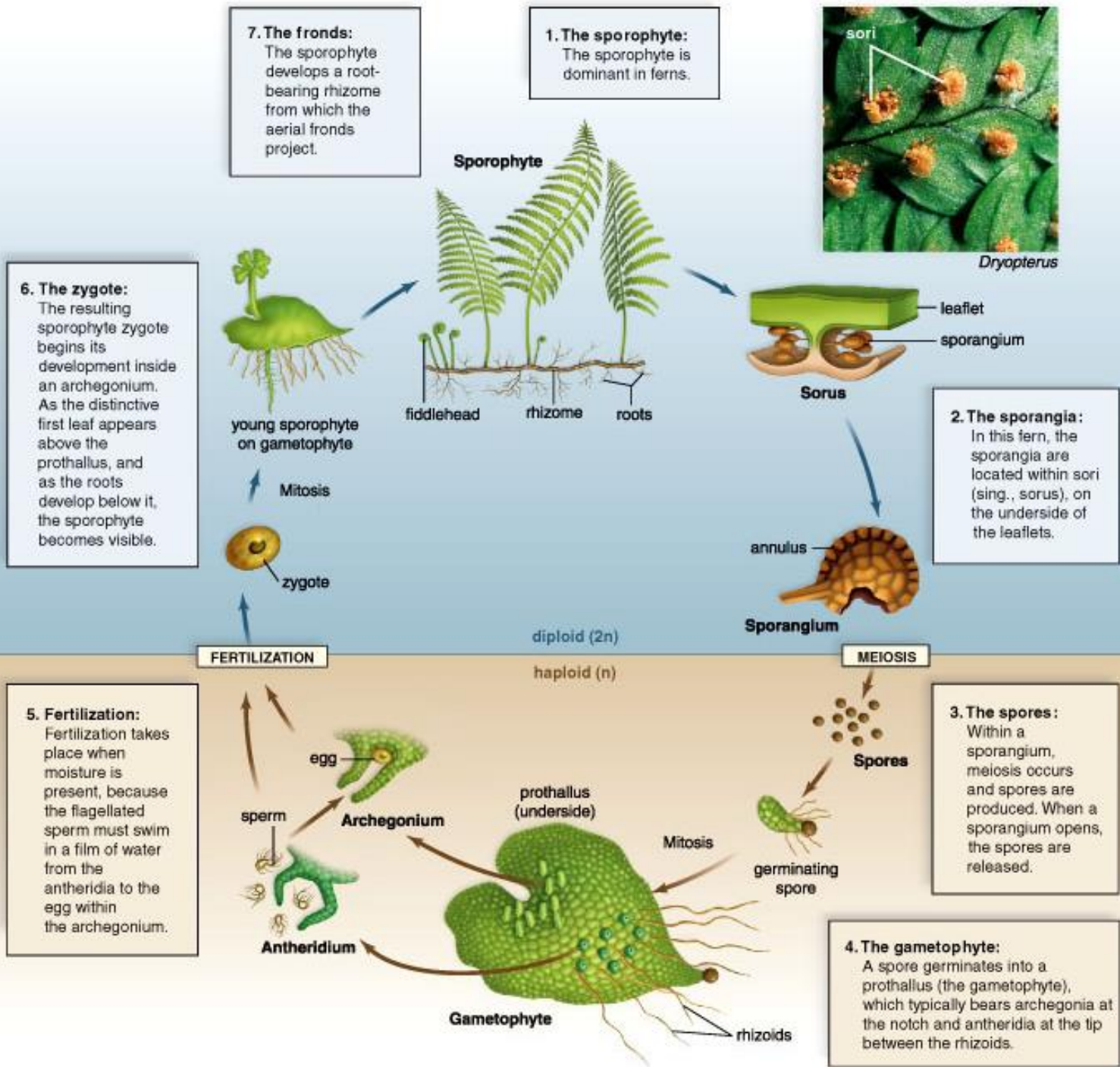
Seedless Vascular Plants

Lycophytes and Pterophytes

- They have true leaves and roots
- Sporophyte is dominant
- Homosporous (spores are about same size)
- Sperm cells are flagellated
- Includes:
 - Club Mosses (a)
 - Whisk Ferns (b)
 - Horsetails (c)
 - Ferns (d)



Fern Life Cycle



The Uses of Ferns

- Edible ferns are used as a food source
- Can be used as fuel
- Harbor nitrogen-fixing cyanobacteria
- *Azolla* is grown in rice paddies, where it fertilizes rice plants.
- Ferns and their allies are used as medicines in China.
- Extracts from ferns have also been used to kill insects
- Used as decoration

Don't turn green...!

- 1. List the traits that classify a plant as a bryophytes & explain various methods of bryophyte reproduction**
- 2. Give an overview of the life cycle of mosses**
- 3. List the unique structural adaptations found in Lycophytes & Pterophytes**
- 4. How does xylem contribute to an upright body**
- 5. Why are fern still dependent on external water?**
- 6. Explain archegonium & antheridium, homosporous & heterosporous**

Quiz Time:

<https://openlab.citytech.cuny.edu/oer-biology/lecture-schedule/>