

Week 5: *Physcomitrella* and other seedless plants



Reading:

- Read lab manual chapter 5
- Pages 121-145, 147-150



Statistics!

- Mean: average of all data points

Excel: =AVERAGE()

Sum of all data points/# of data points

- Standard deviation: how spread out your data points are

Excel: =STDEV()

$$\sigma = \sqrt{\frac{\sum (X - \bar{X})^2}{n - 1}}$$

- Sample size: n

Excel: =COUNT()

Number of data points in your sample

- Standard error: How close your estimated mean is to the actual mean

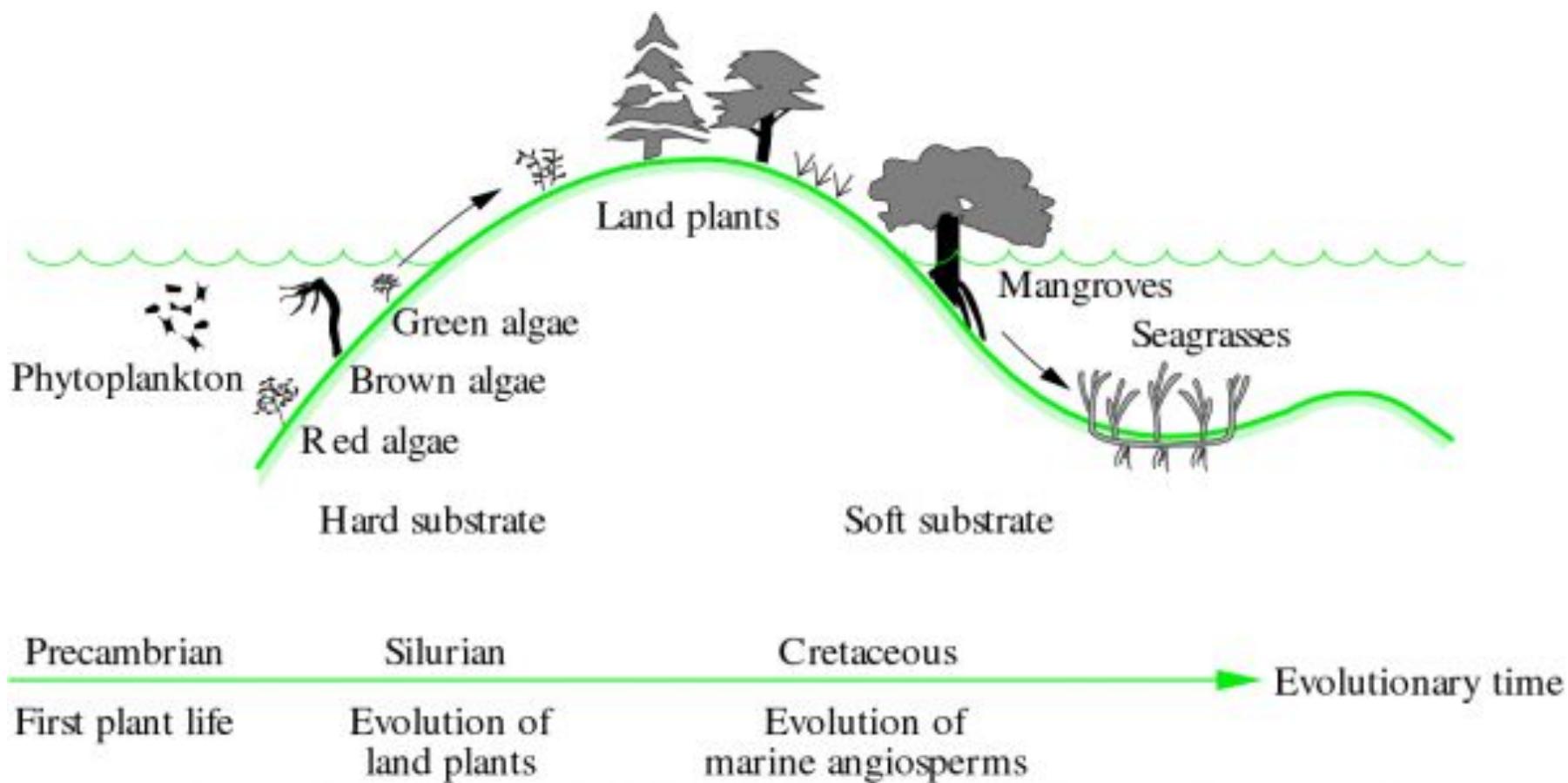
Excel: =STDEV/SQRT(n)

Incorporates sample size and standard deviation

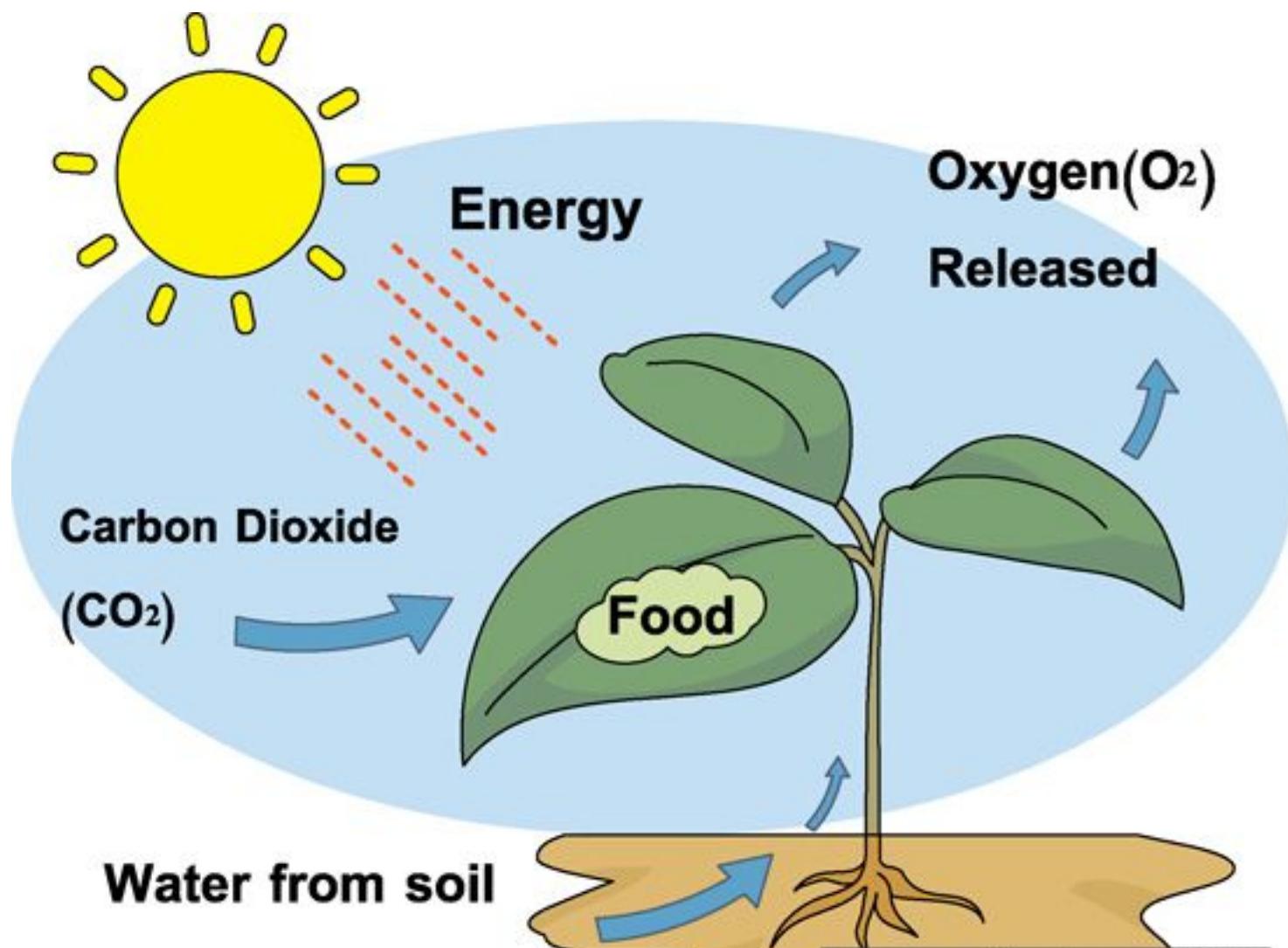
- IN THIS CLASS: we will believe there is a significant difference between two measures if the error bars (SE) do not overlap



