

Botany

Plant Systematics, Anatomy, and Physiology



Matt Jones

Horticulture Extension Agent
NCCE Chatham County Center

Botany 101

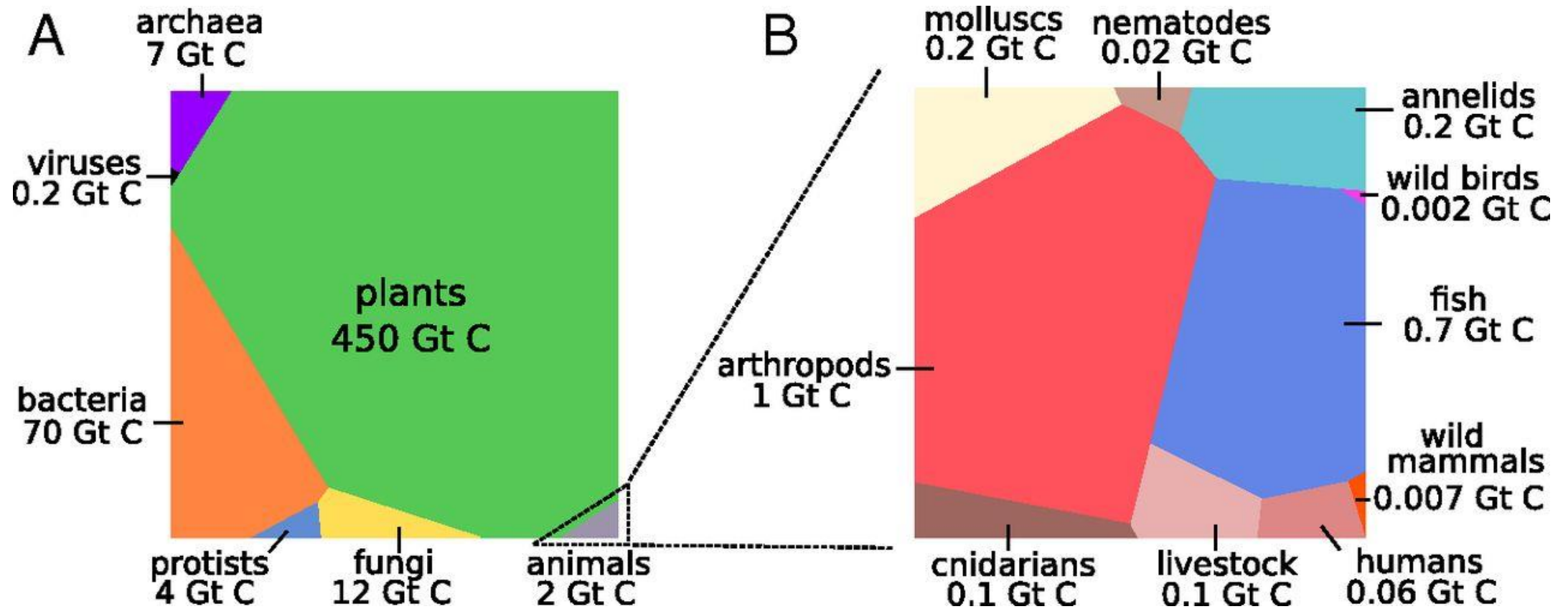
Tonight's Lecture

- Four Major Groups of Plants
- Plant Physiology
 - Photosynthesis
 - Transpiration
- Plant Anatomy

Upcoming plant-related BYN classes

- Plant Ecology and Communities 9/23 (Ashley Troth)
- Plant ID Techniques and Resources 9/25^{ish} (Matt Jones, pre-recorded)
- Plant Insect Interactions 10/7 (Sam Marshall)

Plants are 86% of Earth's Biomass



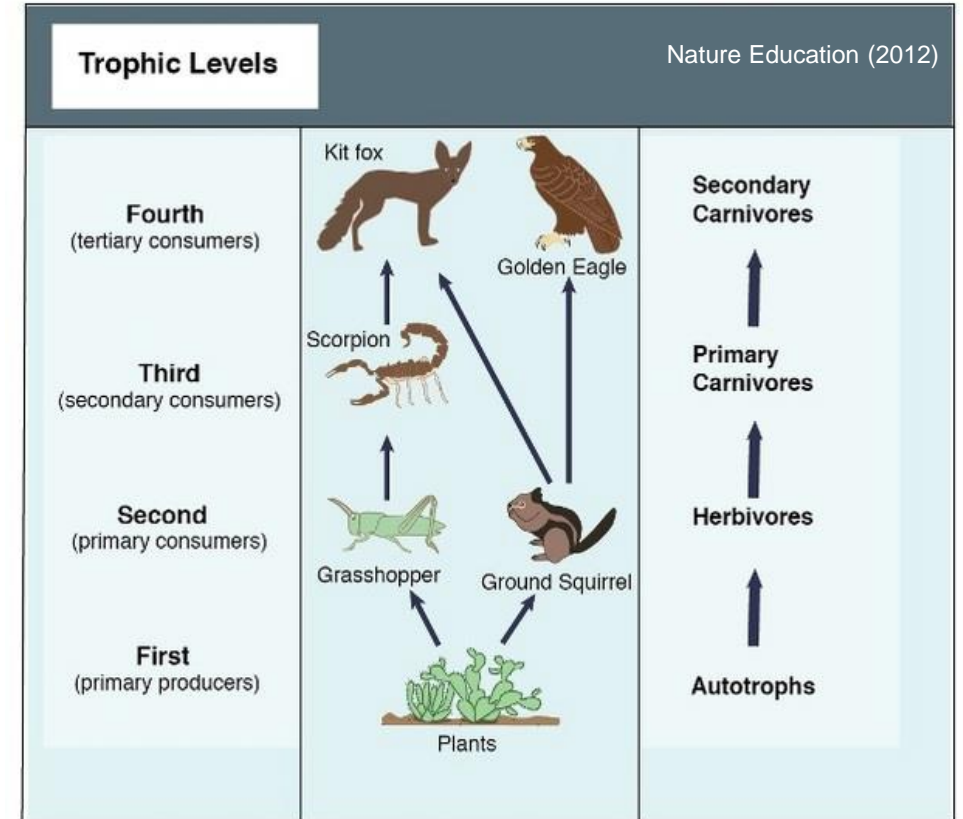
Where do animals obtain energy?

Where do animals obtain matter?

- Carbohydrates, fats, proteins

By consuming other plants, animals, and fungi!

- Use energy by *respiration*



Where do plants obtain energy?

Where do plants obtain matter?

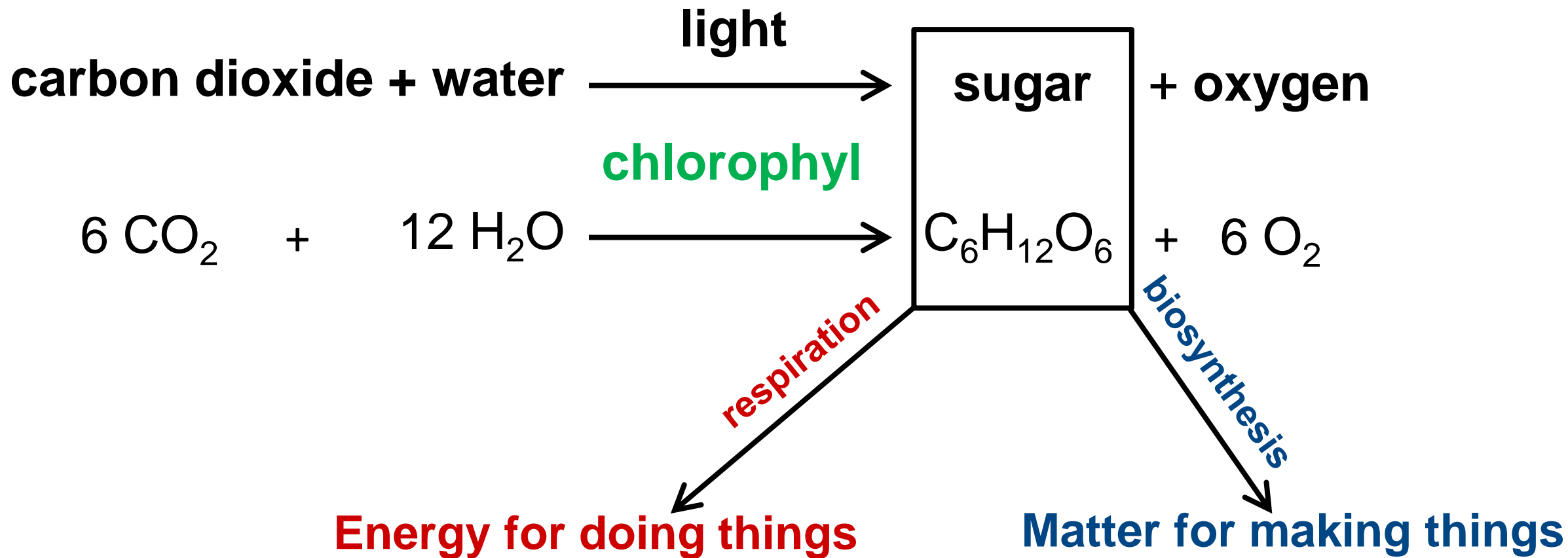
- Carbohydrates, fats, proteins

By photosynthesis!



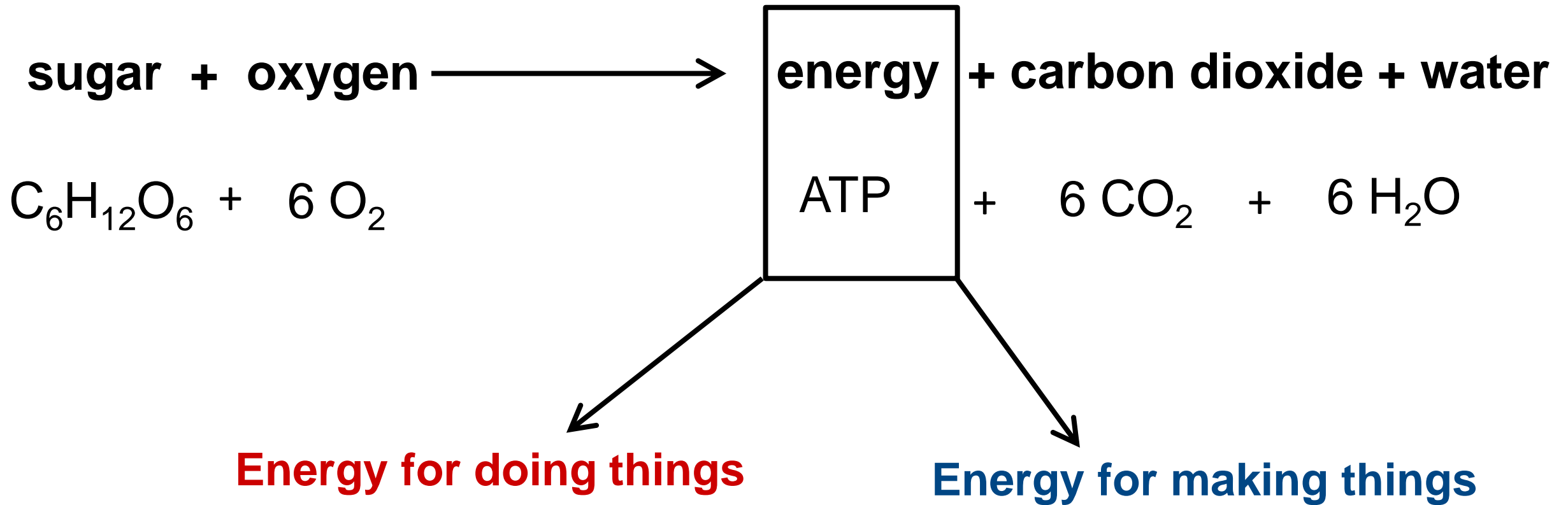
Photosynthesis

Turns CO₂ into sugars using the energy of the sun



Respiration

The process that turns food (sugar) into energy.