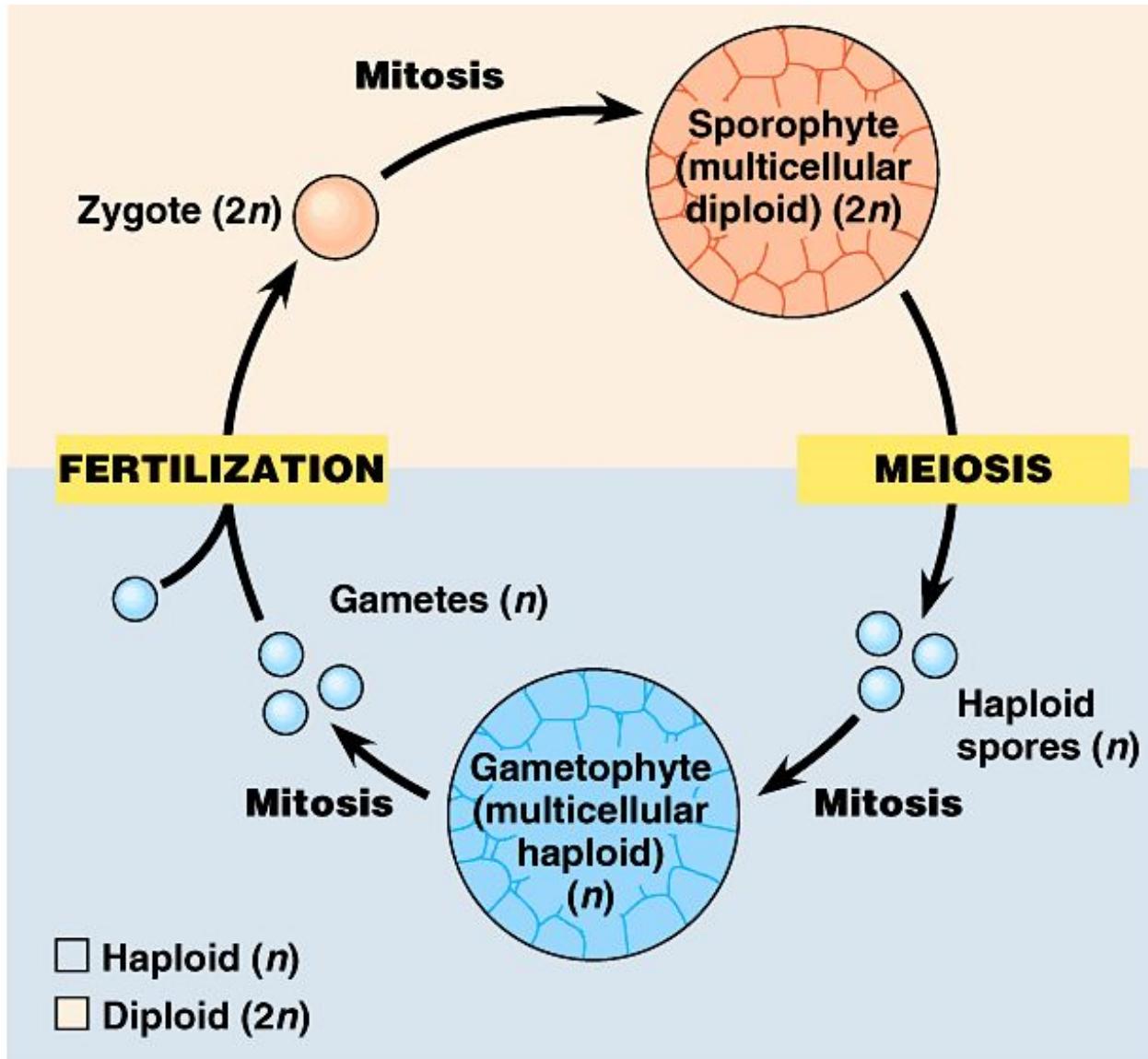
Evolution of Plants

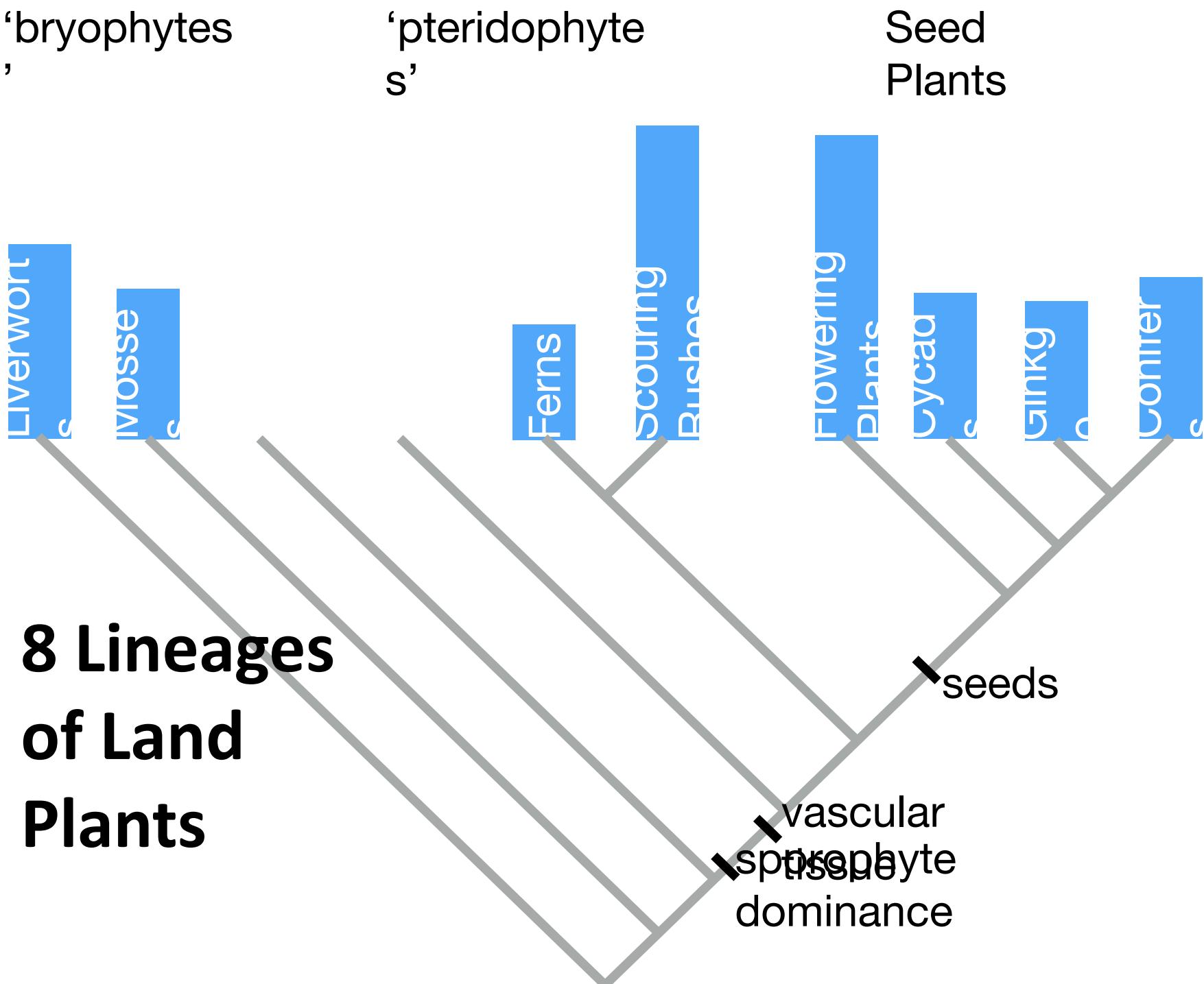


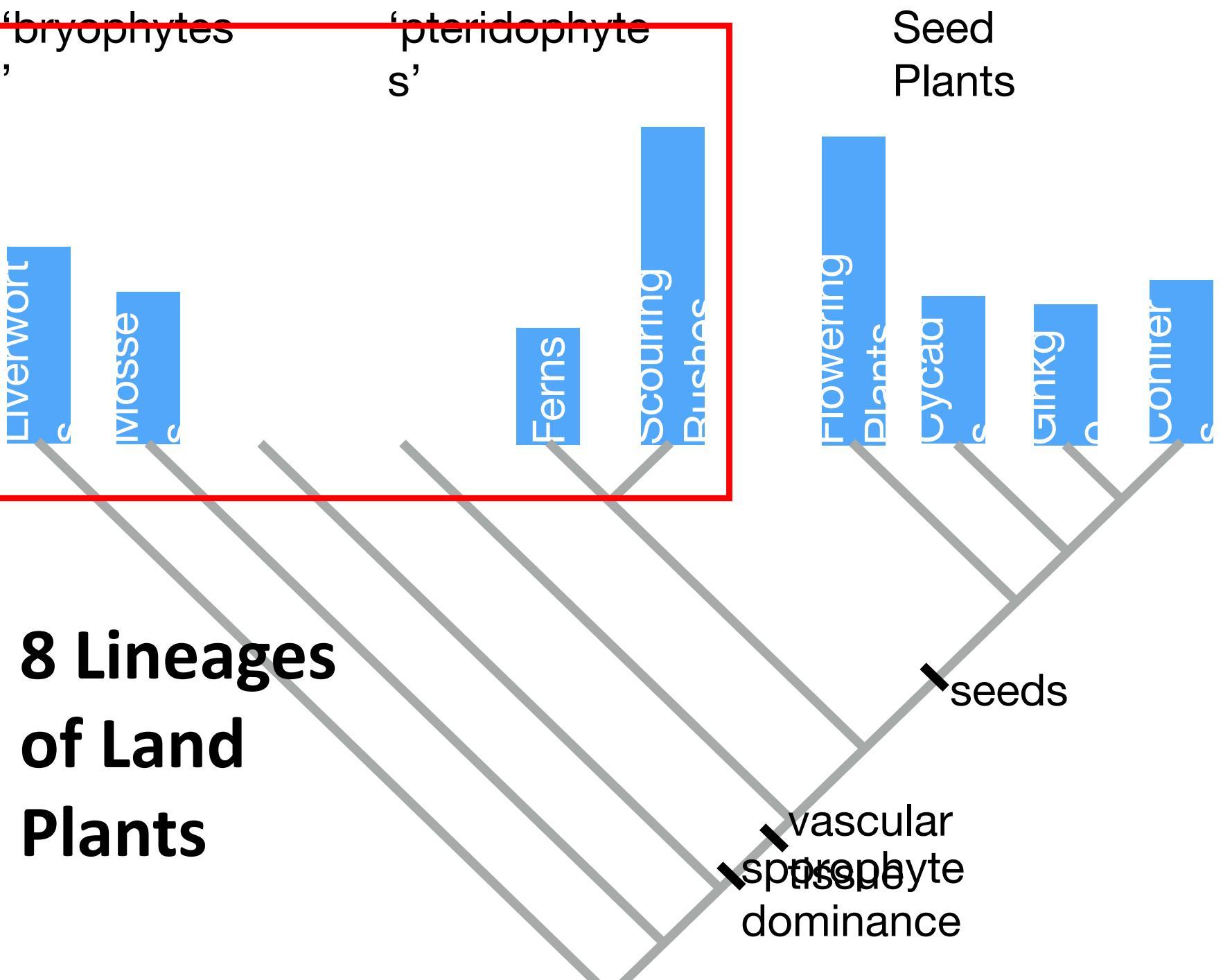
Plants are Autotrophic Organisms



Alternation of Generations







Lineage Plantae

The Bryophytes

- Phylum Hepaticophyta
- Phylum Musci

The Pteridophytes

- Phylum: Monilophyta

The “Gymnosperms”

- Phylum Cycadophyta

Important Characteristics: Moss & Ferns

1. Chlorophyll *a* is the primary photosynthetic pigment
2. Starch is the primary food reserve
3. Cell walls made of cellulose
4. Cell division by formation of a **phragmoplast** after mitosis
5. **Oogamous** - gametes of two different sizes
 1. As opposed to **isogamous**
6. Moss: (**Poikilohydric**) Ferns: (**Homeohydric**)

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Bryophytes (mosses & liverworts)

Vasculars (ferns)

Minimal vasculature (without lignin)

Vascular tissue elaborate (including lignin)

Sporophyte lives out its life on gametophyte—gametophyte dominant

Sporophyte dominant—grows off of gametophyte

Vascular tissue = conductive tissue (xylem and phloem)

Lignin = Component of cell wall that gives rigidity



Bryophytes

Where do bryophytes grow?

- NOT just in wet, shaded places!
- Live in all terrestrial biomes, including tundra, shrubland, and desert
- Can grow on rocks, trees, on dirt, in water
- Many types can dry out completely desiccation tolerance



Phylum Musci

The Mosses

- Gametophyte is dominant generation
- Rhizoids multicellular
- Sporangium with operculum and peristome
- Leaves spirally arranged



Mosses: ~ 14,000 species worldwide

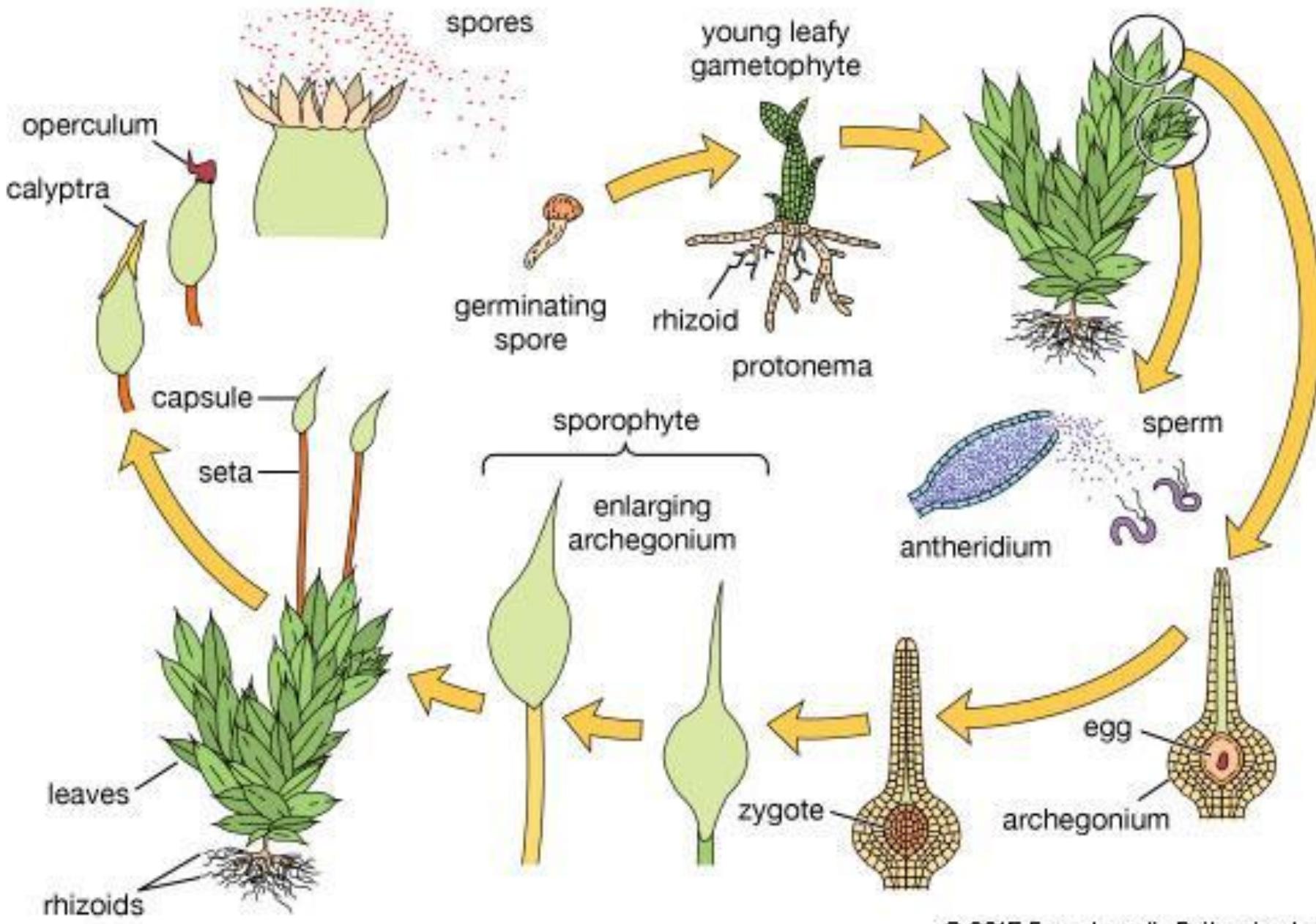


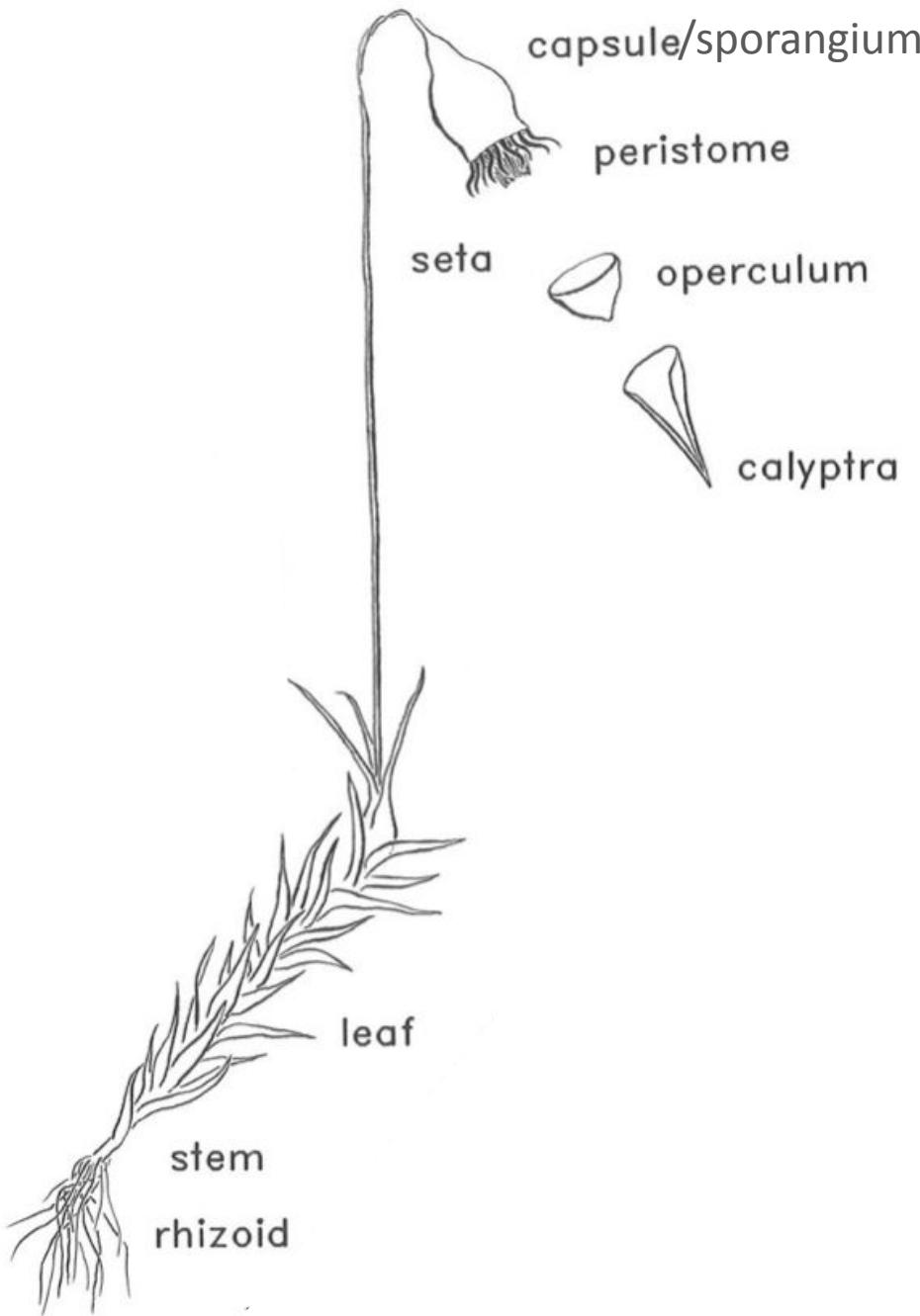
Moss Rehydration

Poikilohydric

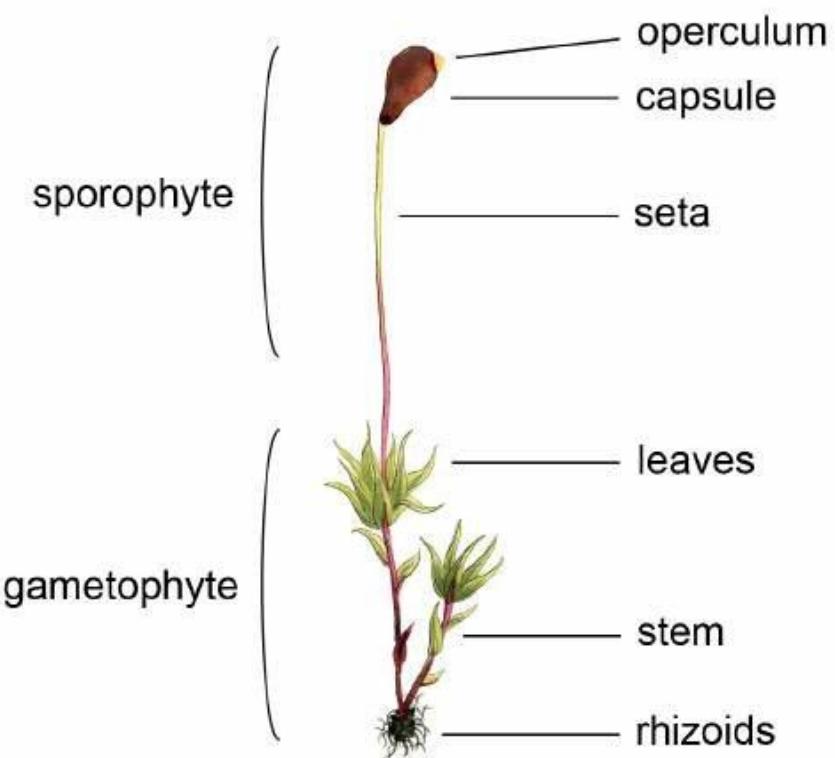
Desiccated mosses can rehydrate

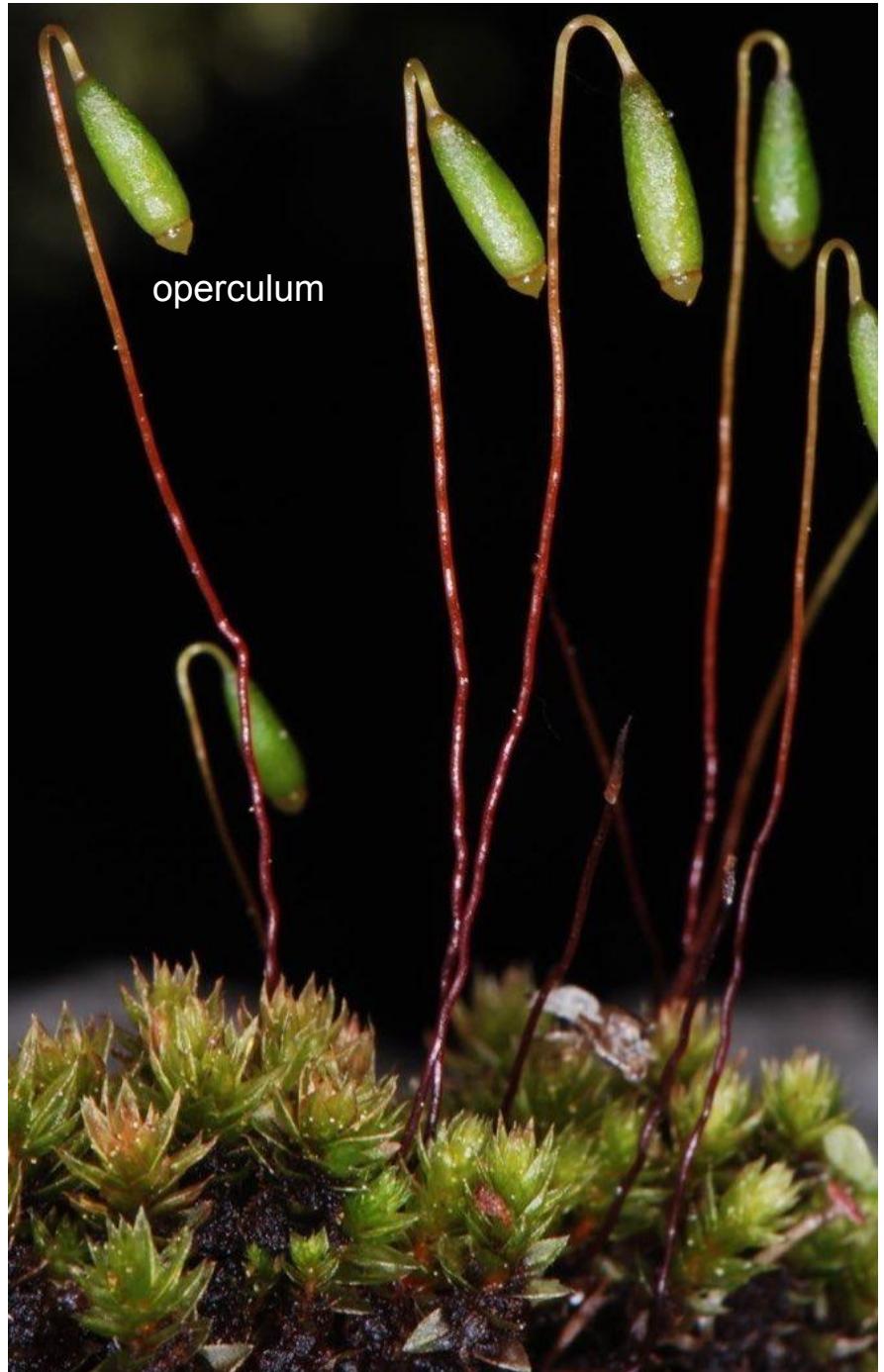


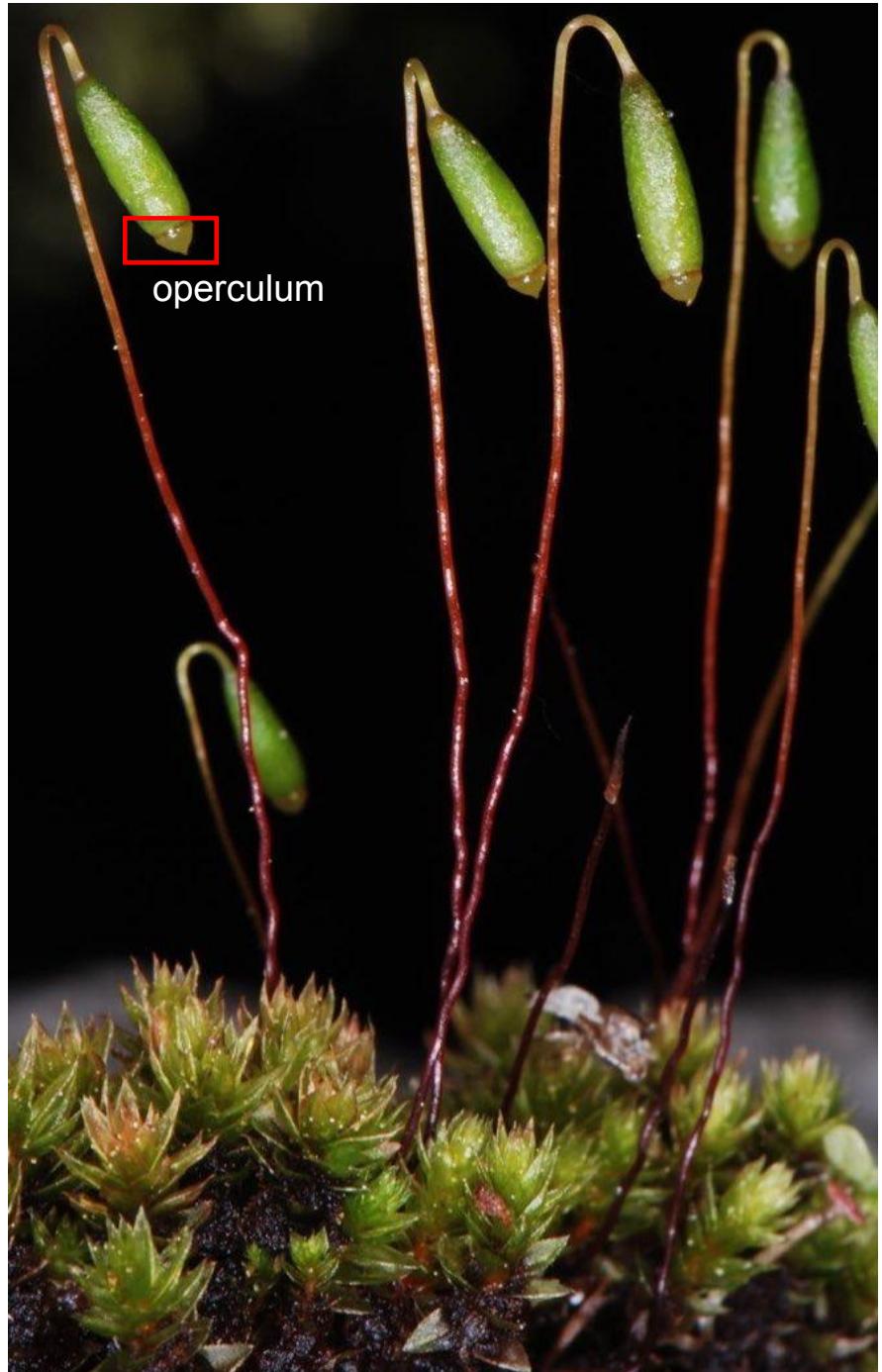


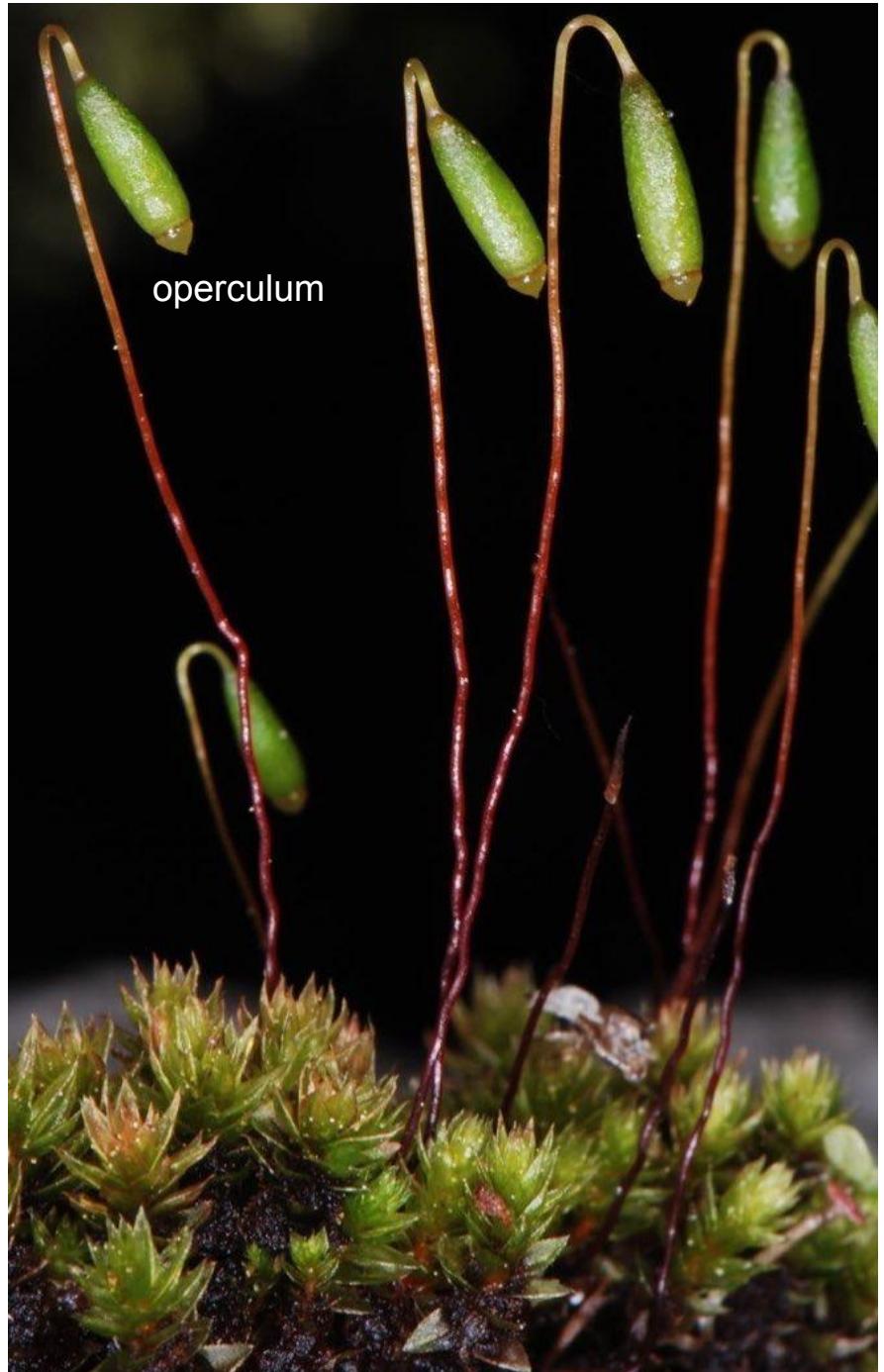


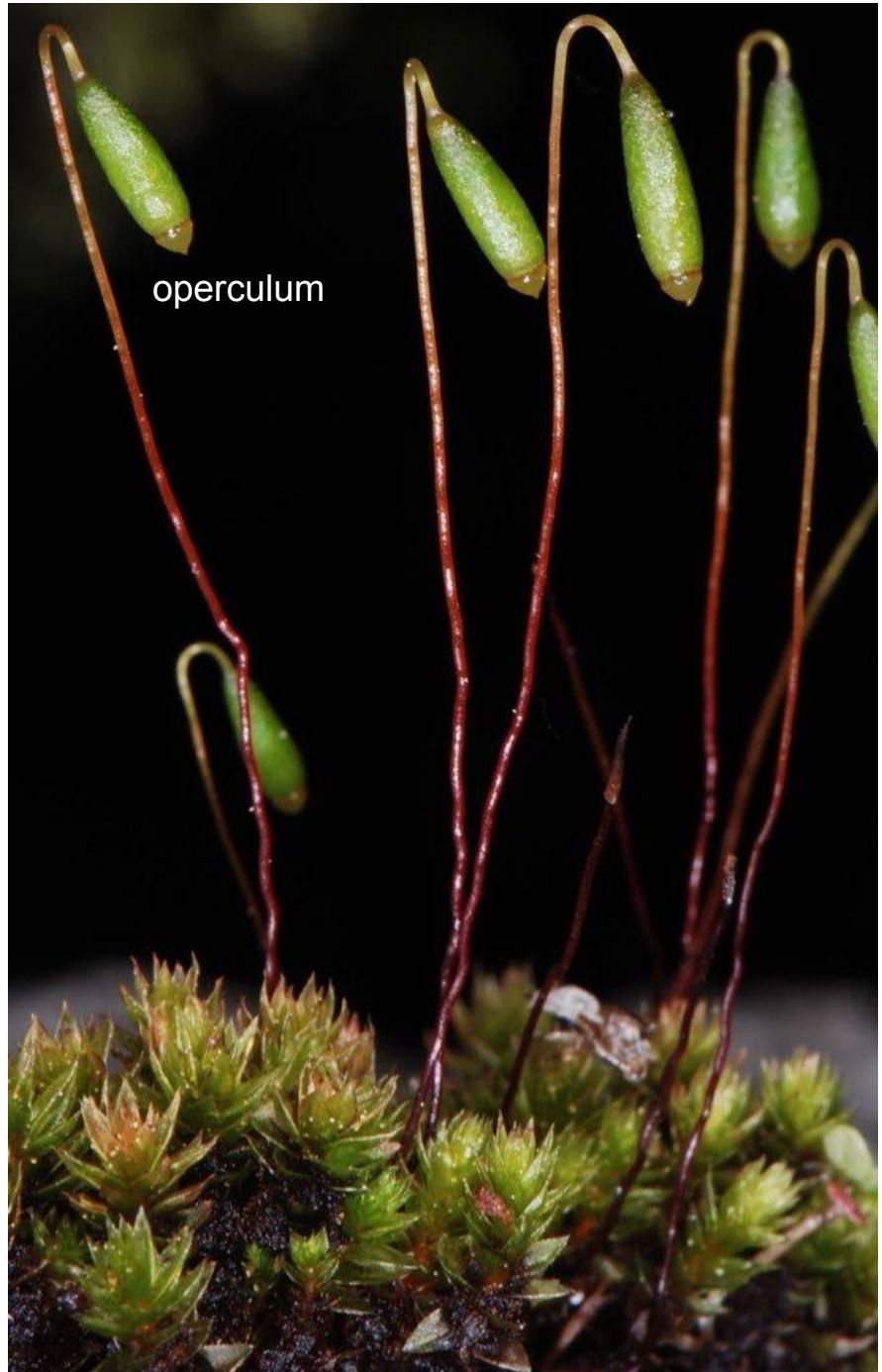
Moss Reproductive Structures











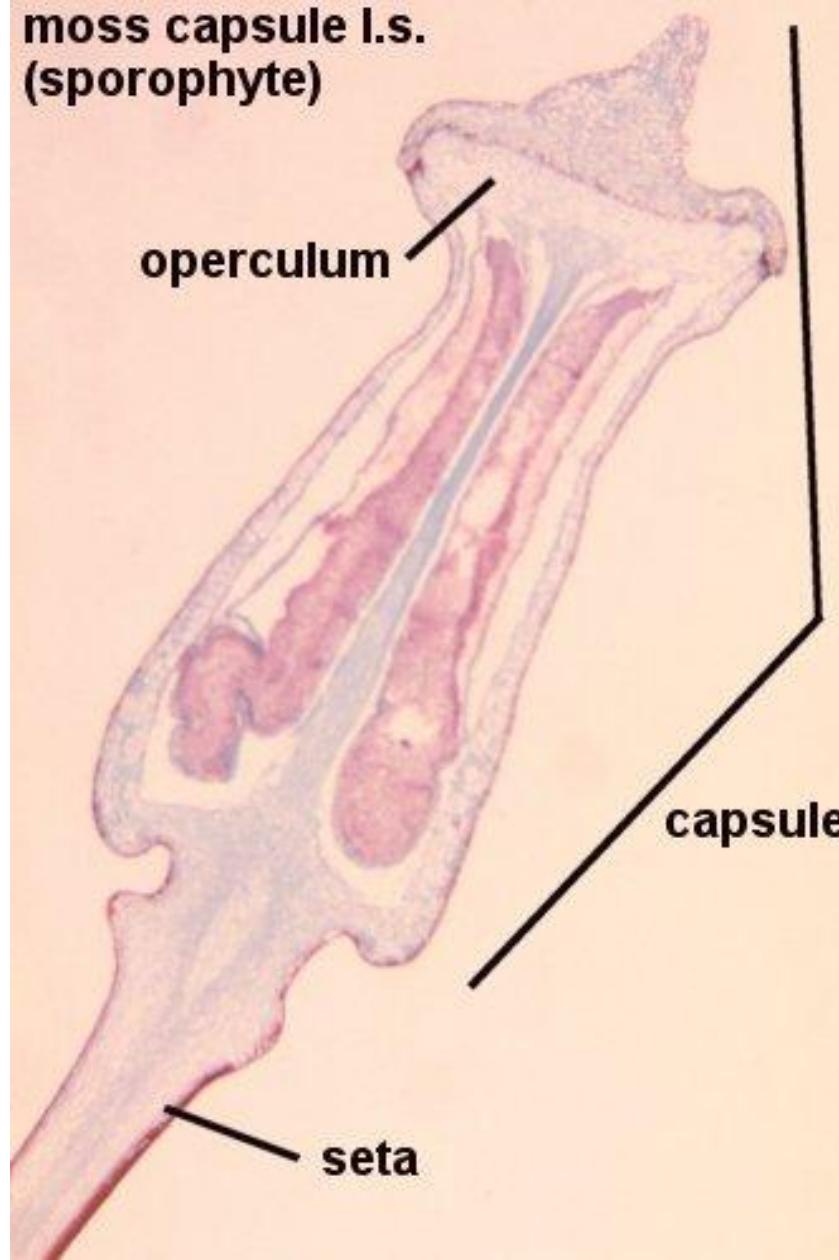


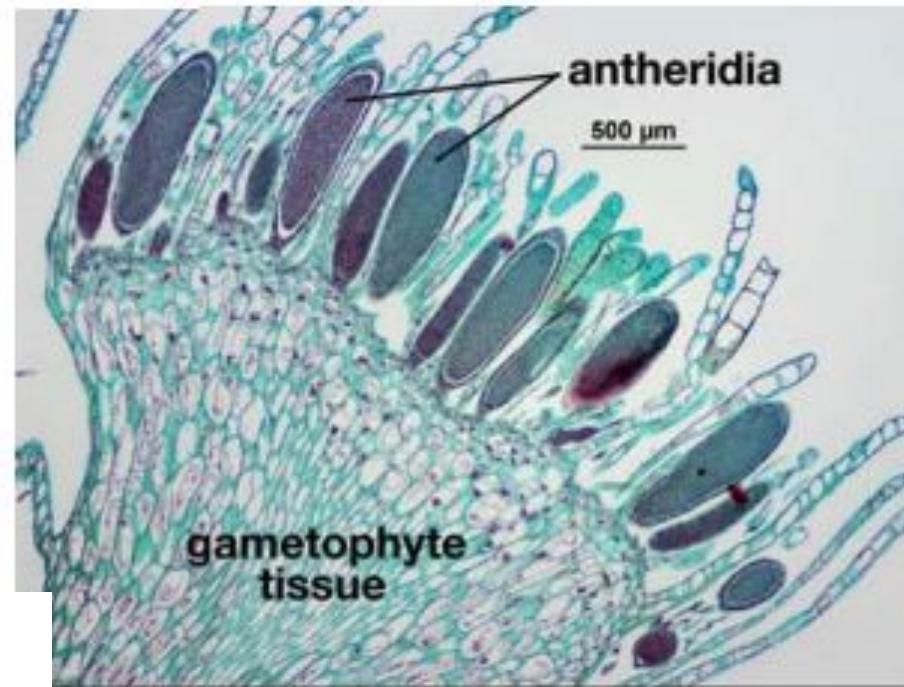
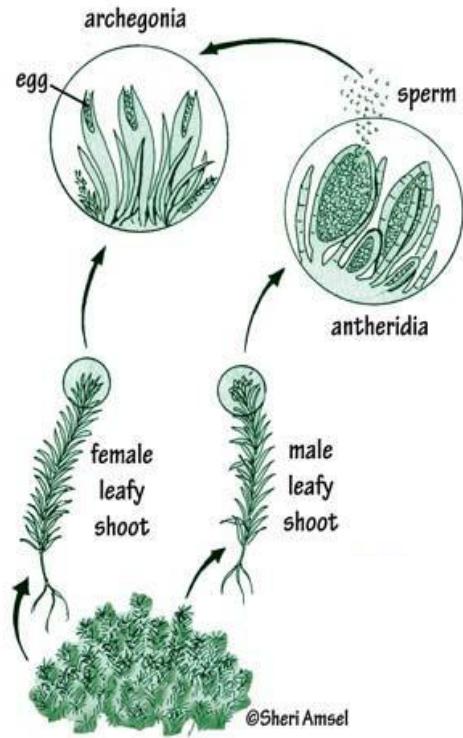
calyptra

seta