Energy as Money

Plants can:

Spend energy

- Growth and defense

Save energy

- Store for future growth

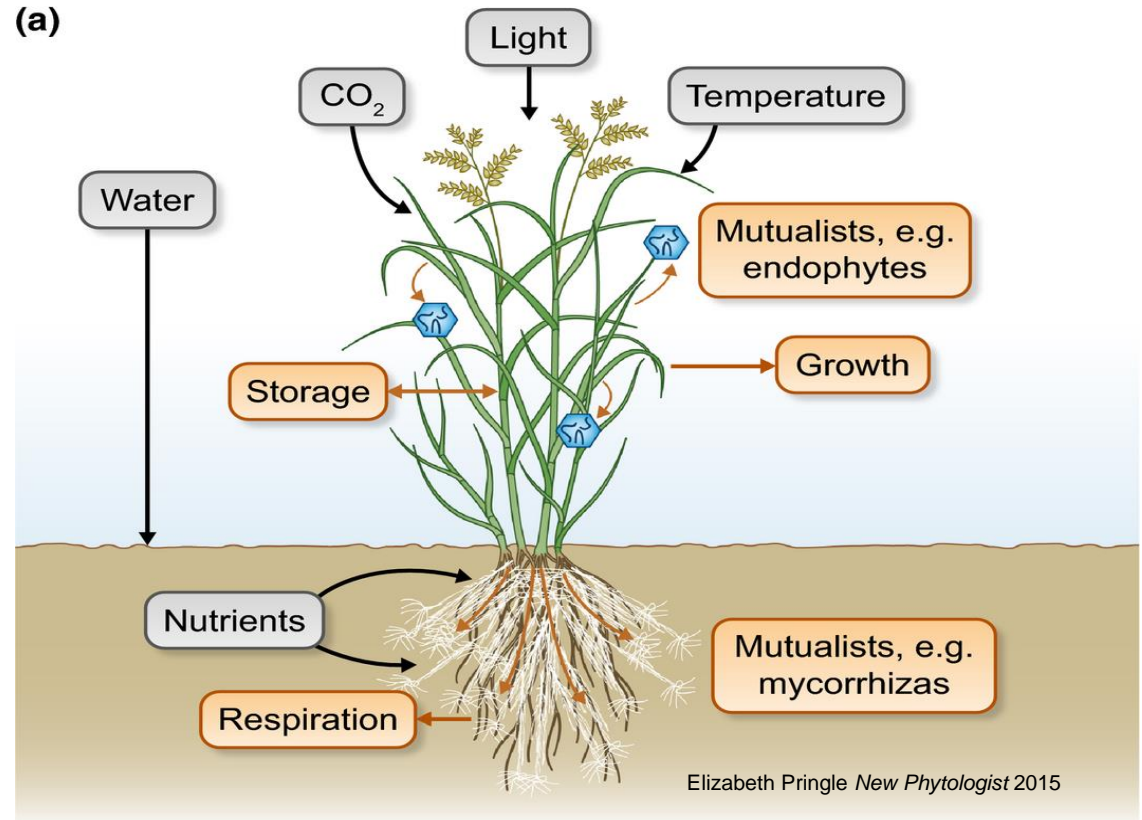
Invest energy

- Seeds for future generations

Give away energy

- Herbivores, fruit dispersers, pollinators, gardeners

Total photosynthesis (money in) must exceed total respiration (money out) for growth, reproduction, defense, and energy storage to occur.



Biomass as a Solar Energy Store

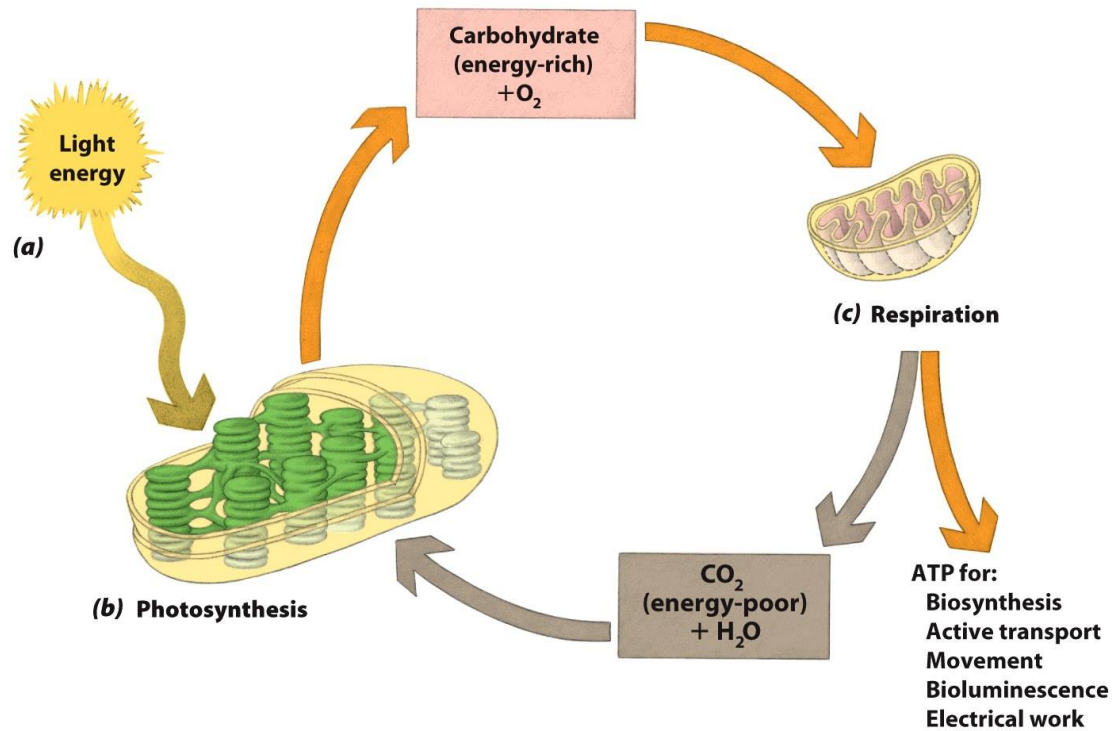
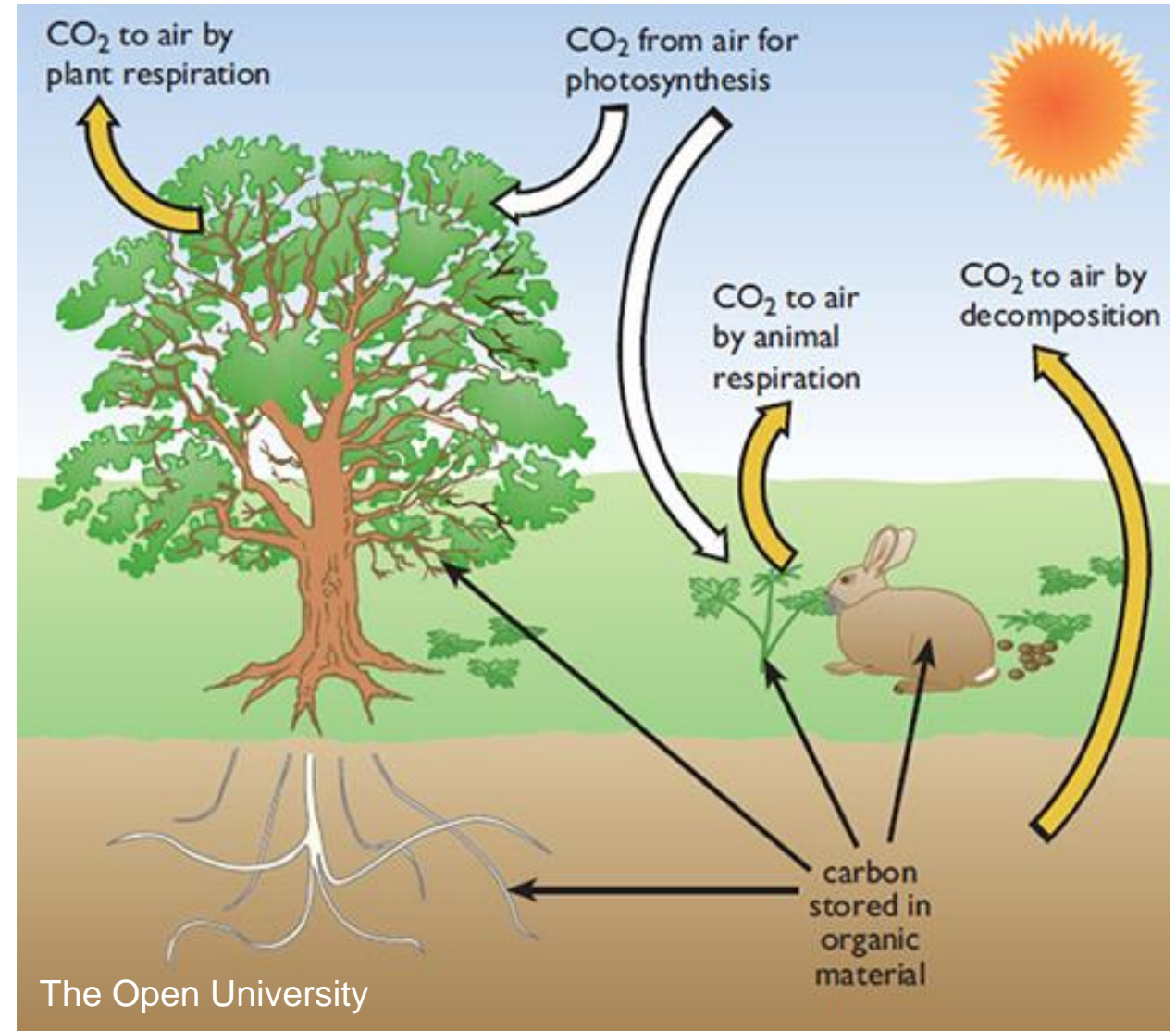
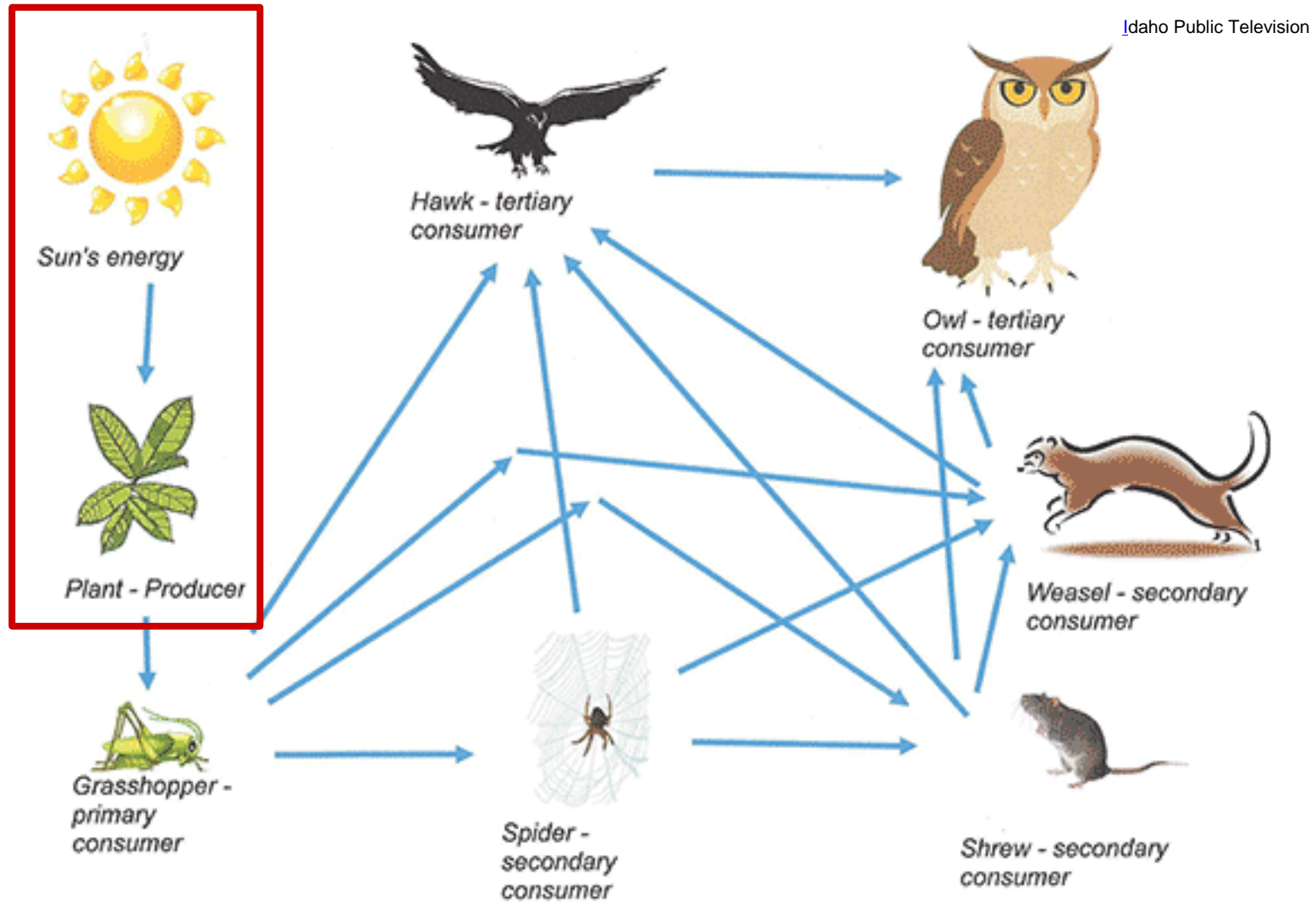