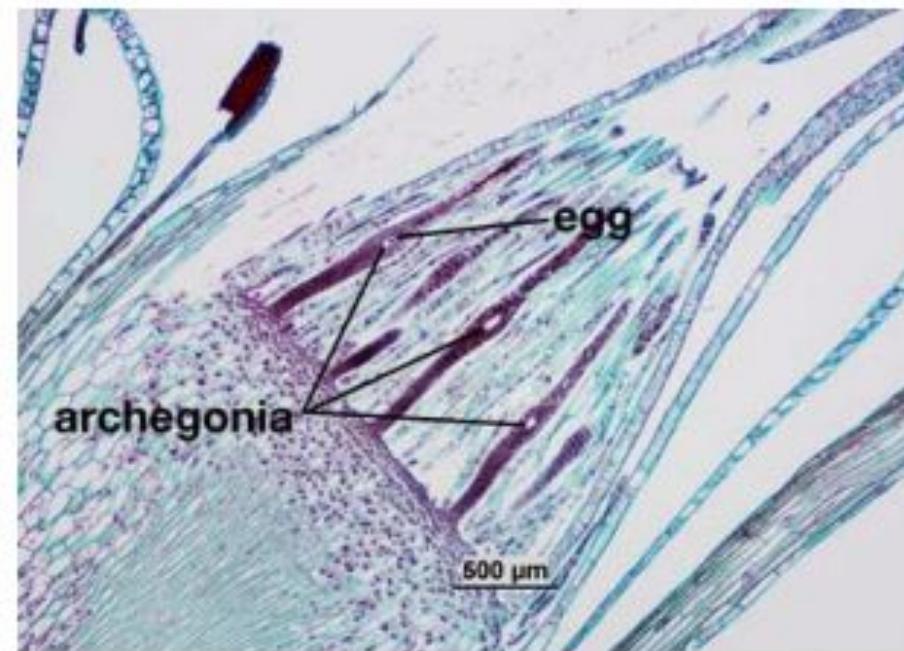
capsule

Musci specimens





Musci specimens



Phylum Hepaticophyta

The Liverworts

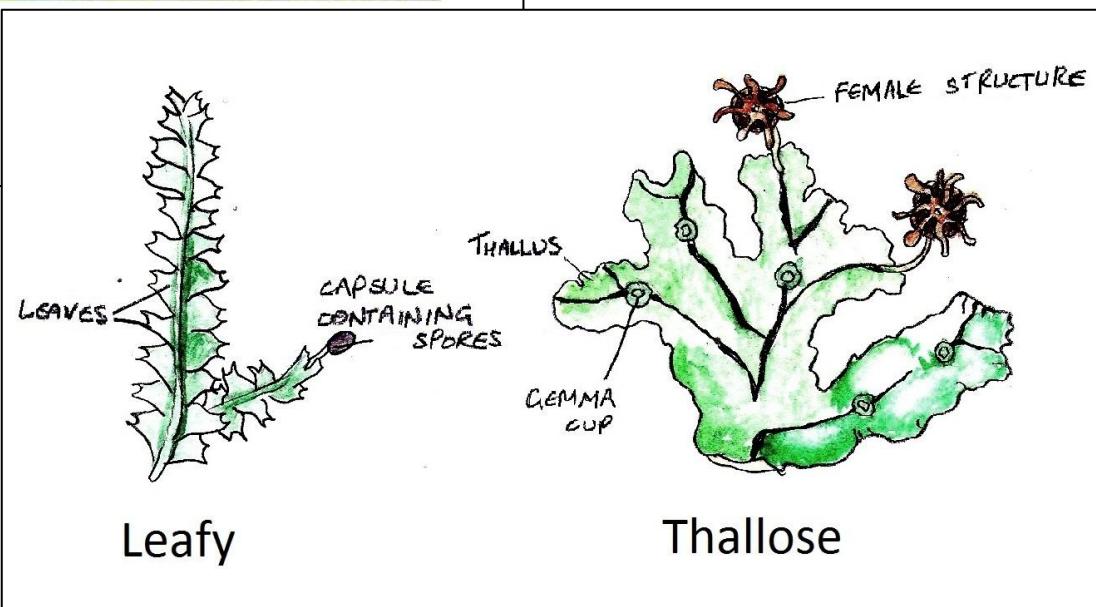
- Gametophyte is dominant generation
- Rhizoids unicellular
- Morphotype: Leafy and Thallus
 - Gemma cups (asexual reproduction)



Liverworts: maybe 7,000 species worldwide



Leafy vs Thallose Liverwort





Leafy liverwort

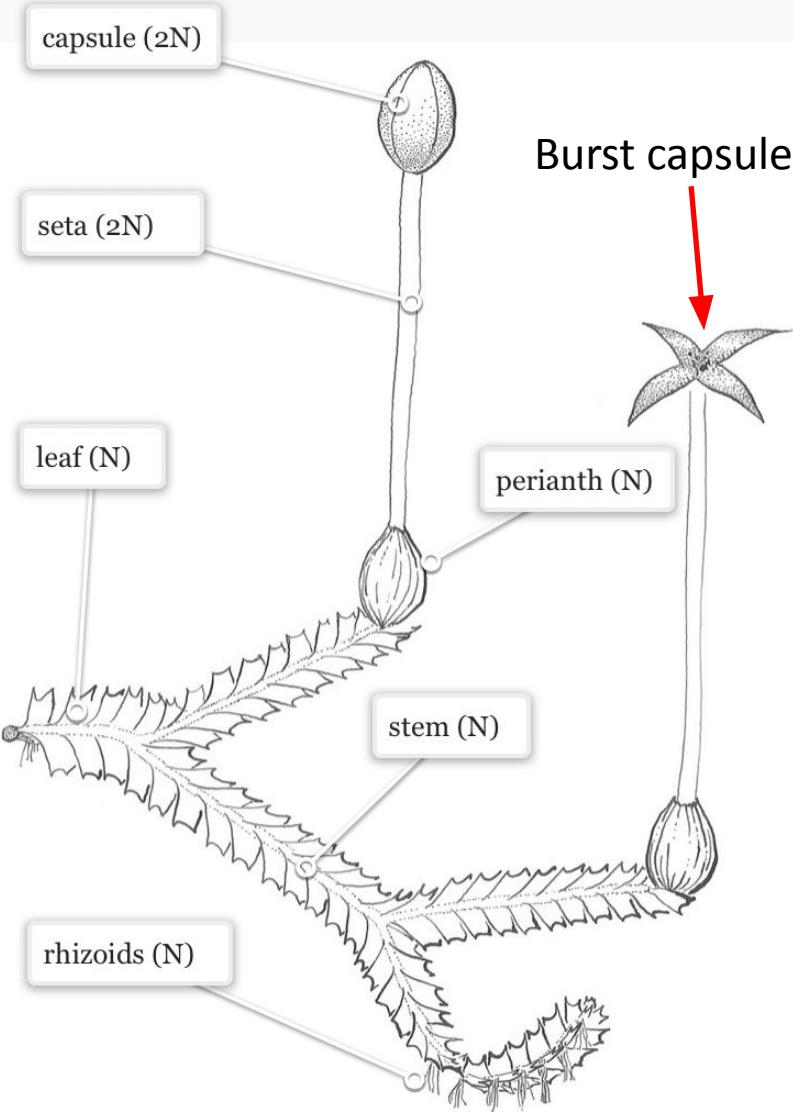


Thallose liverwort

Liverwort Reproductive Structures



Liverwort Reproductive Structures



Liverwort Reproductive Structures

Marchantia spp.