Figure 5-1
Raven *Biology of Plants*, Eighth Edition
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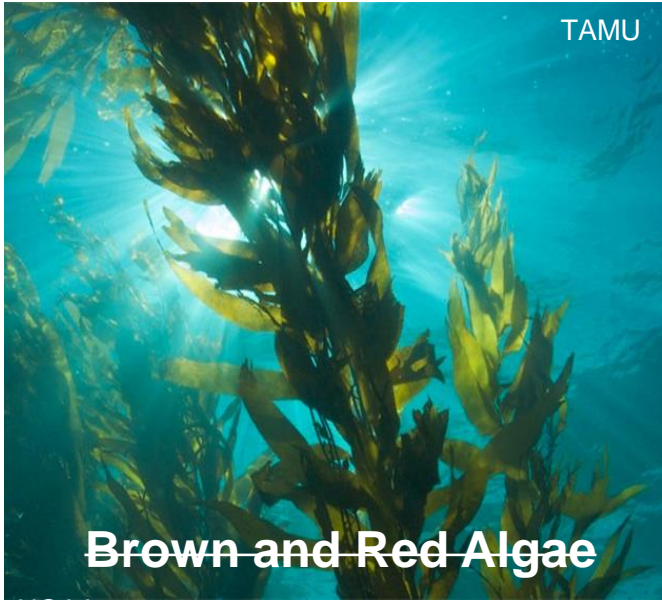
The Basis for Terrestrial Food Webs



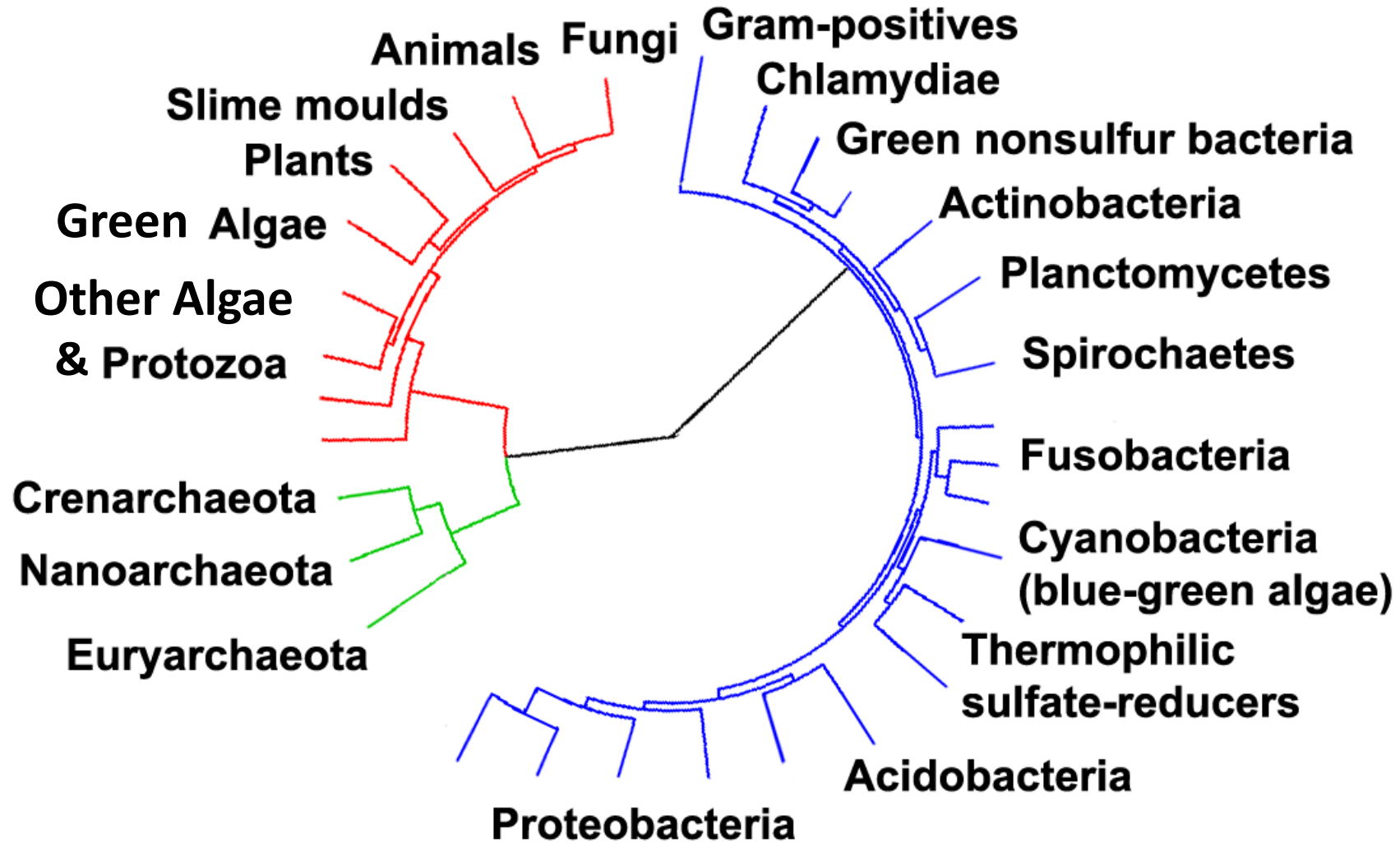
What are plants?



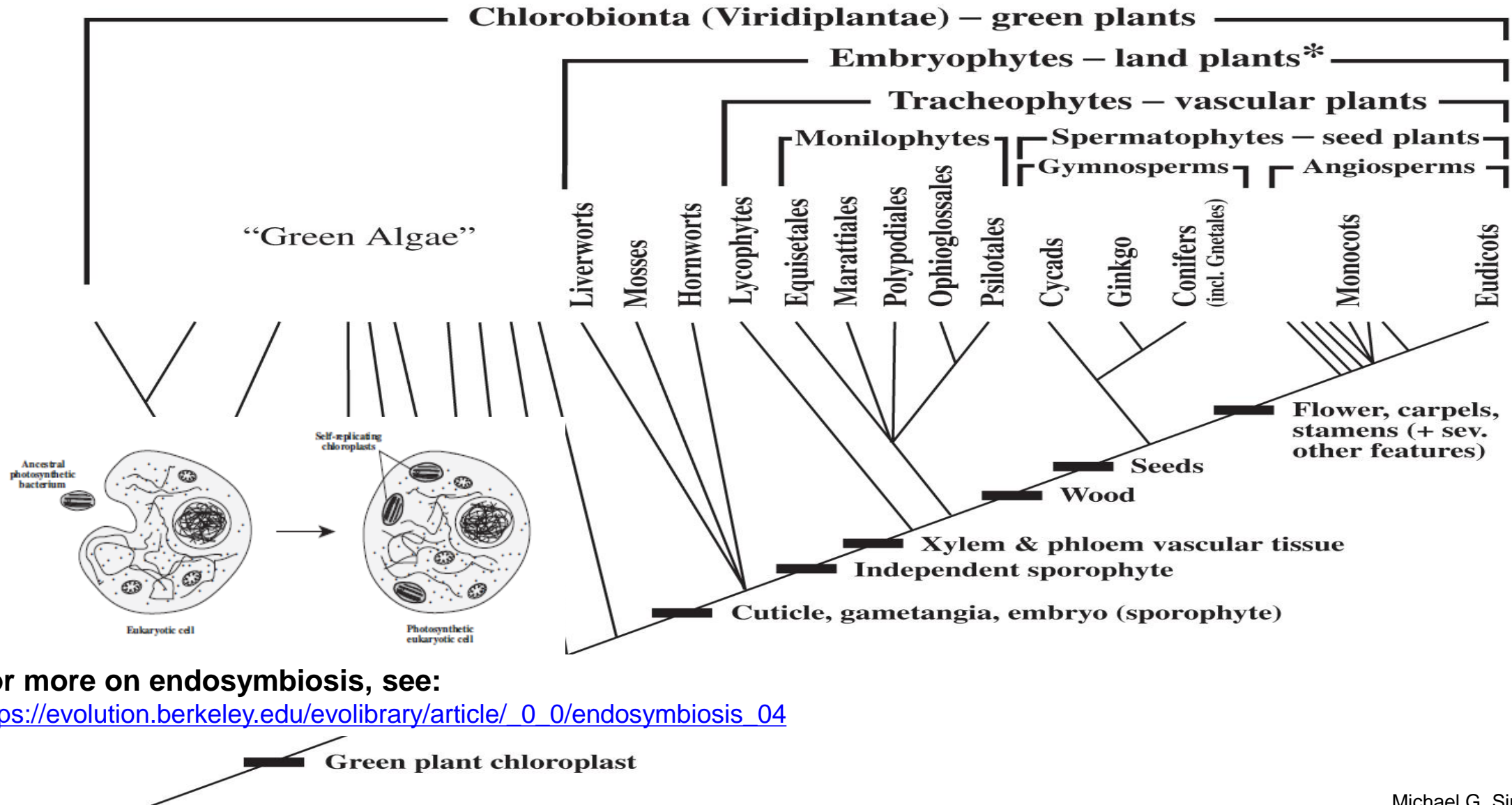
Cyanobacteria



Plants in the Tree of Life



Green Algae vs. Land Plants



For more on endosymbiosis, see:

[https://evolution.berkeley.edu/evolibrary/article/ 0_0/endosymbiosis_04](https://evolution.berkeley.edu/evolibrary/article/0_0/endosymbiosis_04)

Green Algae



Spirogyra

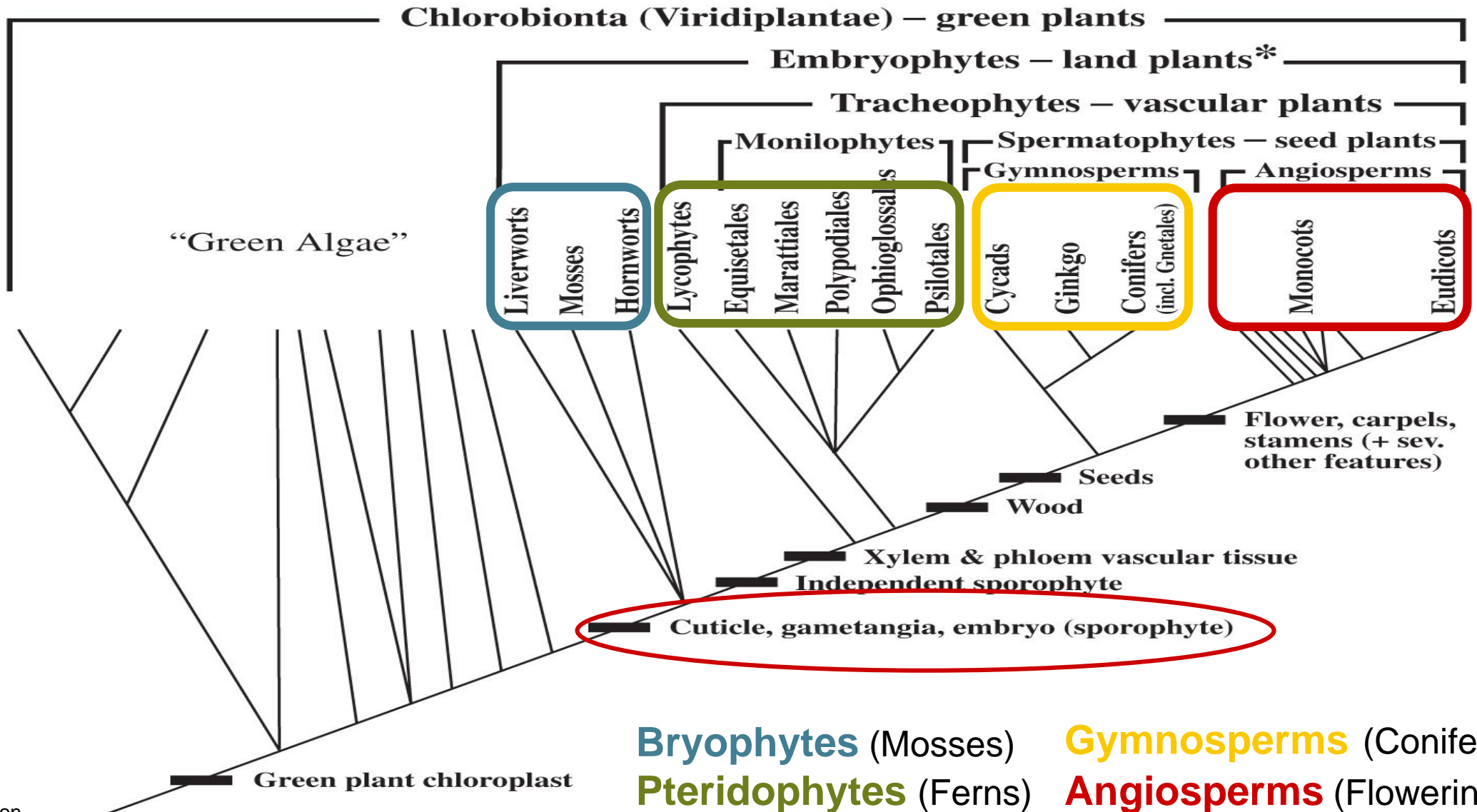


Hydrodictylon



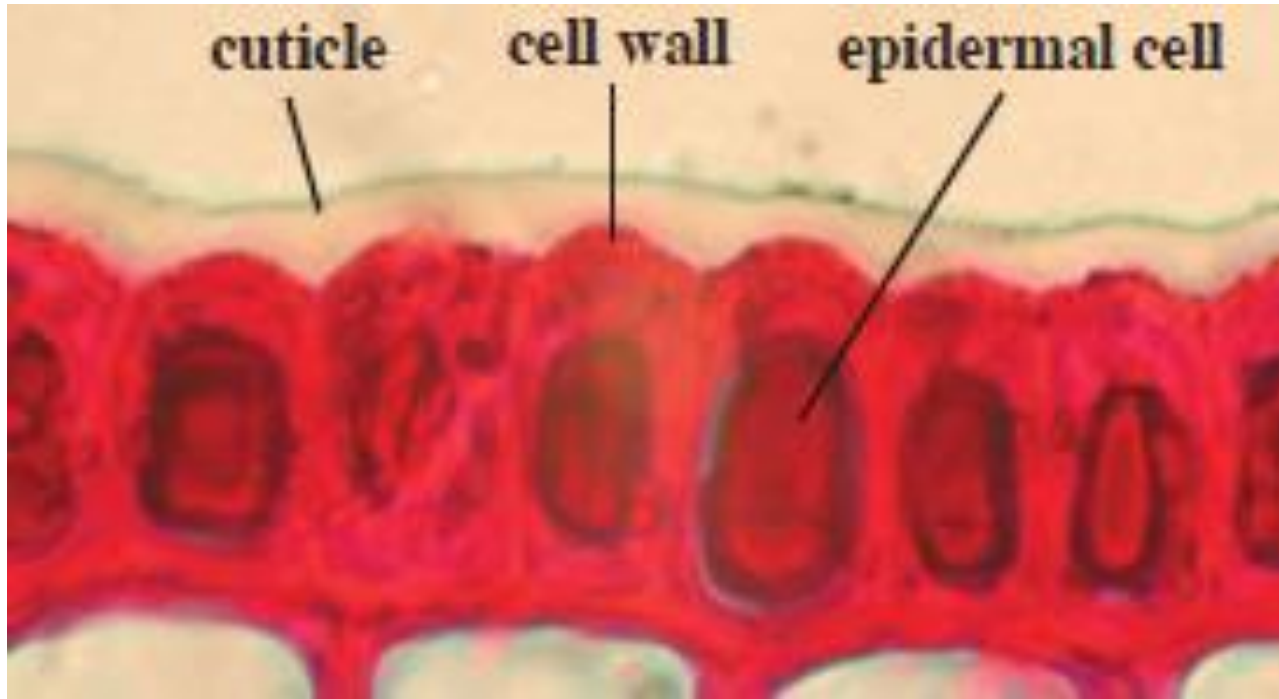
Chara

Green Algae vs. Land Plants

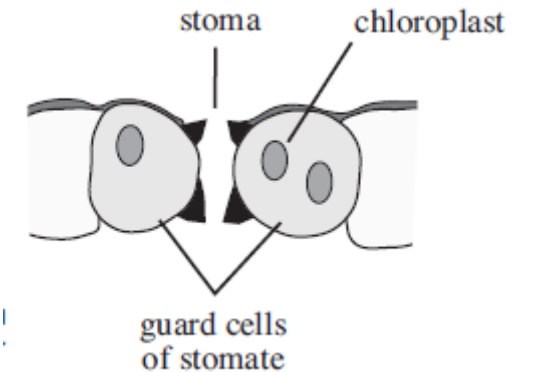
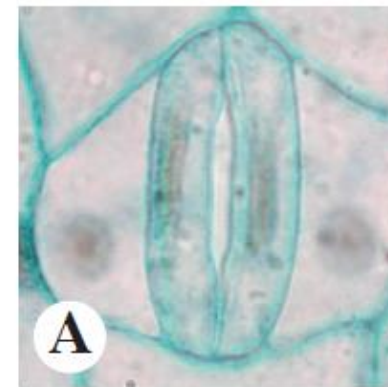
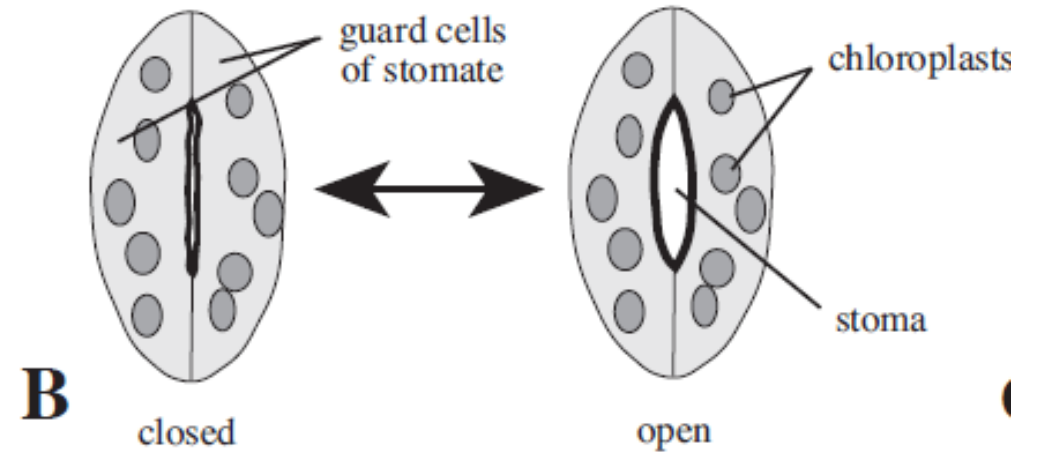


Shared Characters of Land Plants

Michael G. Simpson
Plant Systematics, 3rd Ed.



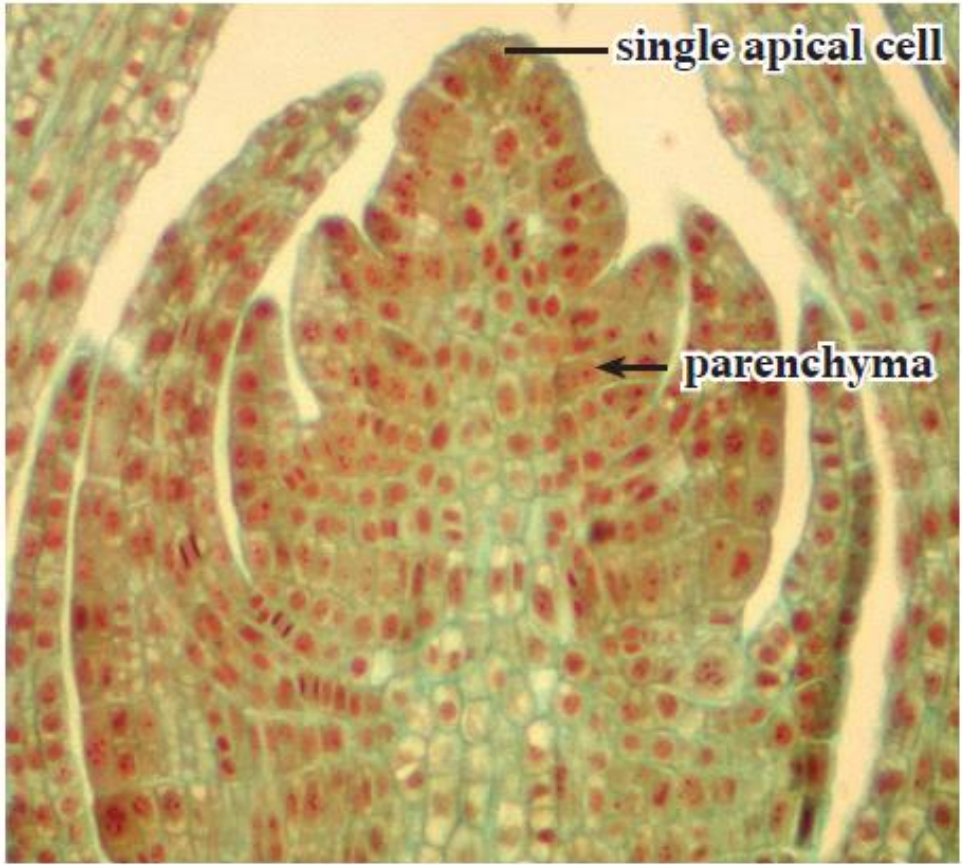
Cuticles reduce water loss.



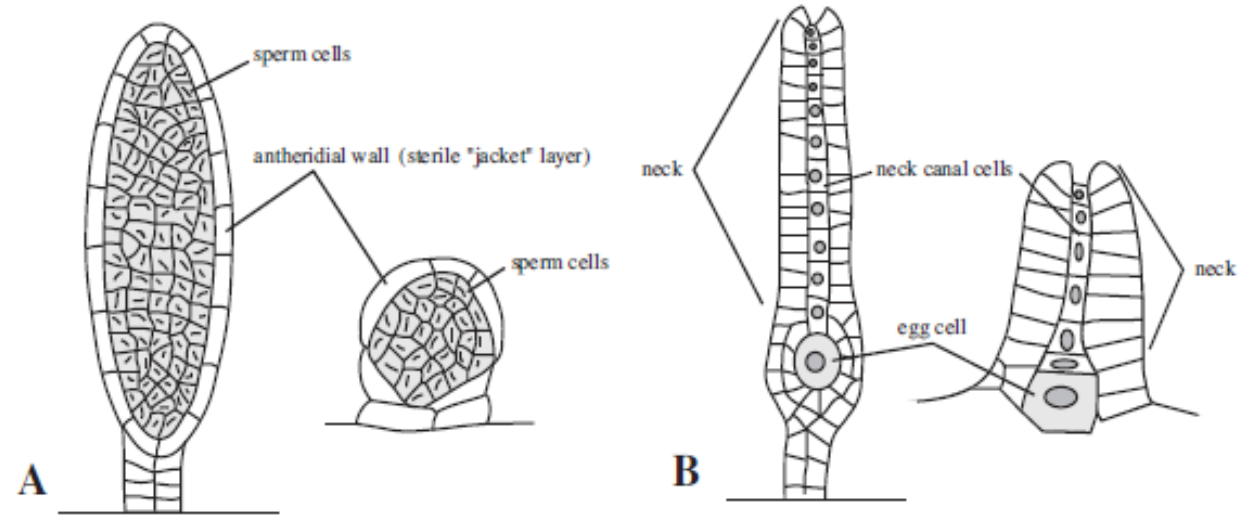
Stomata allow CO₂ in (photosynthesis) and H₂O out (transpiration).

Shared Characters of Land Plants

Michael G. Simpson
Plant Systematics, 3rd Ed.



Apical meristems
produce undifferentiated cells.