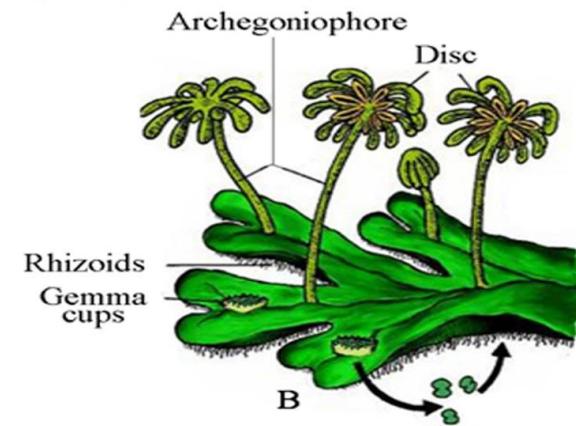
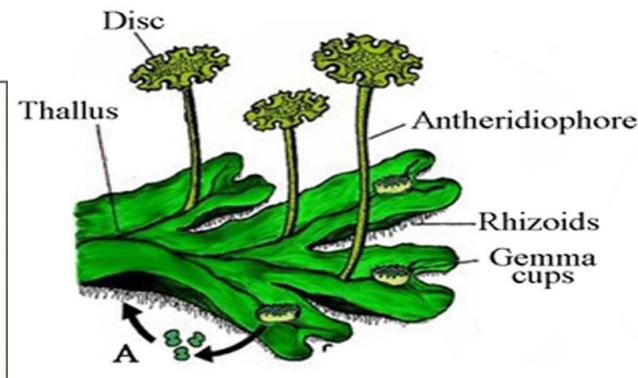
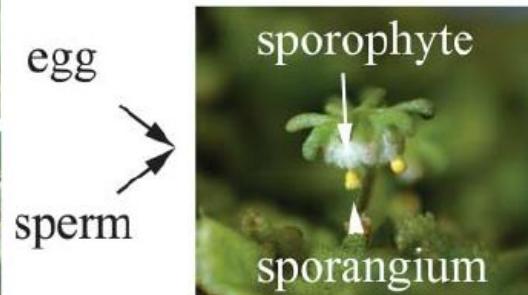
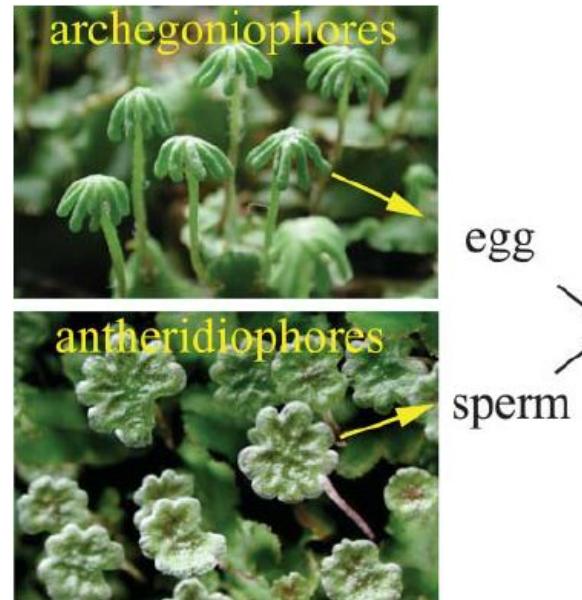
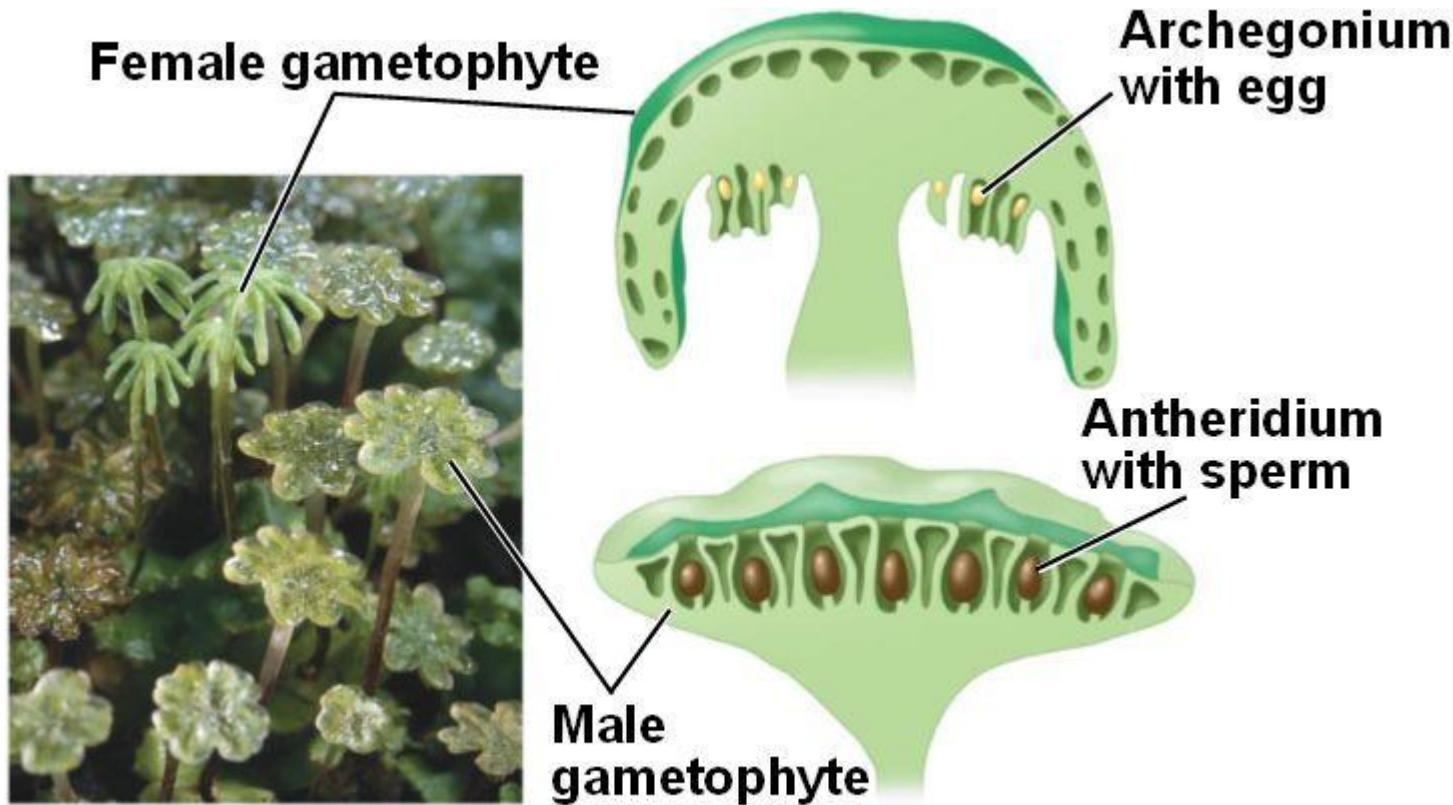


Fig: *Marchantia* spp. (A) Male plant, (B) Female plant.



Sexual Organs

- Archegonium – Organ that produces eggs
- Antheridium – Organ that produces sperm



Archegonia and antheridia of *Marchantia* (a liverwort)

Liverwort specimens

Archegoniophore (♀ female gametophyte)

Archegoniophore



1 stalk; 2 cap; 3 archegonia; 4 slime cells; 5 thallus

Liverwort specimens

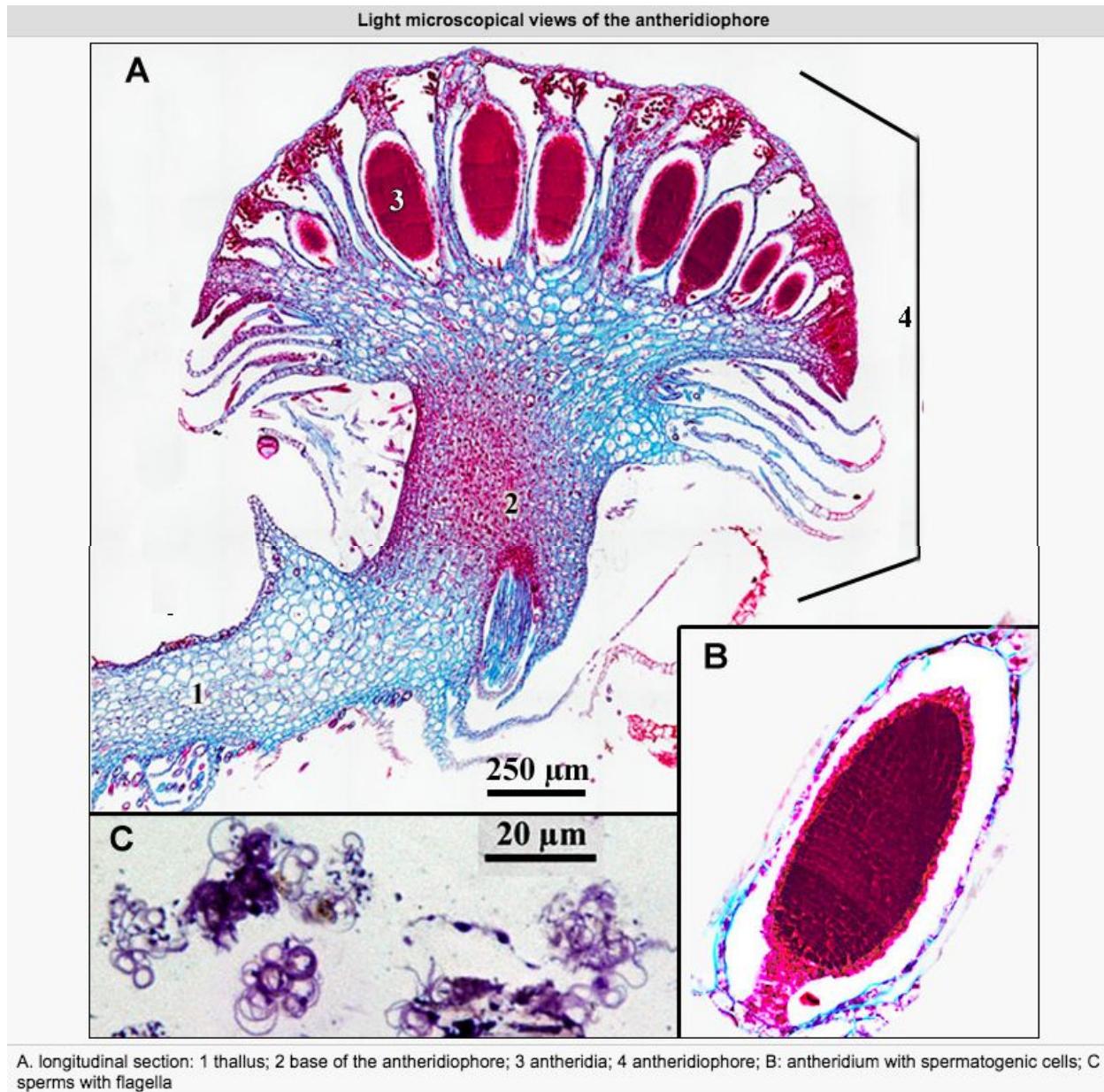
Archegoniophore (♀ female gametophyte)

Archegoniophore

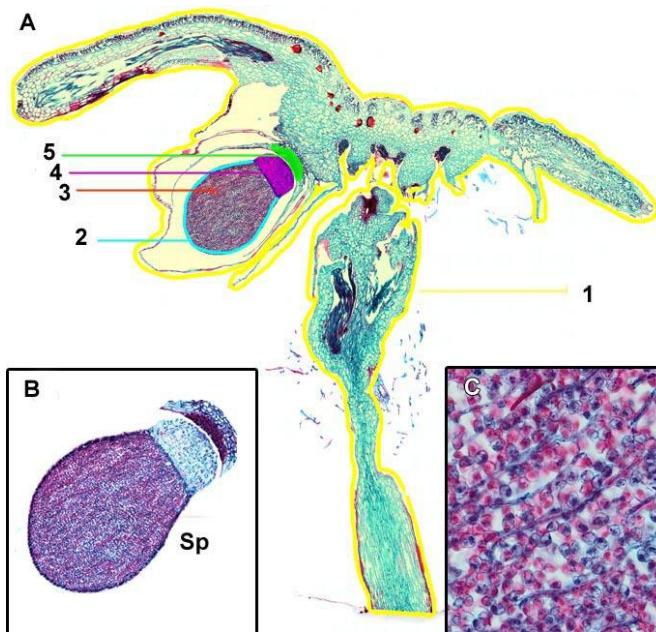


1 stalk; 2 cap; 3 archegonia; 4 slime cells; 5 thallus

Liverwort specimens



Liverwort specimens



Pteridophytes



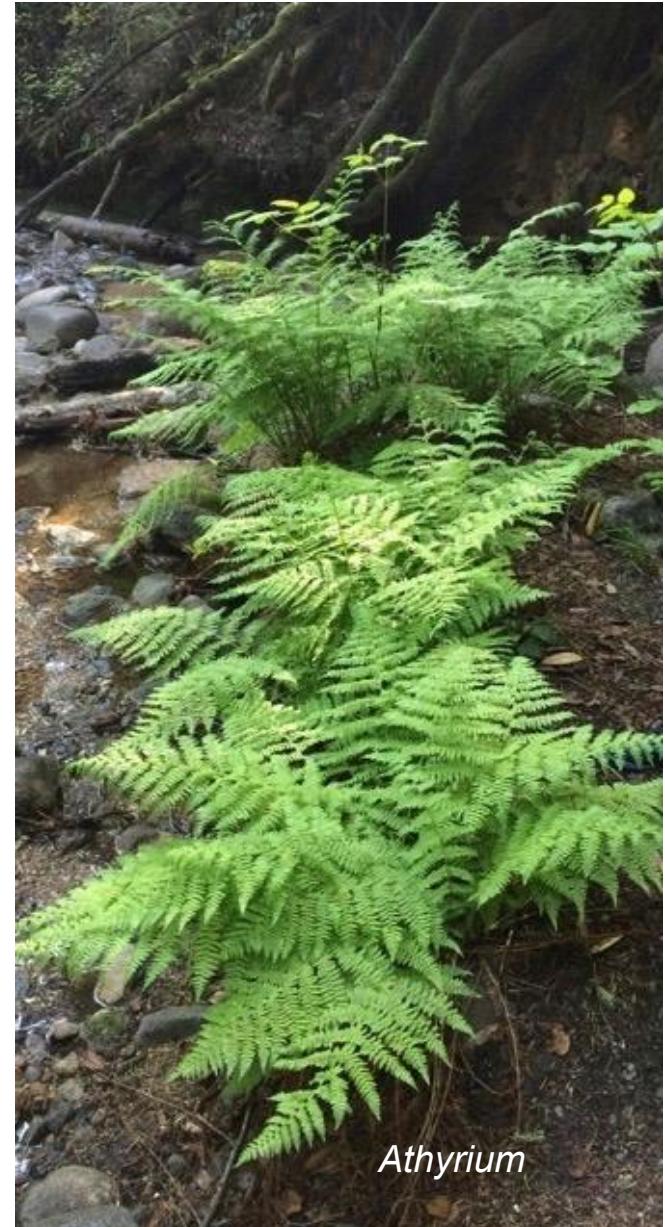
Phylum Monilophyta

The Ferns

- Flagellated sperm
- Sporophyte generation dominant



Ferns, etc. (Monilophytes): about 9,000 species worldwide



Diversity in Fern Morphology



Adiantum capillus-veneris



Polypodium californicum



Matteuccia struthiopteris



Pellaea mucronata



Sphaeropteris excelsa

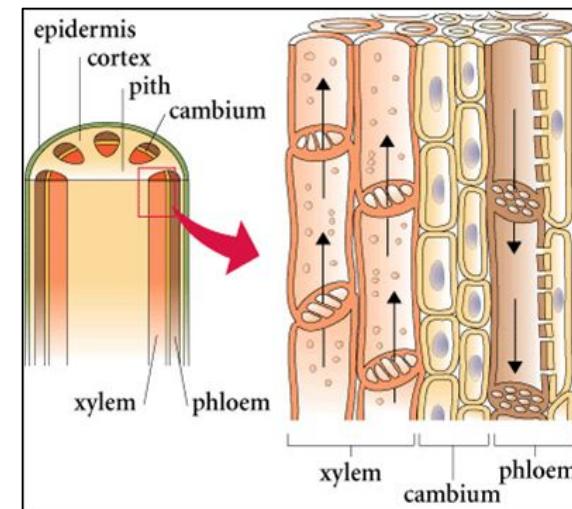
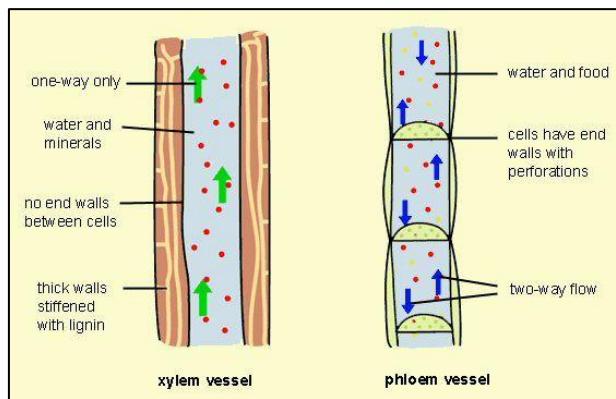
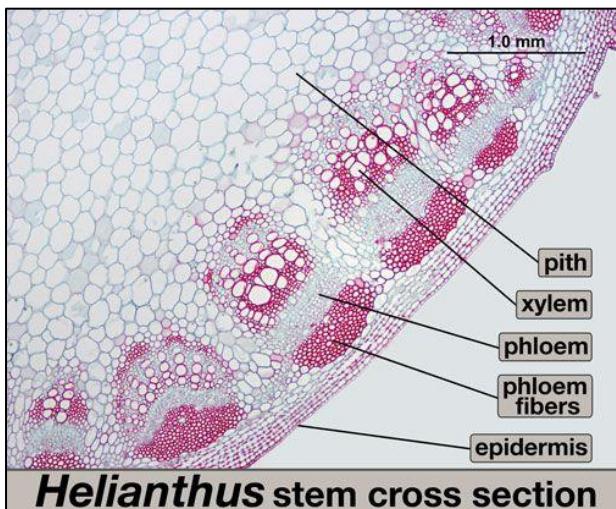
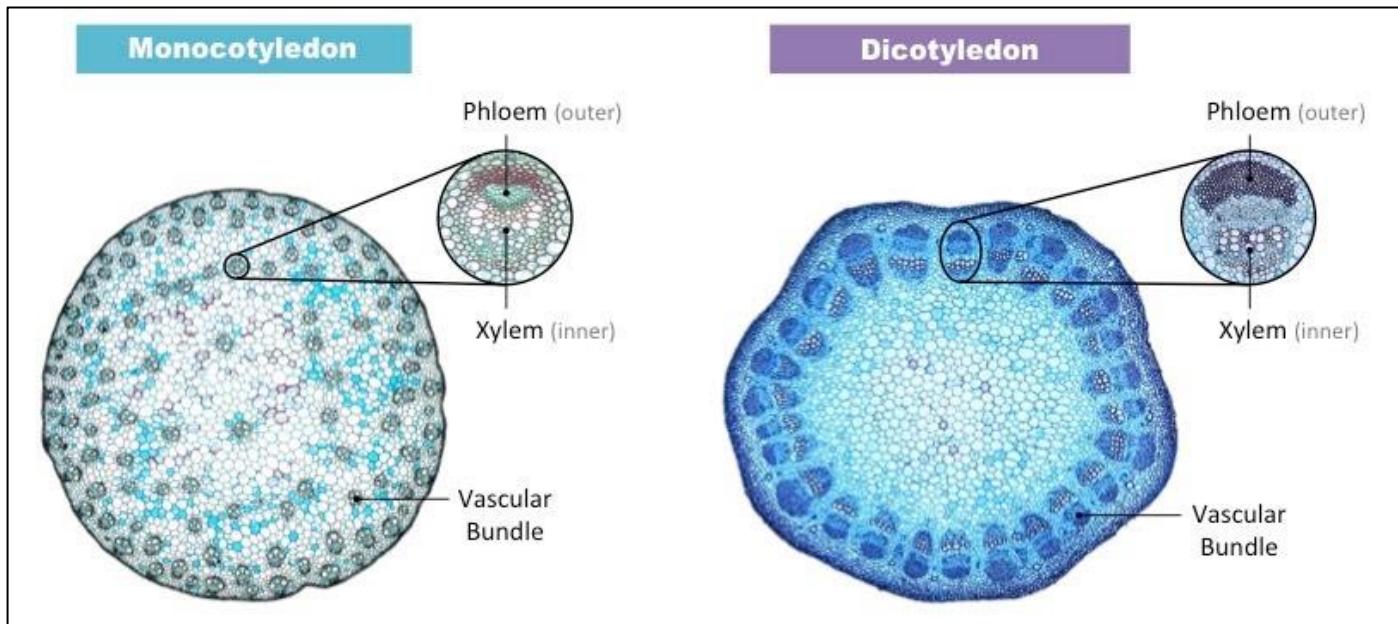
3 Key Morphological Features Evolved

- Protective walls around spores
- Waxy cuticle covering cells
- Vascular system
 - Xylem
 - Phloem