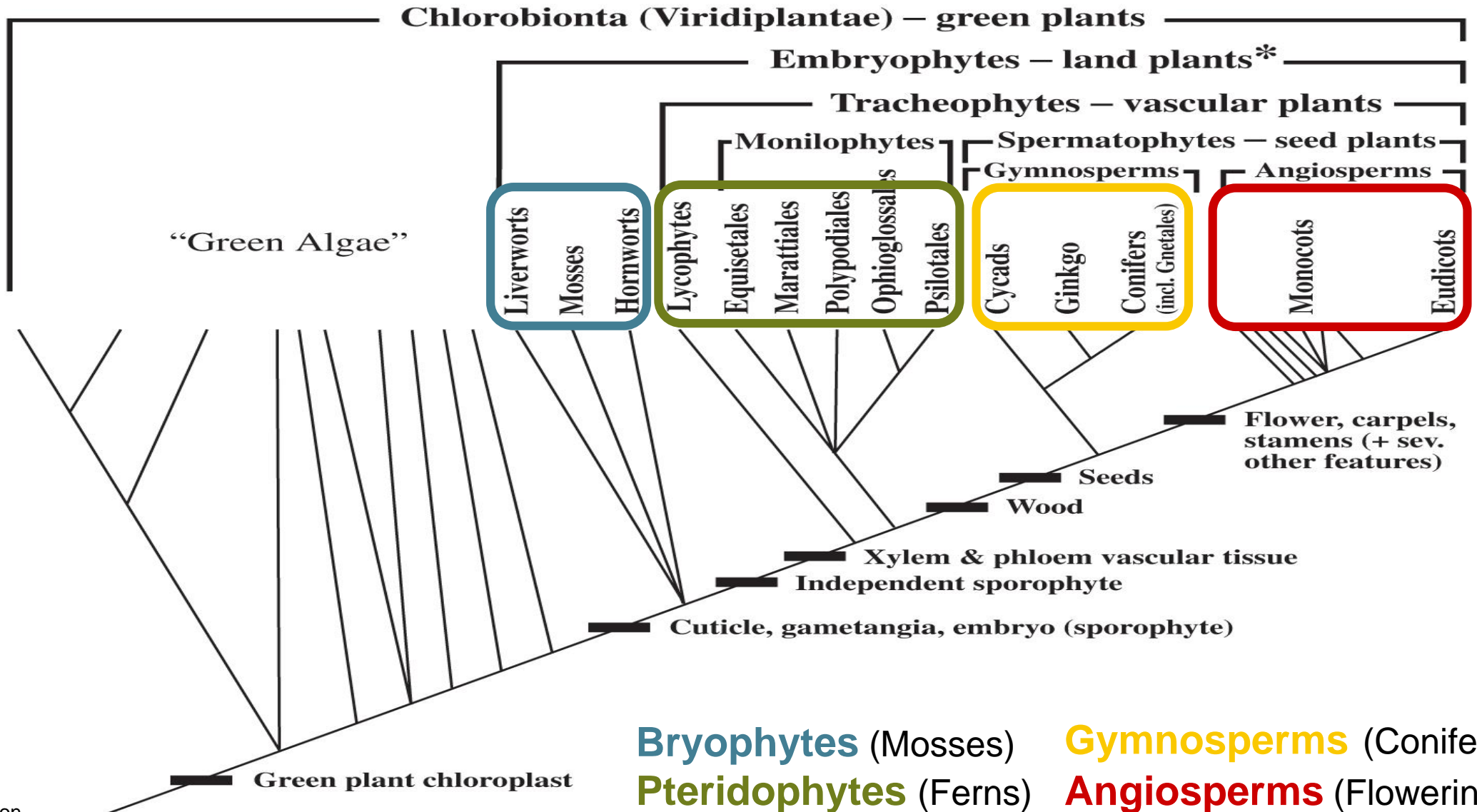


Antheridium

Archegonium

Sperm and egg protected from
desiccation in *gametangia*

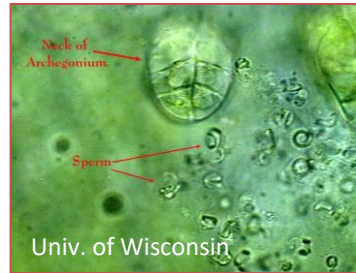
Green Algae vs. Land Plants



Three Modes of Reproduction

Dispersal of
Gametes

Sperm via Water



Mosses & Ferns

Dispersal of
Offspring



Spores via wind

Pollen via Wind



Conifers, Cycads, Ginkgo



Seeds from cones
via wind & animals

Pollen via
Animals & Wind



Flowering Plants



Seeds from fruits
via animals, wind, & water

Bryophytes



Three Groups of Bryophytes



Mosses



Liverworts



Hornworts

Bryophyte Features



Rhizoids

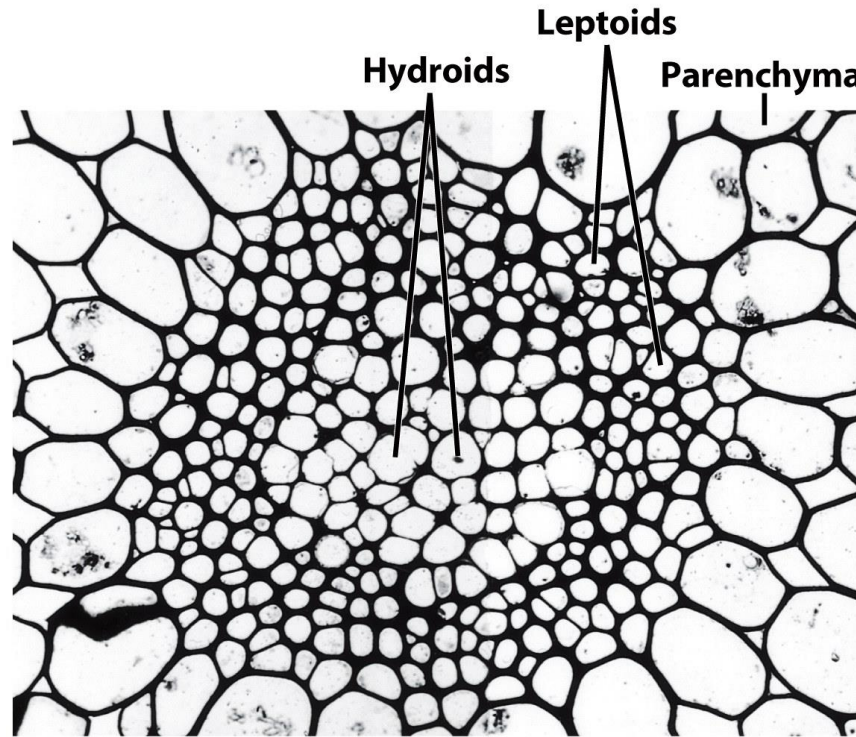
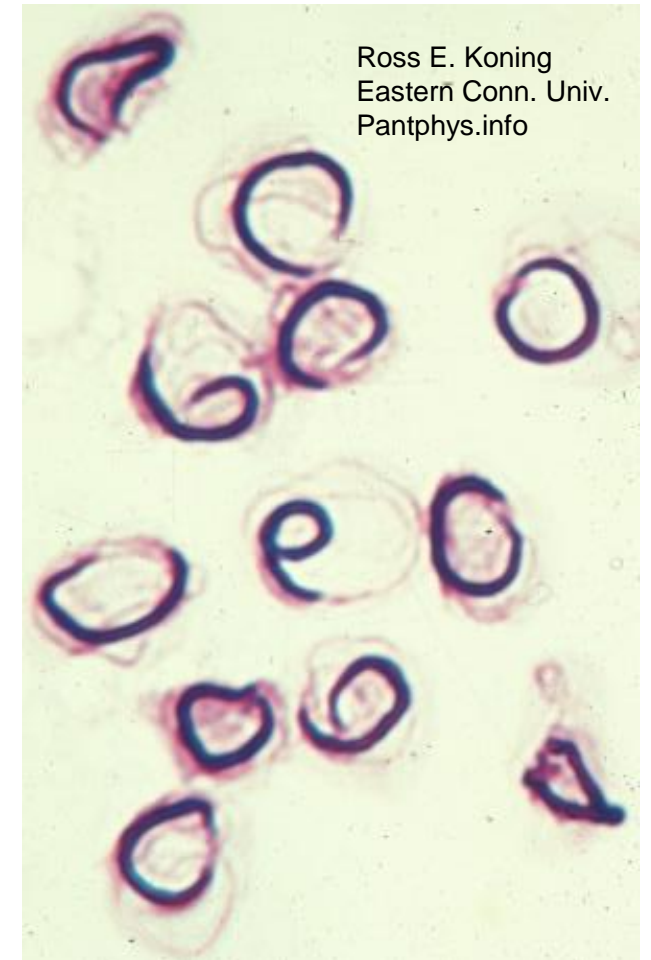


Figure 16-22b
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Lack True Vessels

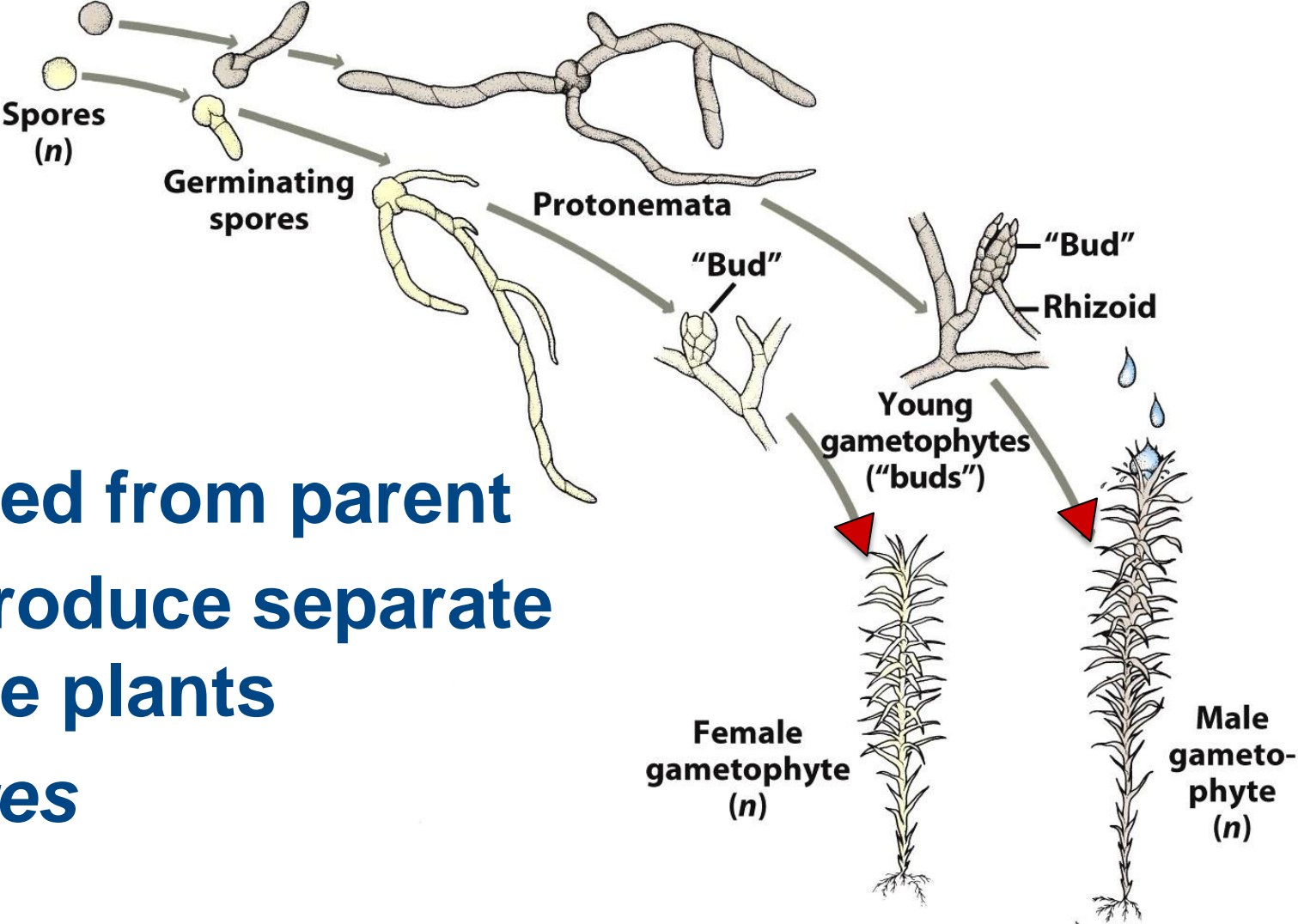
Some mosses have primitive, vessel-like structures



Swimming Sperm

Require water

Moss Life Cycle



- **Spores dispersed from parent**
- **Germinate to produce separate male and female plants**
 - *Gametophytes*

Figure 16-28 part 2
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Moss Life Cycle

- Gametophytes produce gametes (sperm & egg)
- Splashing rain drops transport swimming sperm

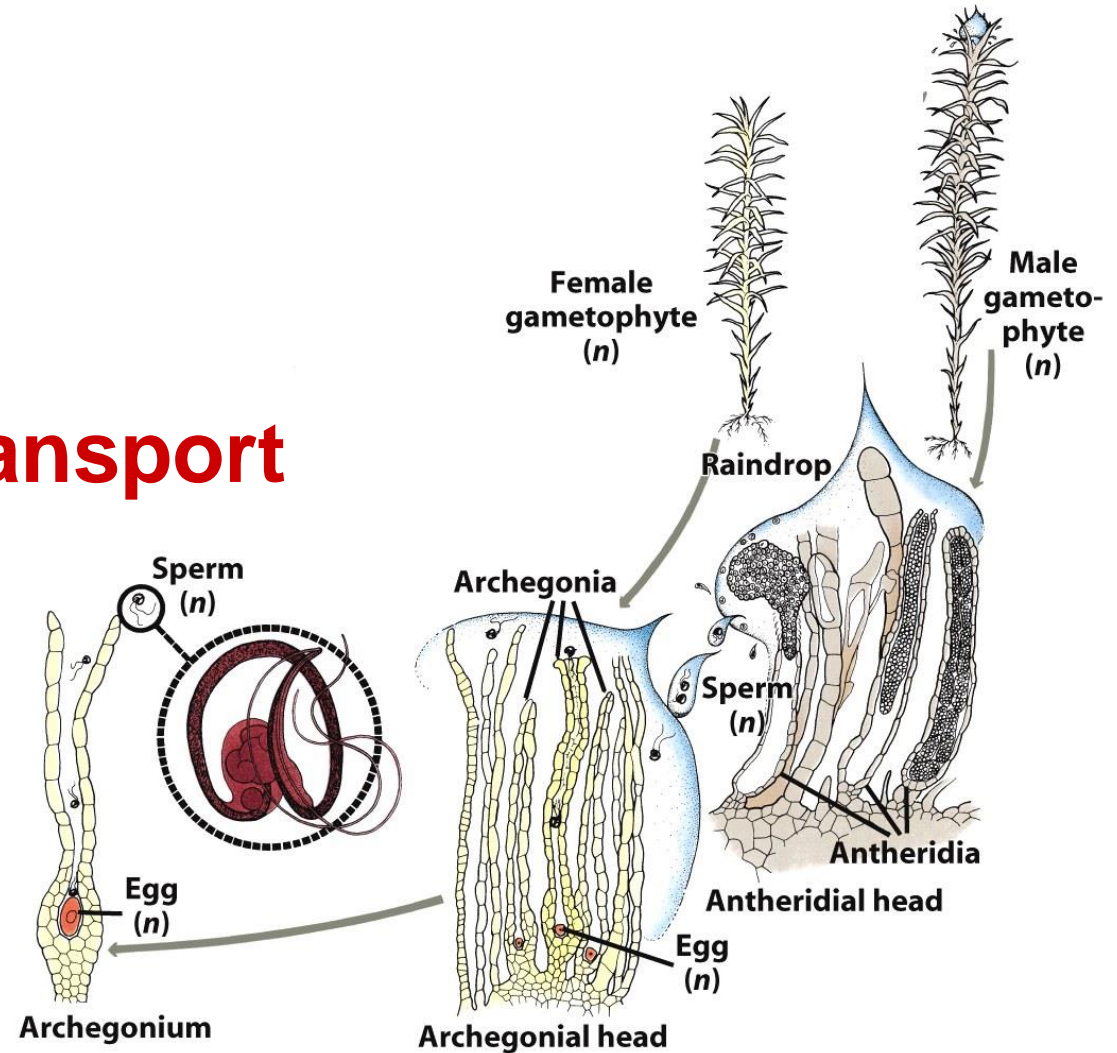


Figure 16-28 part 3
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Moss Life Cycle

- Sperm fertilizes egg
- Grows into a sporophyte
- Sporophyte attached to gametophyte

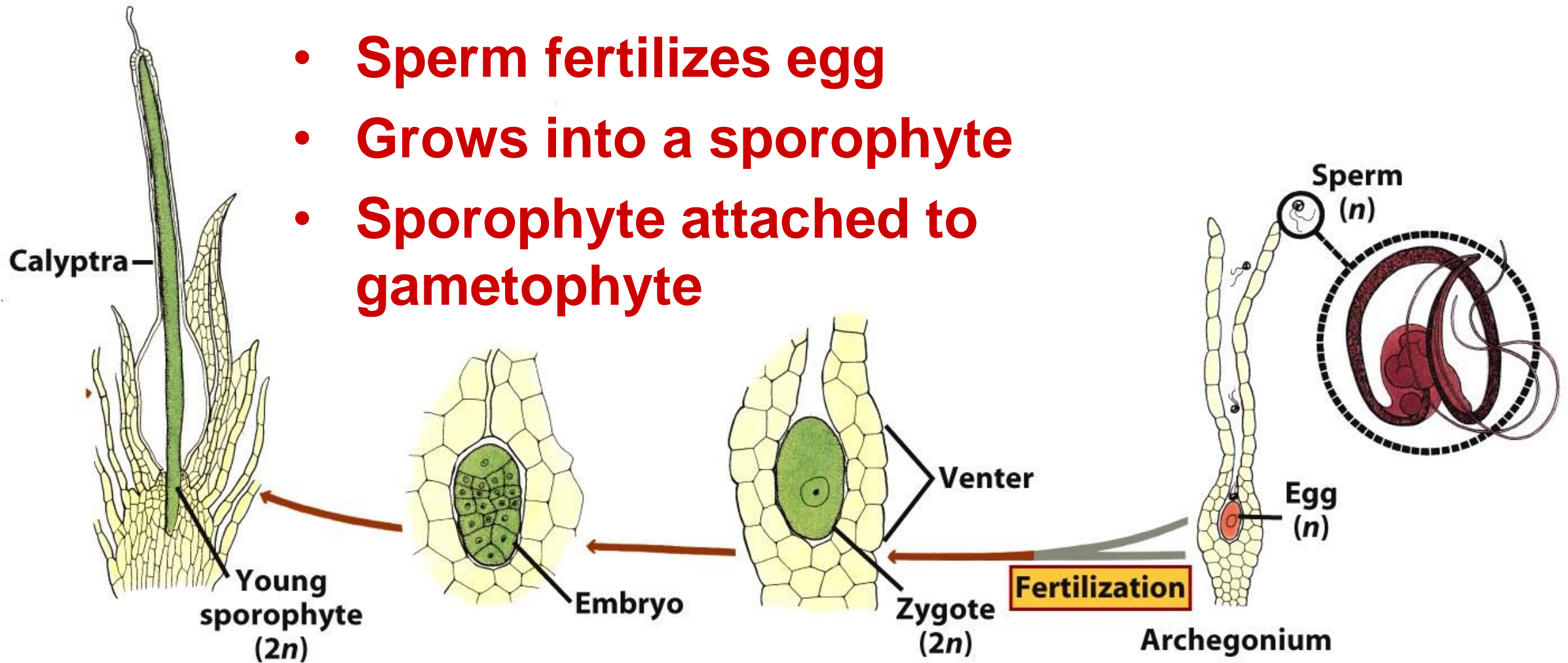


Figure 16-28 part 4

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Moss Life Cycle

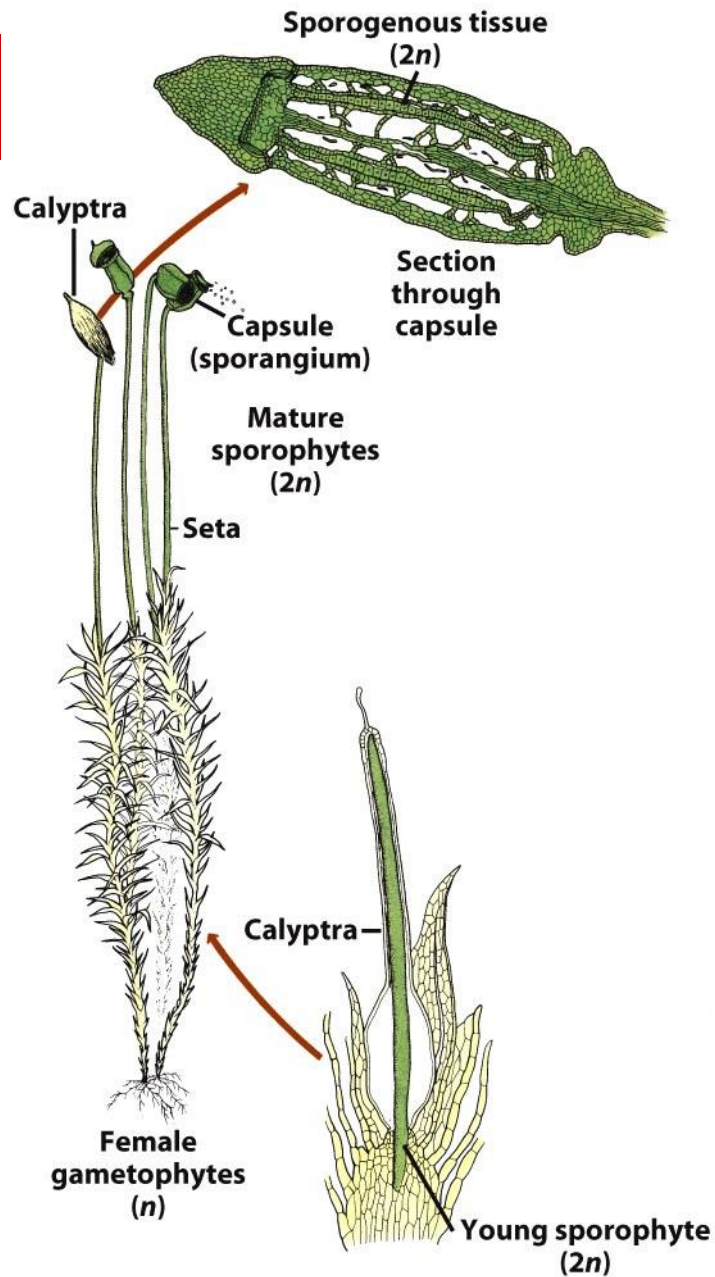


Figure 16-28 part 5
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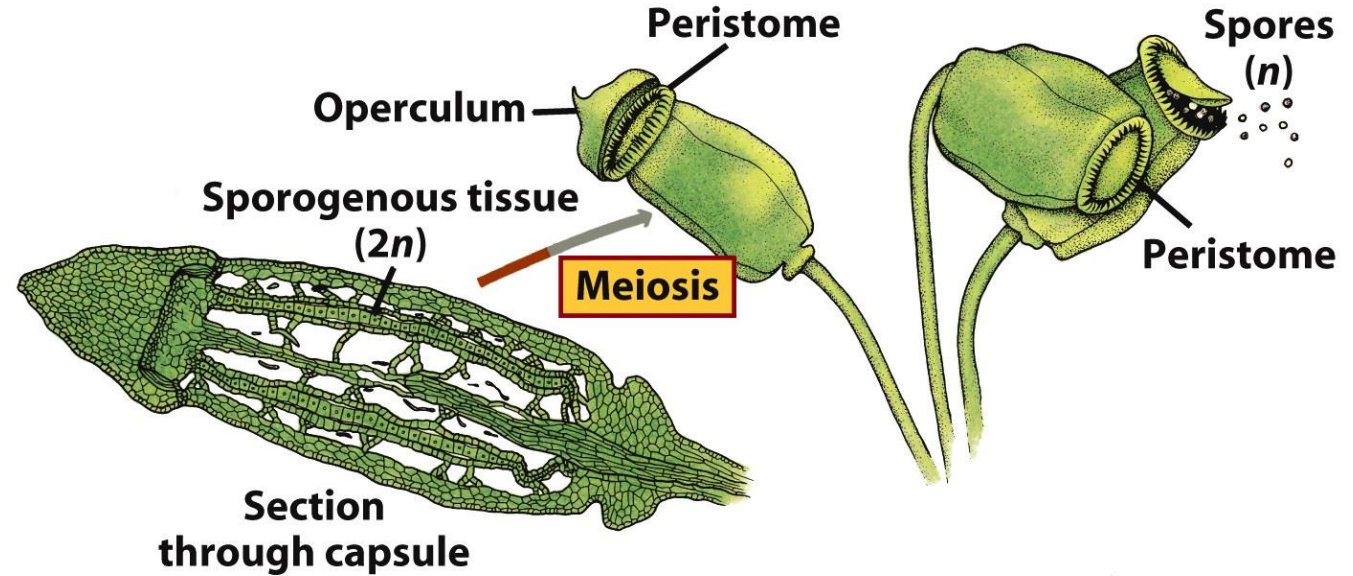


Figure 16-28 part 6
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- Sporophytes release and disperse spores
- Rinse and repeat

Bryophyte Diversity

454 Moss Species in NC



Bartramia



Rhodobryum



Leucobryum

Bryophyte Diversity

230 Liverwort Species in NC

7 Hornwort Species in NC



Bazzania



Pallavicinia



Notothylas

Vascular Plants

Have specialized tissues for moving food & water

Pteridophytes (Ferns & Lycophytes)

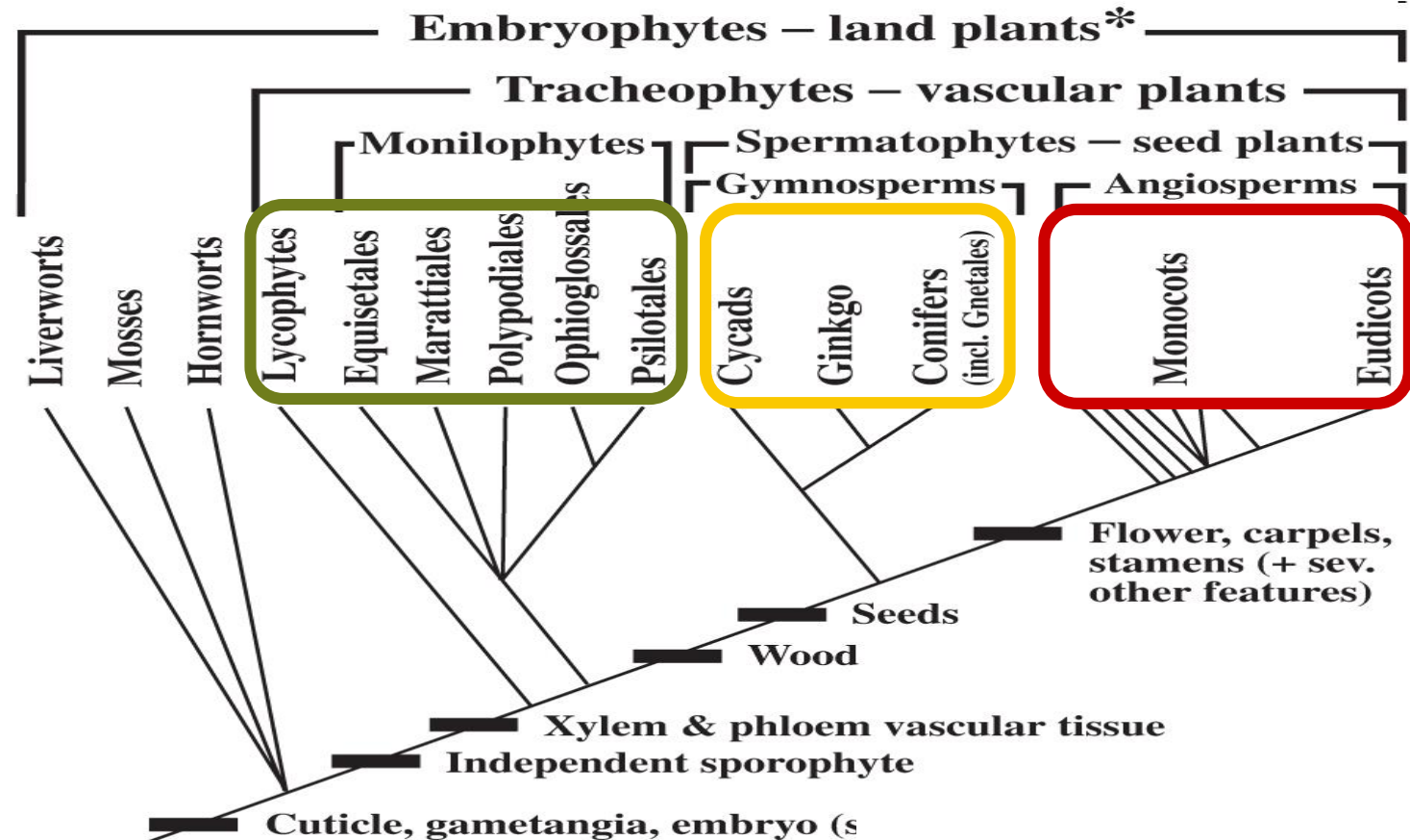
- Produce spores

Gymnosperms (Conifers)