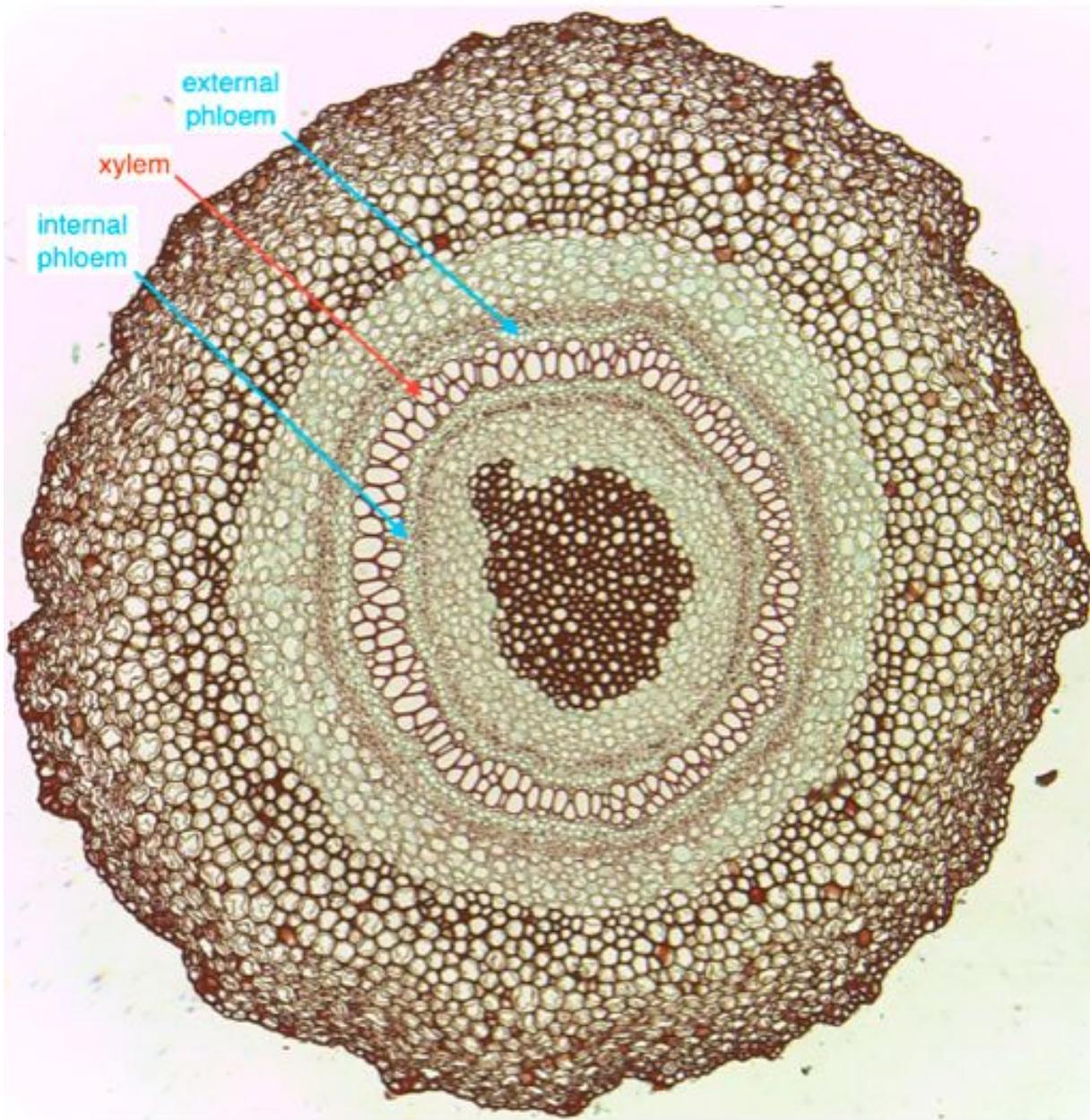


Plant Tissue Systems

- **Vascular**
 - Xylem
 - Phloem

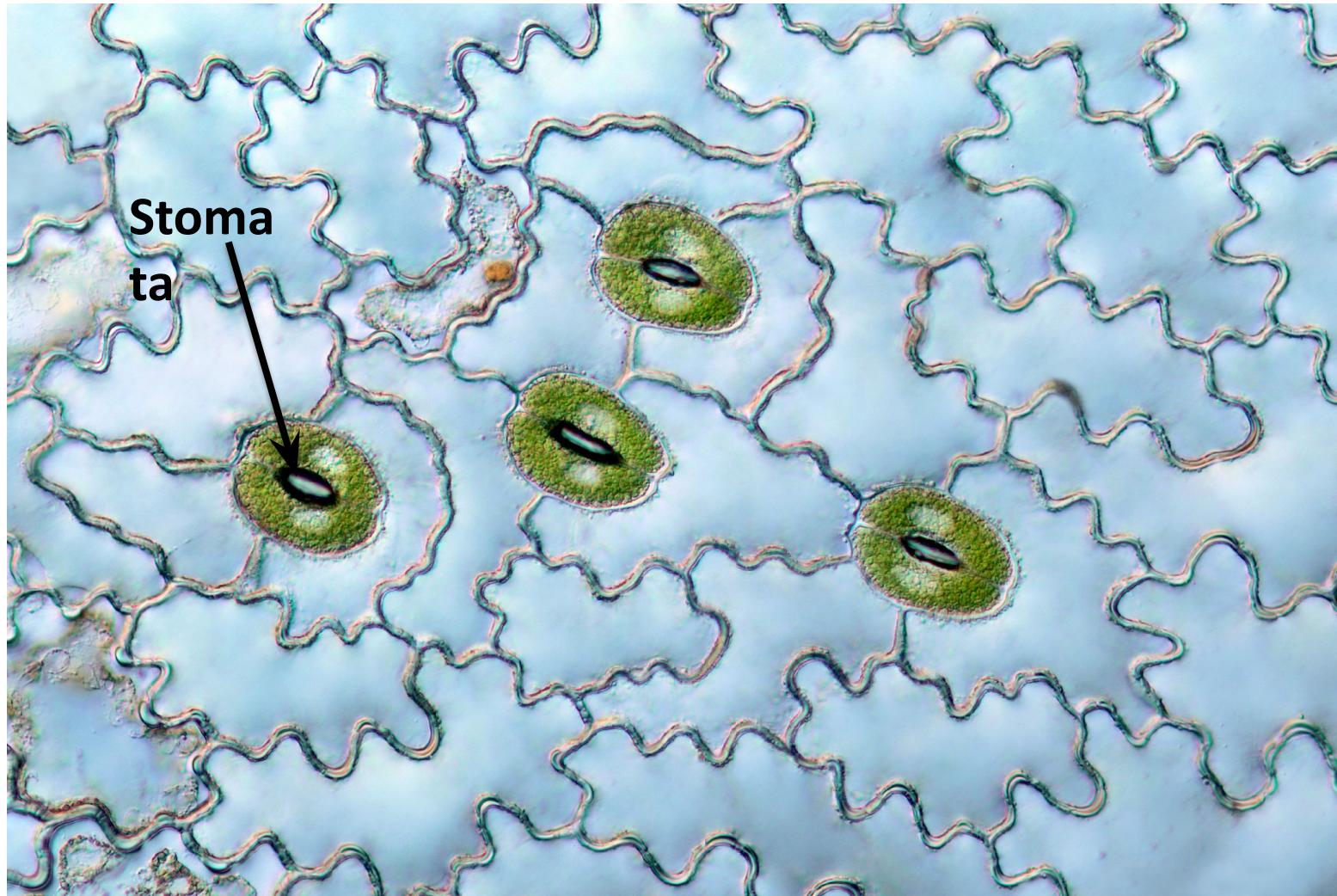


Fern rhizome cross section



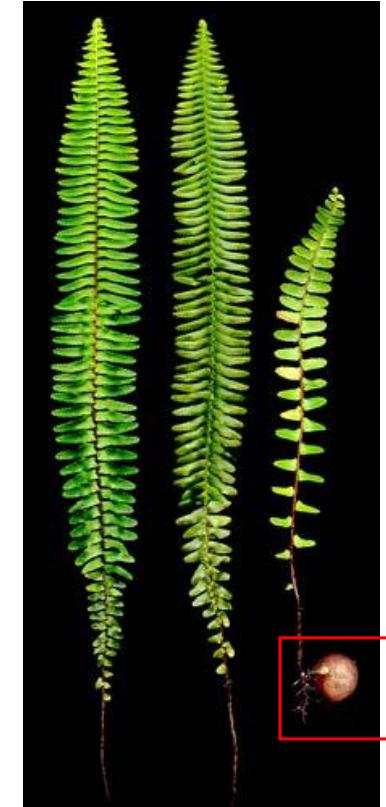
Fern Leaf Epidermal Peel

“Fern Leaf Stomata Nail Polish Impression with Robyn”
video on Canvas



Fern Tubers

- Store energy and moisture
- Desiccation resistance

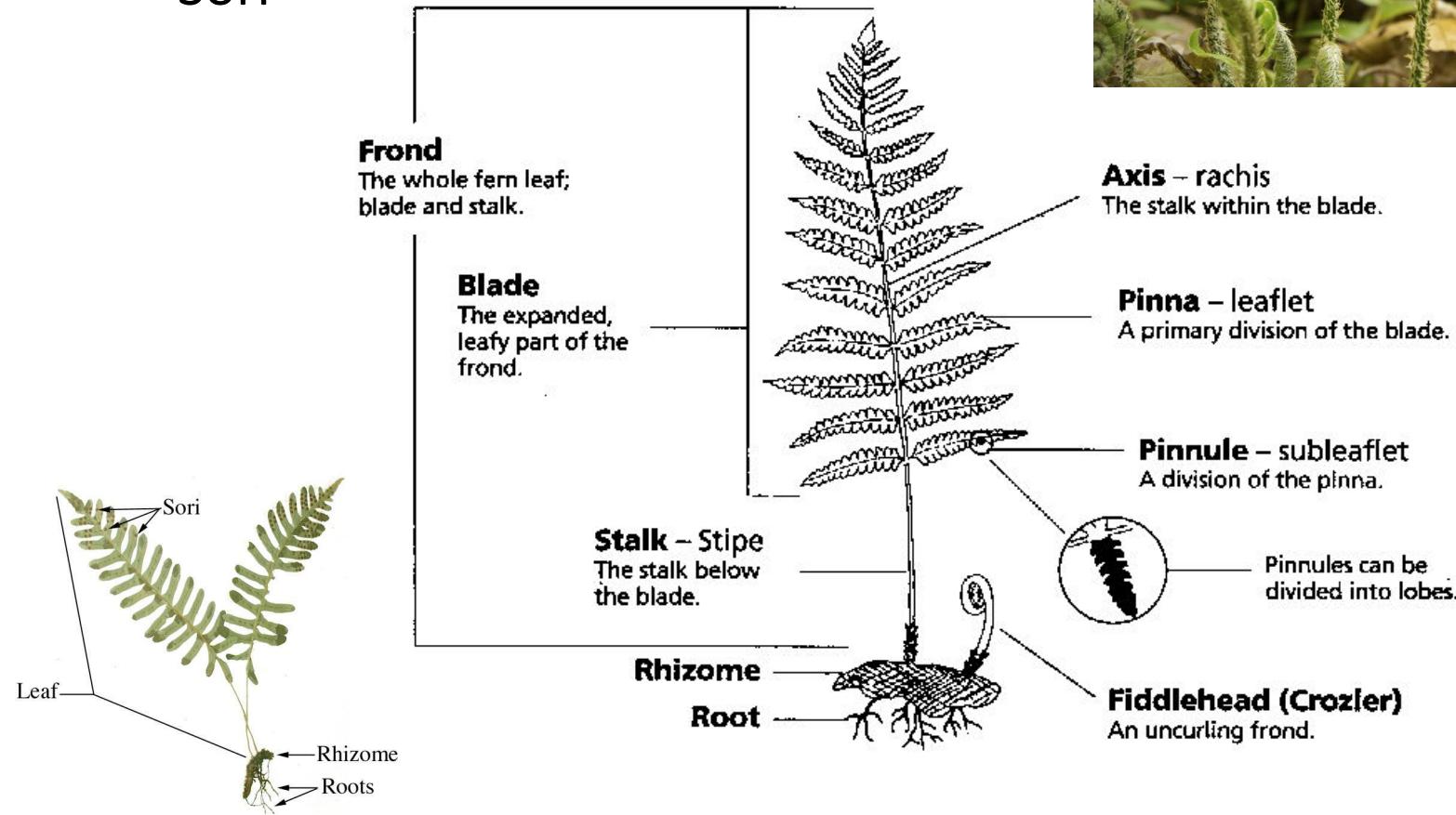


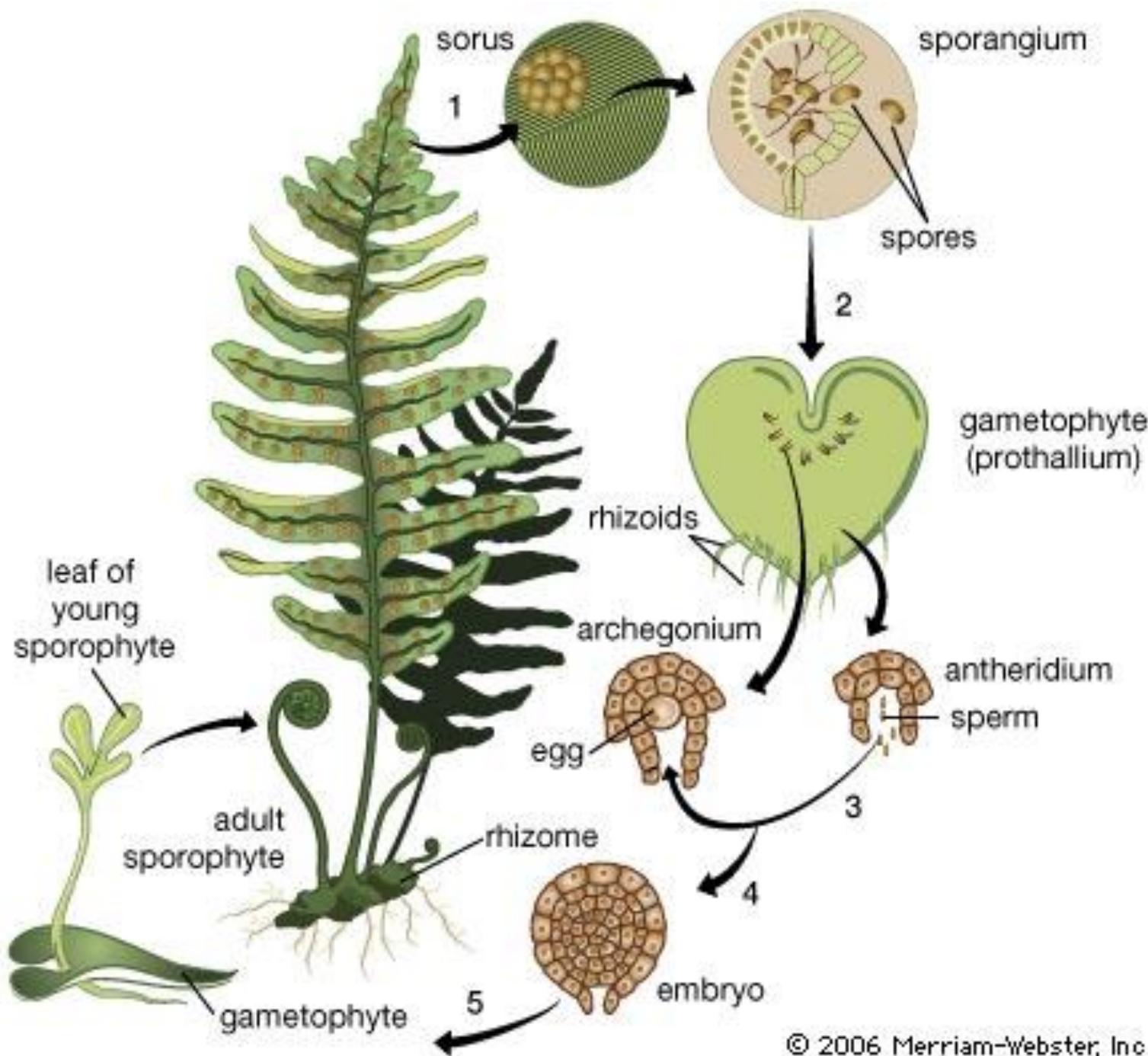
Ferns Structures

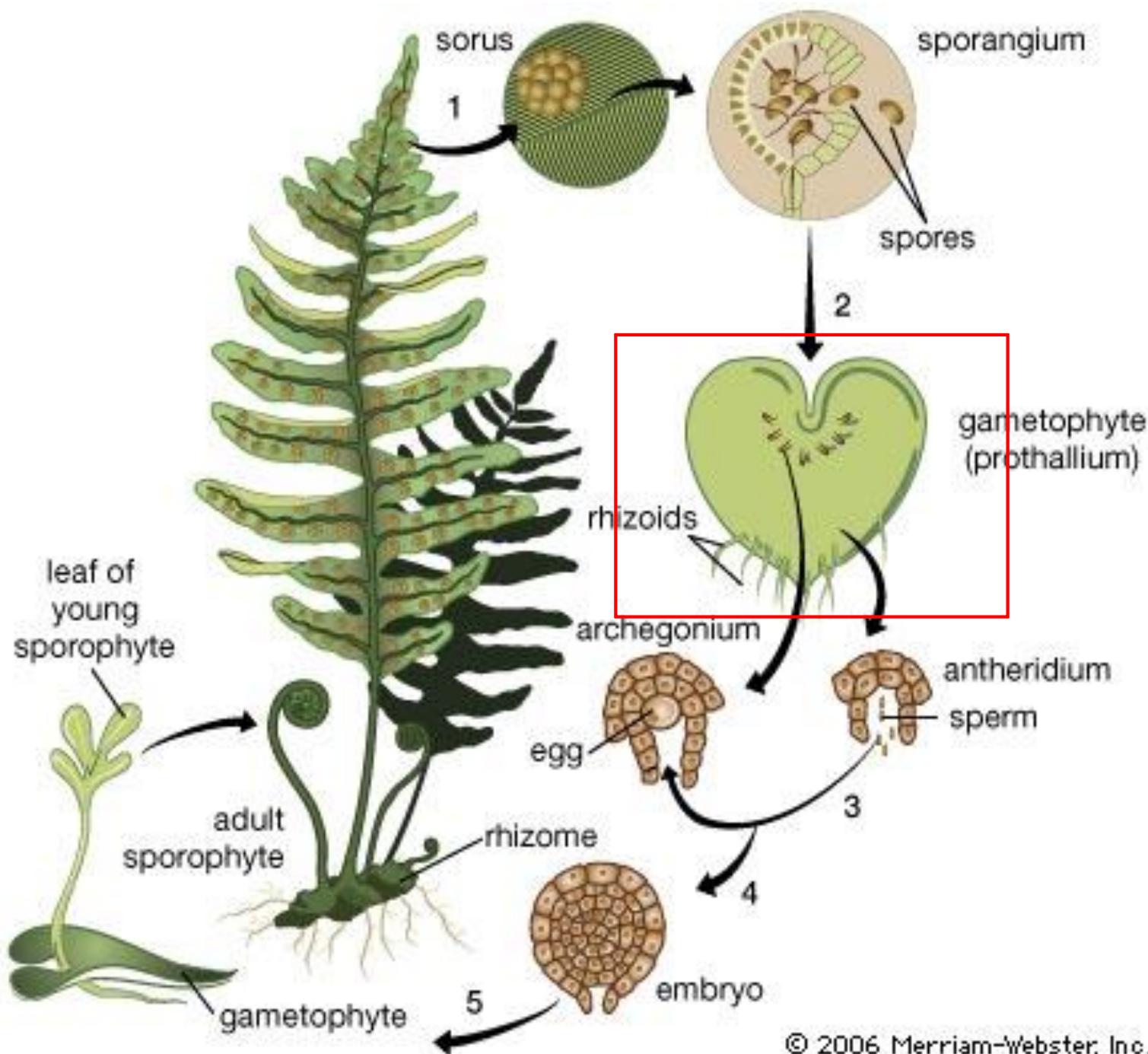
- Frond
- Fiddlehead
- Rhizome
- Sori

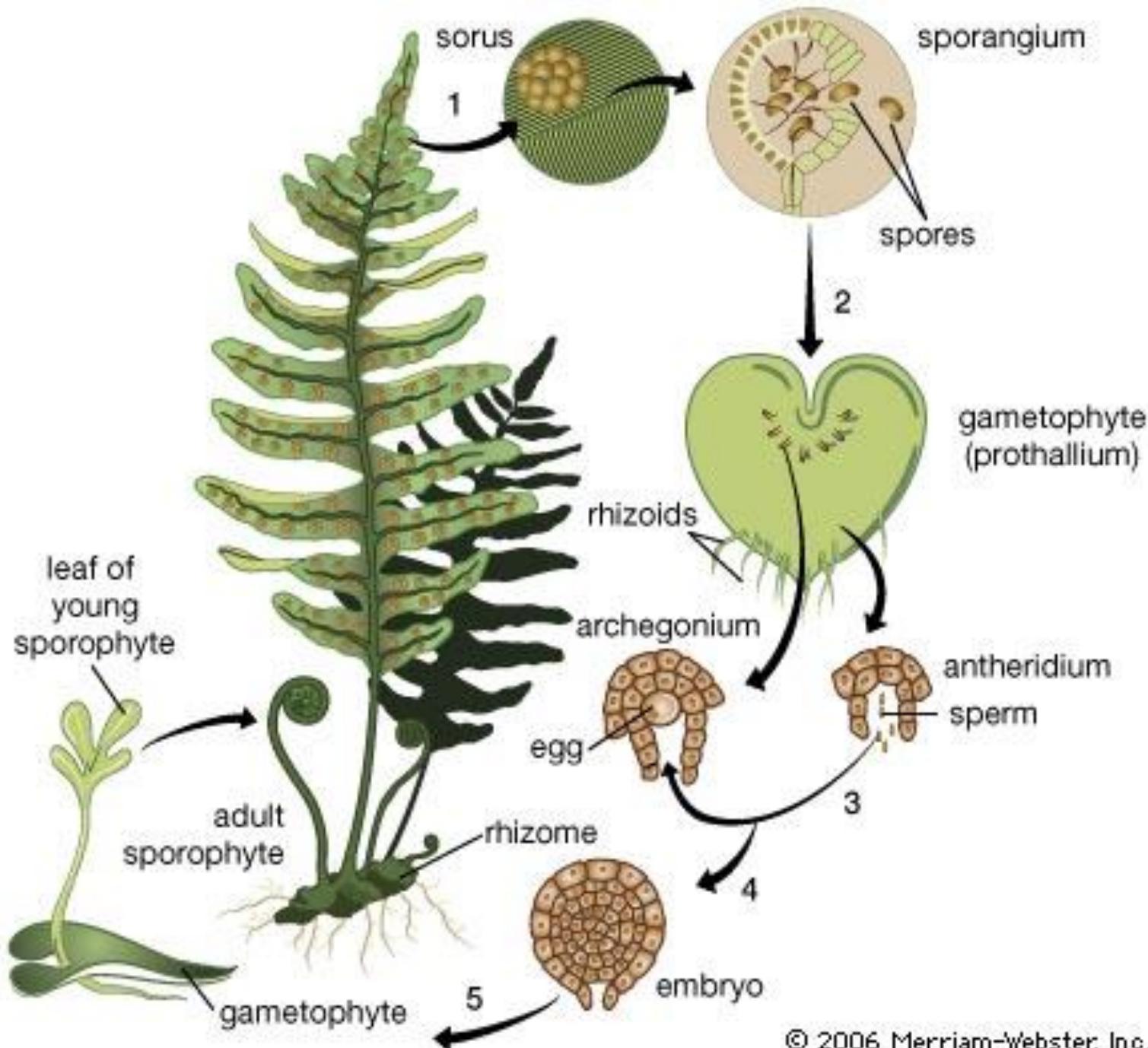


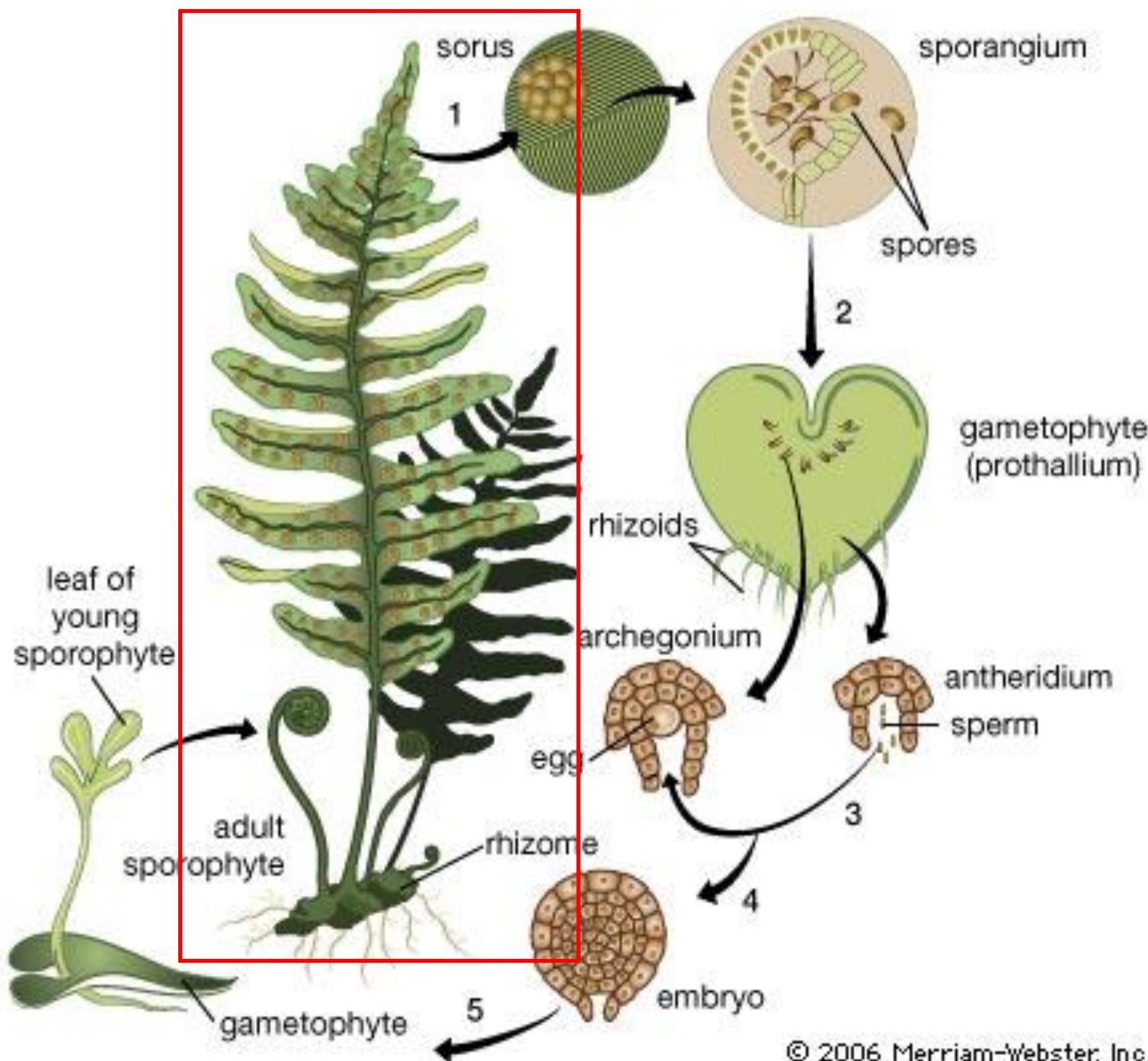
PARTS OF A FERN



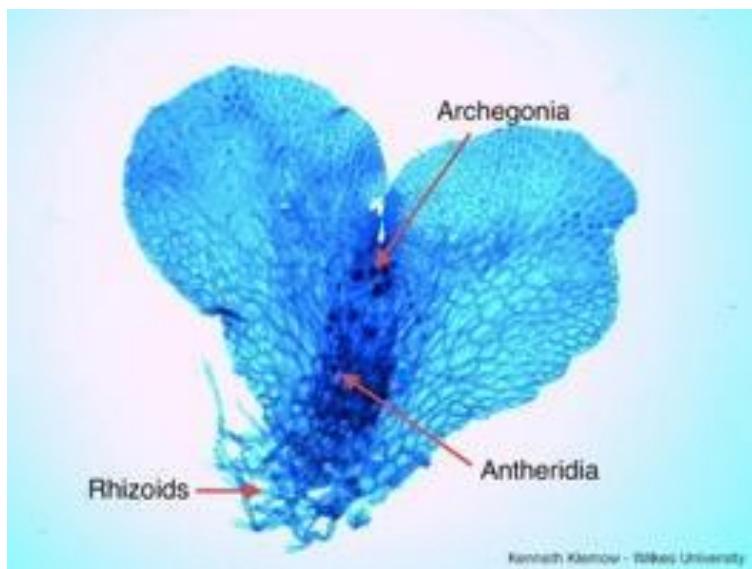
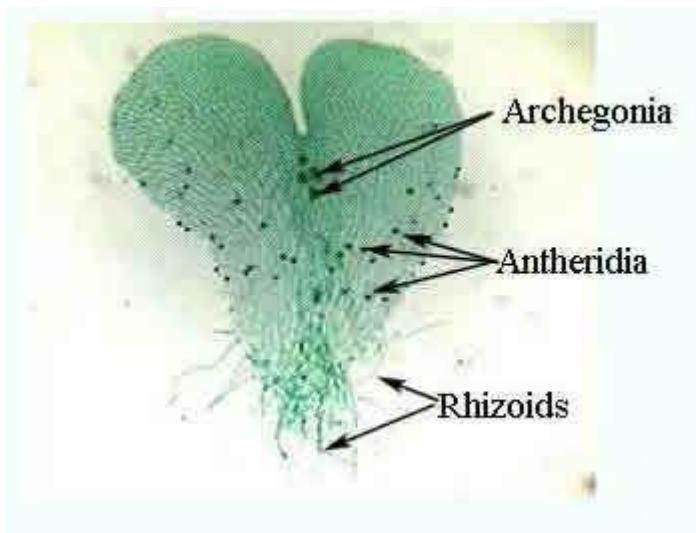
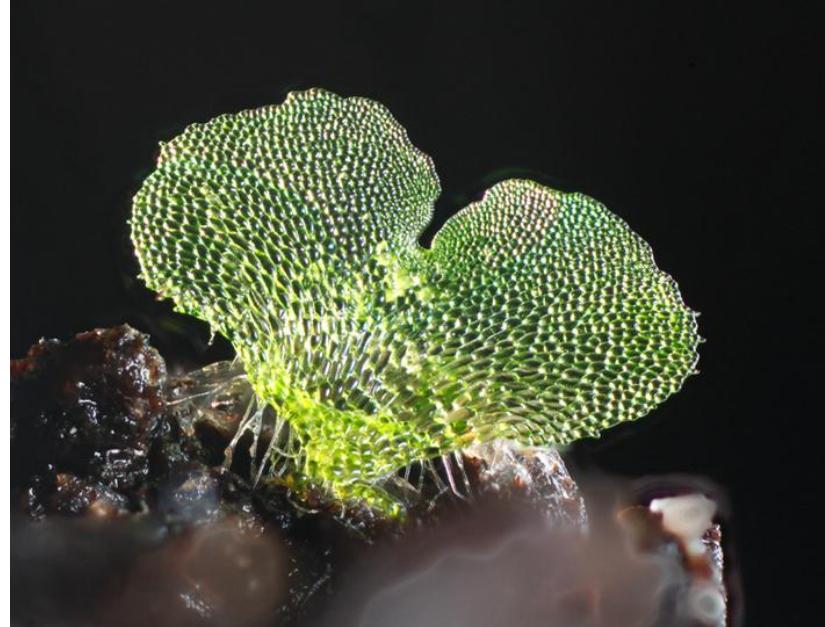






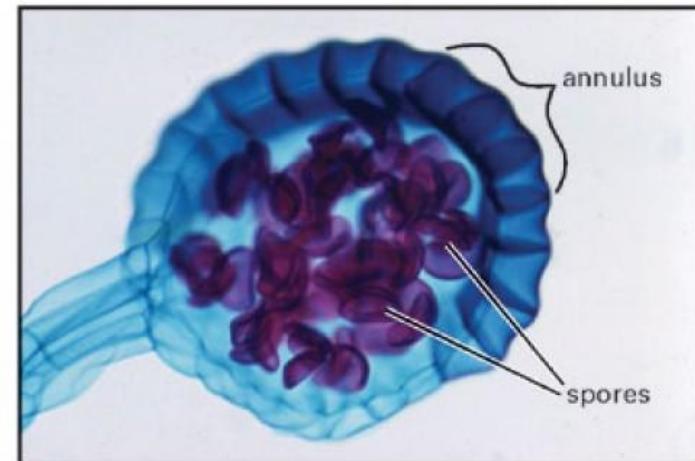
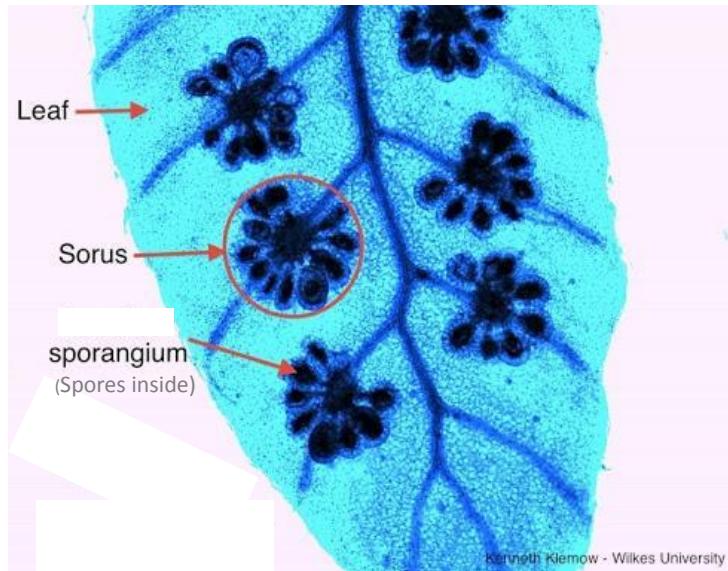
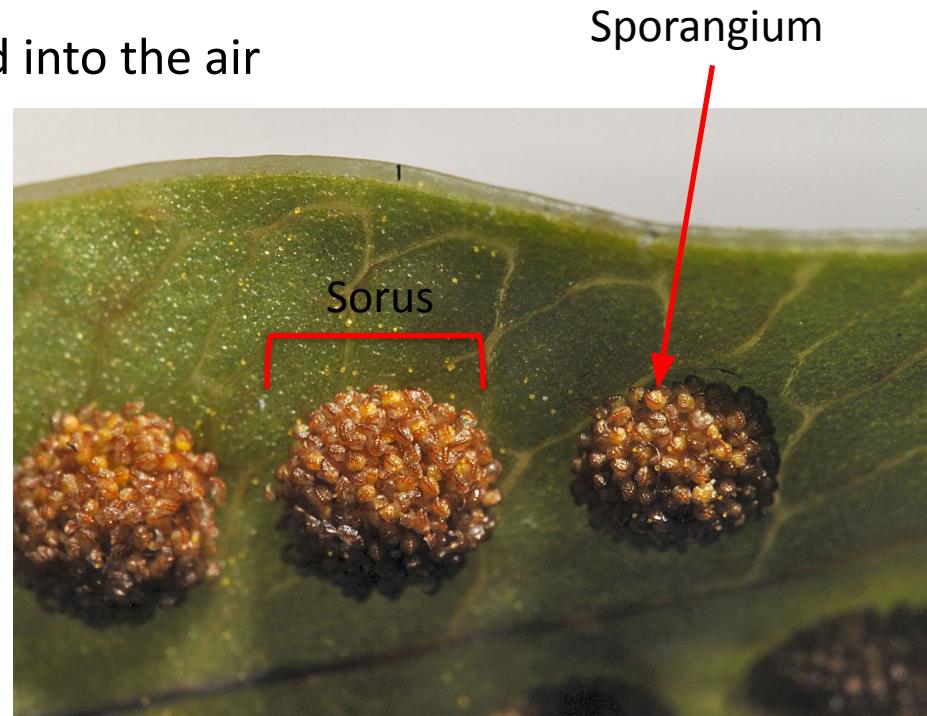


Fern Gametophyte

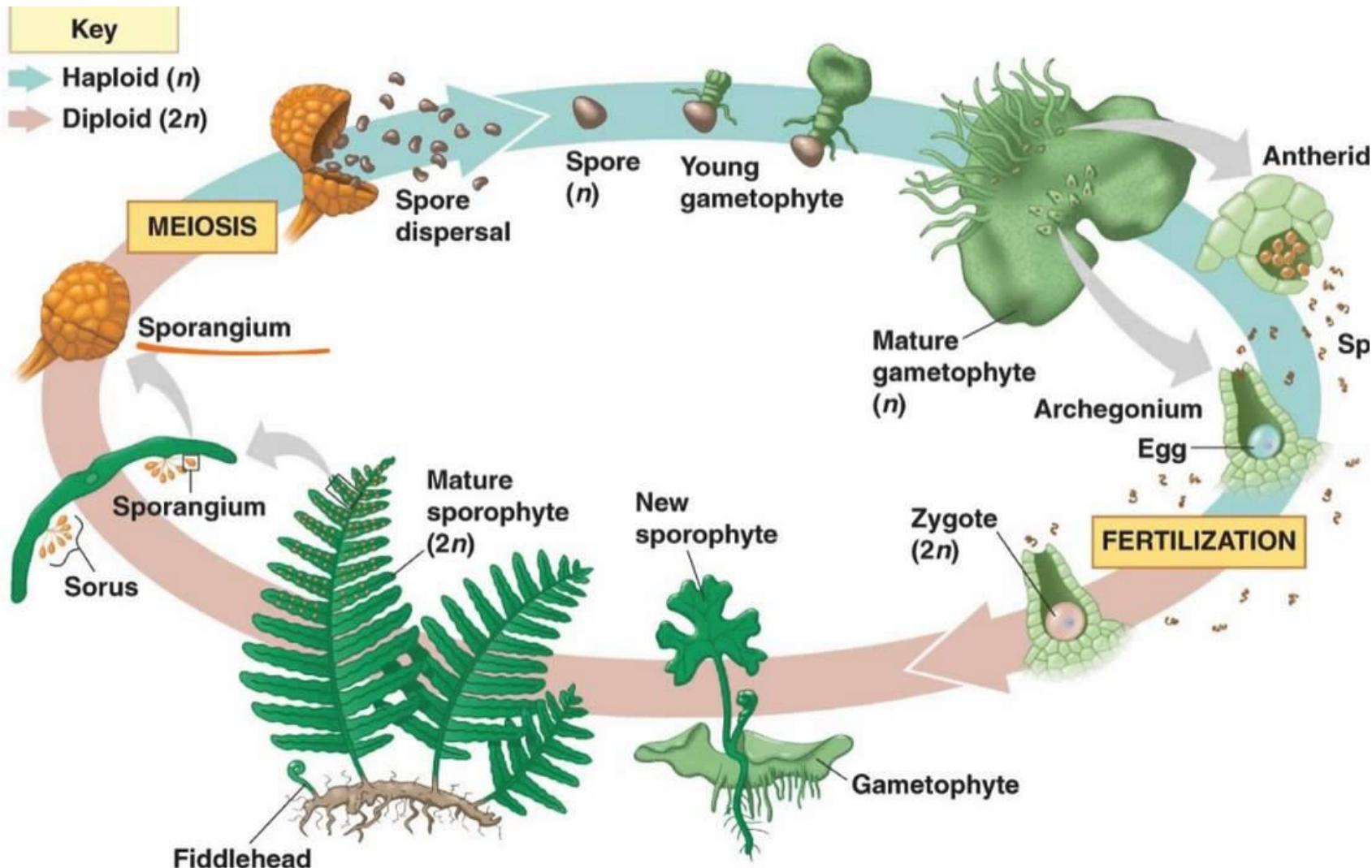


Fern Spores

- Sori (sorus = singular)
- Dehiscence: spores are tossed into the air



Fern life cycle



Hepaticophyta:

- *Marchantia* Antheridiophore
- *Marchantia* Anchegoniophore
- *Marchantia* sporangium
- Thalloid vs leafy liverworts

Musci:

- Observe moss rehydration
- Antheridial head
- Archegonial head
- Sporophyte capsule

Monilophyta:

- Diversity in fern morphology
- Fern sporangia
- Fern tubers
- Fern stomata
- Fern gametophyte
- Fern rhizome vascular tissue

Chapter 5 specimens





Thanks for watching!