- Produce seeds

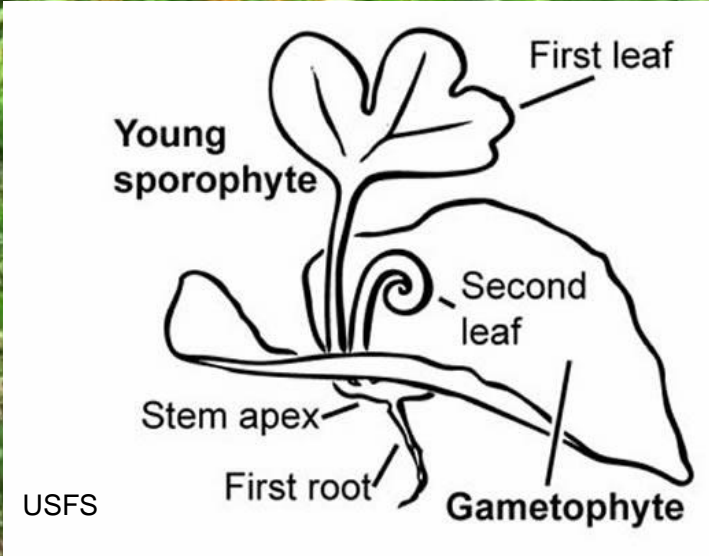
Angiosperms (Flowering Plants)

- Produce flowers
- Produce seeds in fruits



Vascular Plants

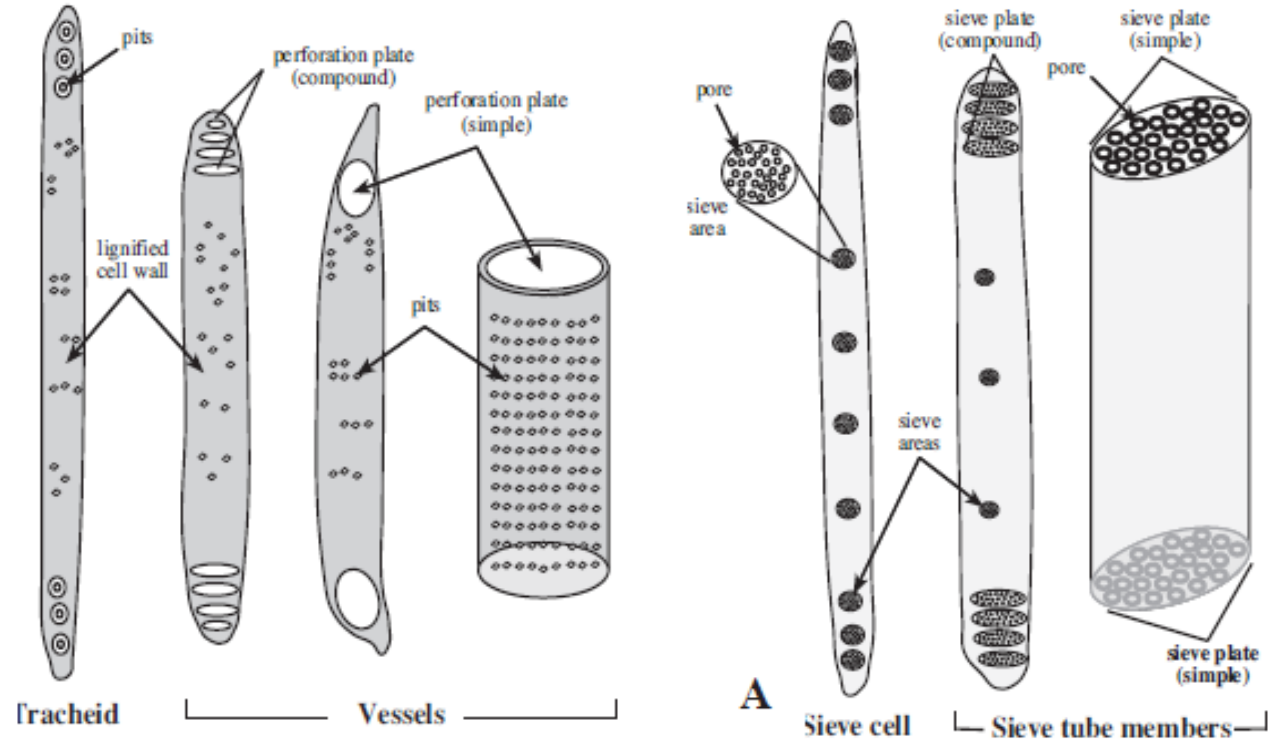
Specialized Features (Apomorphies)



USFS

Joy Weese Moll
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Dominant Sporophyte



Xylem Cells
Transport Water

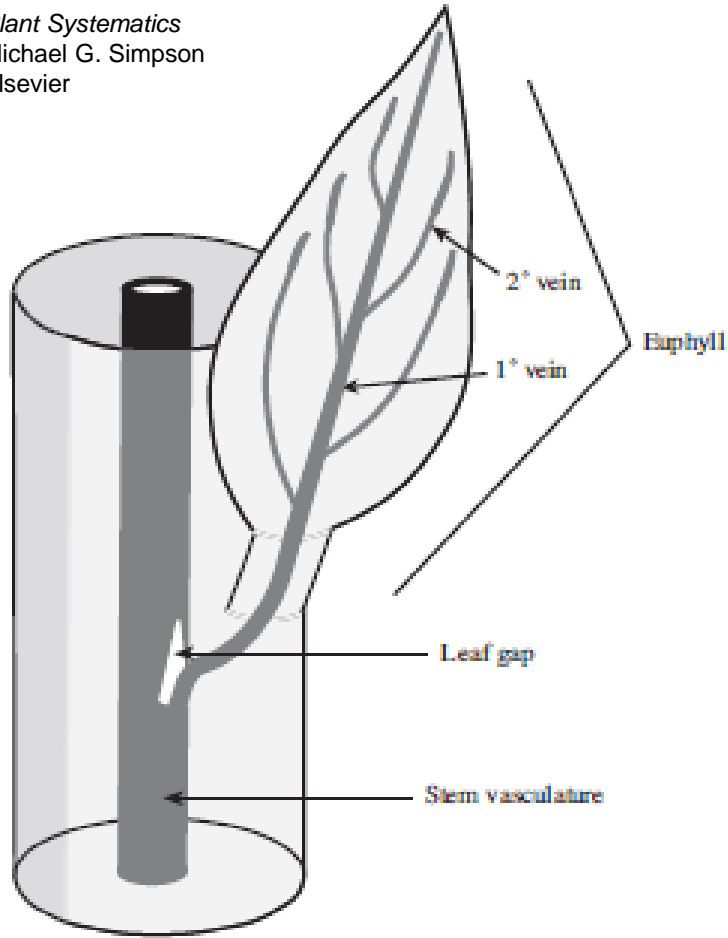
Phloem Cells
Transport Food

Vascular Tissue

Vascular Plants

Specialized Features (Apomorphies)

Plant Systematics
Michael G. Simpson
Elsevier



F

True Leaves

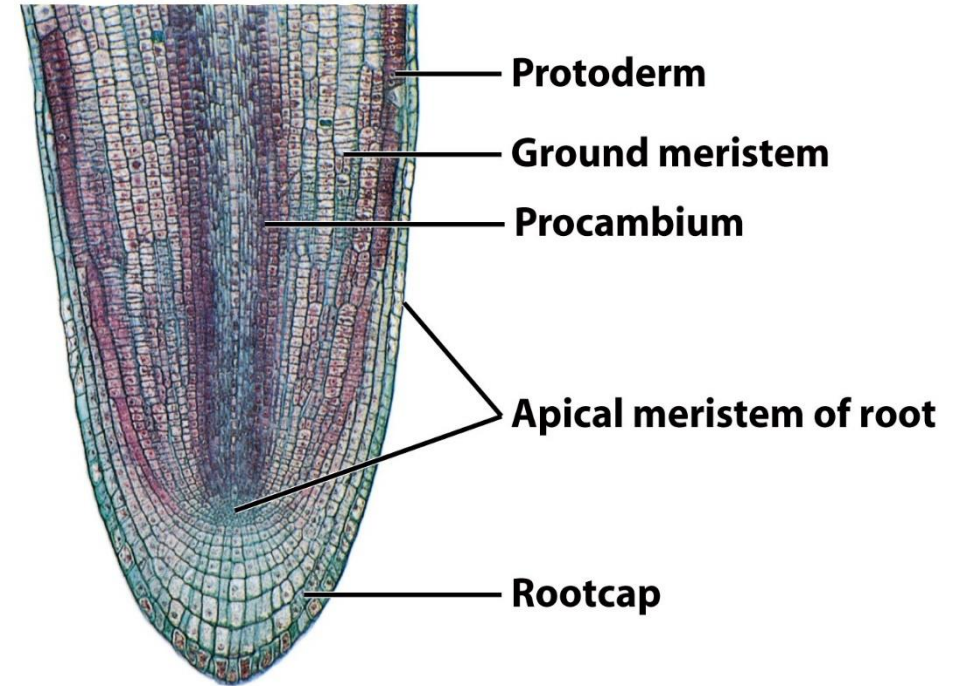
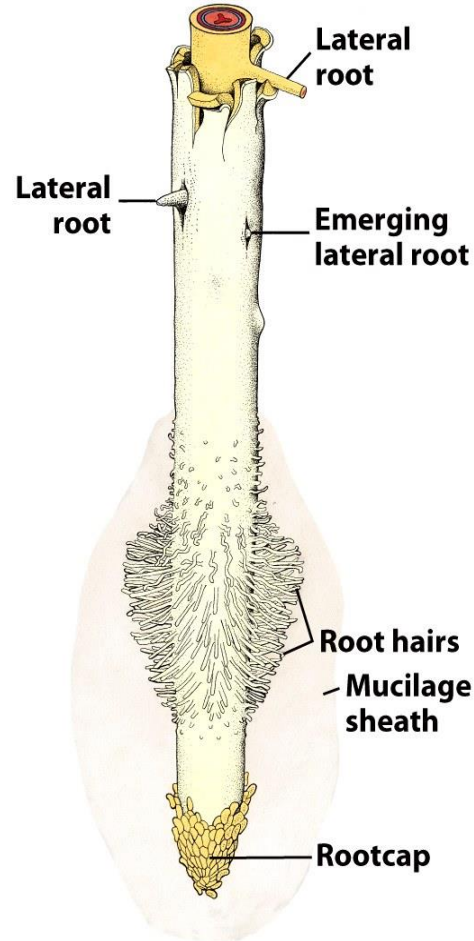


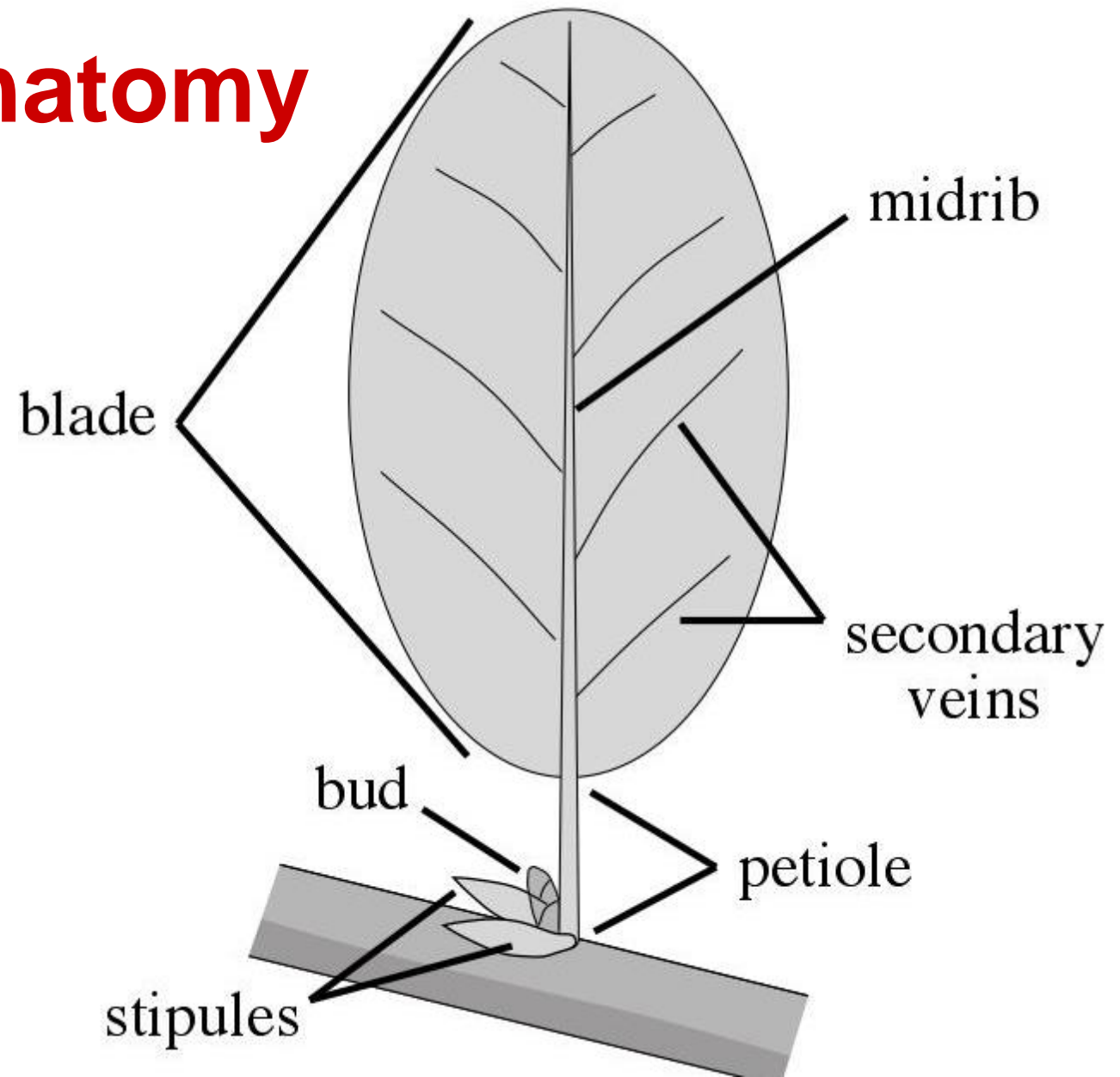
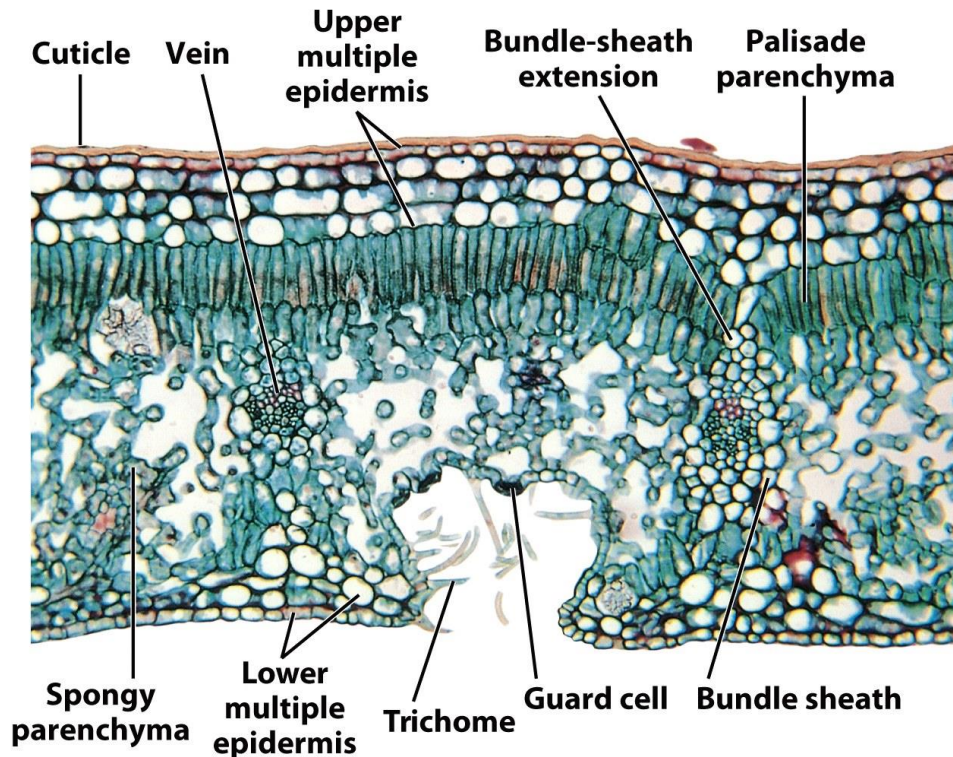
Figure 23-1b
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True Roots

Leaf Anatomy

Functions of a Leaf

- Photosynthesis
- Transpiration



Roots Structure & Function

- Absorb water & dissolved nutrients from the soil
- Anchor plants in soil
- Conduct water and nutrients to the rest of the plant

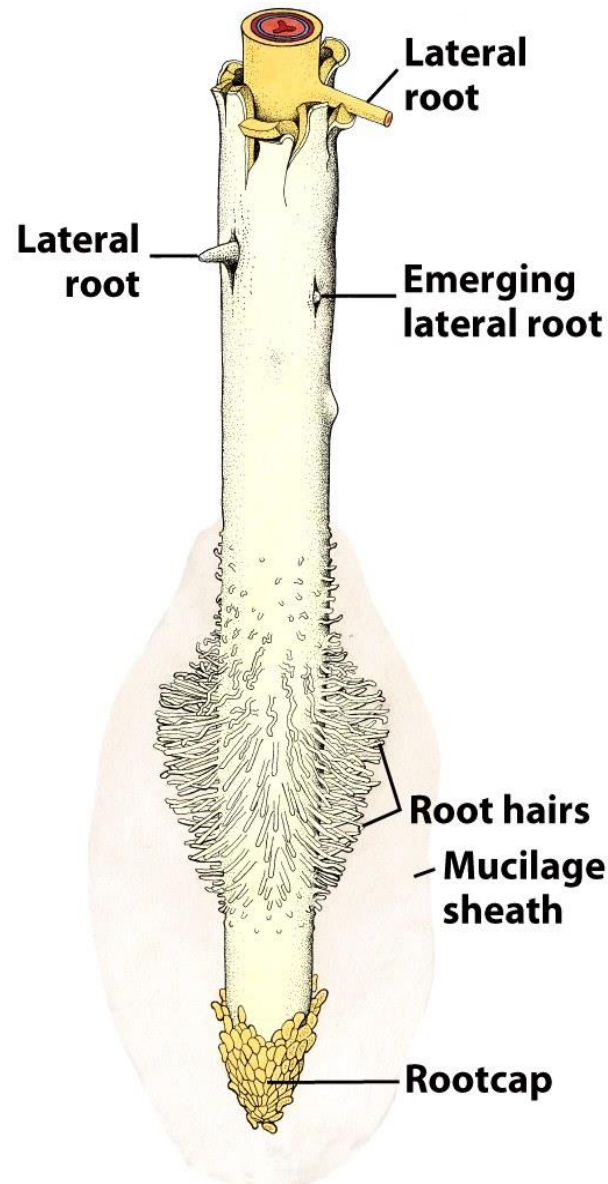
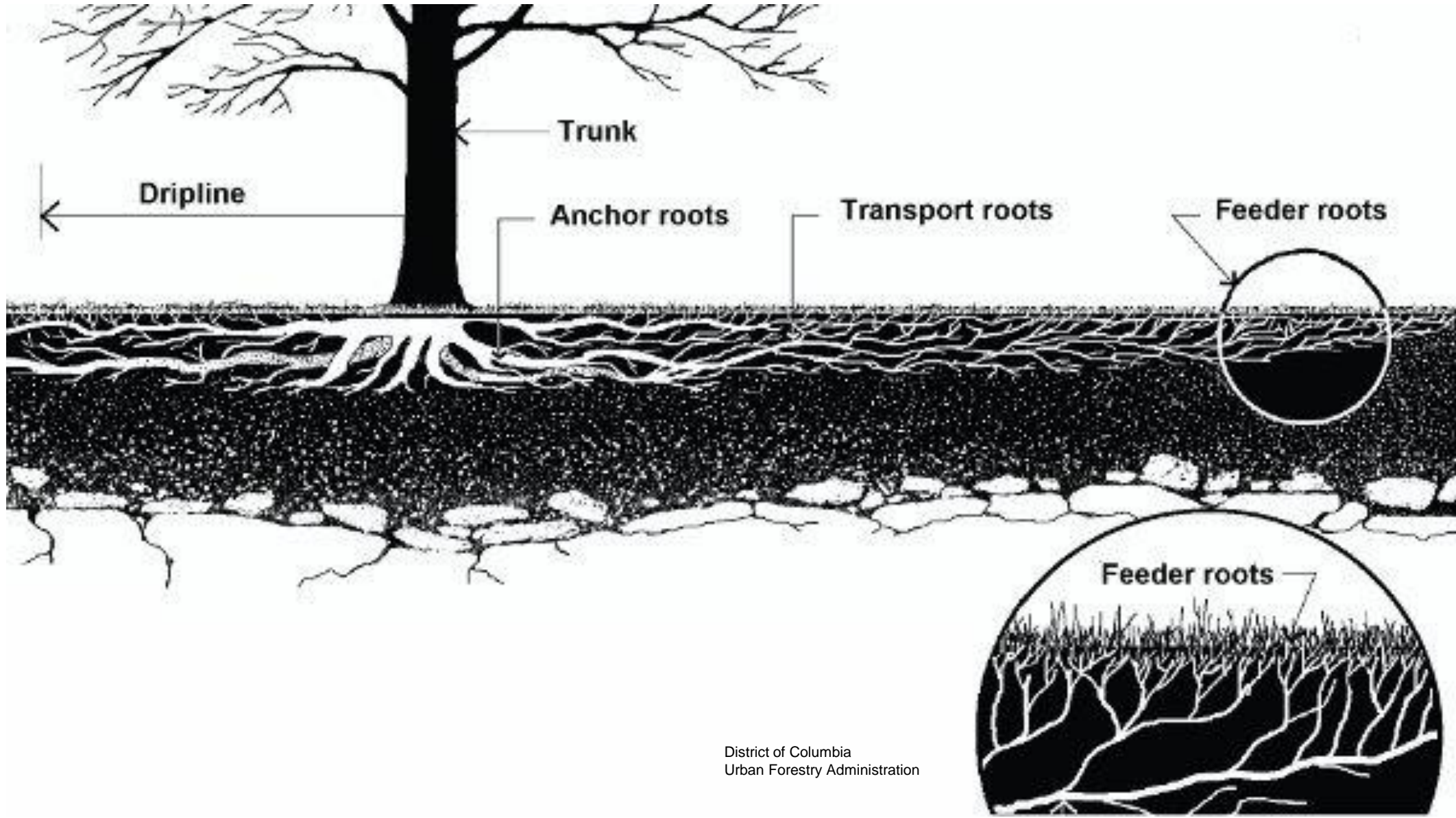


Figure 24-4a
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Figure 24-4b
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Root Distribution



Transpiration

How Plants Move Water

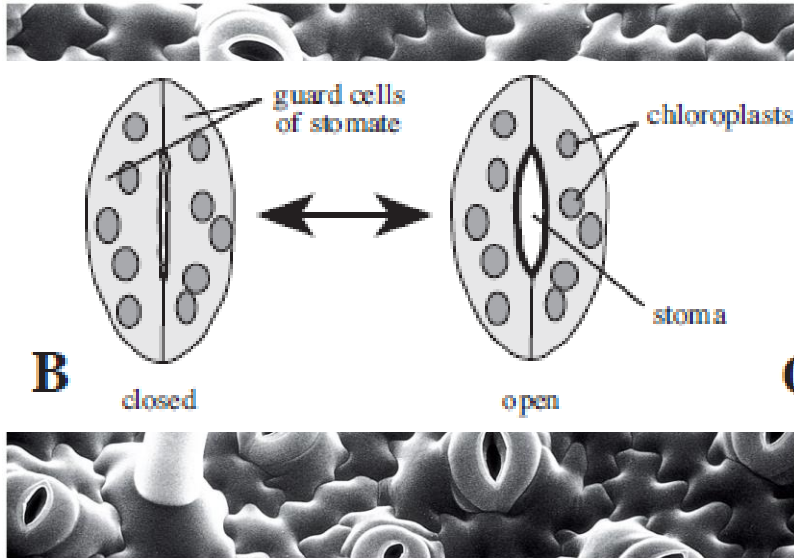
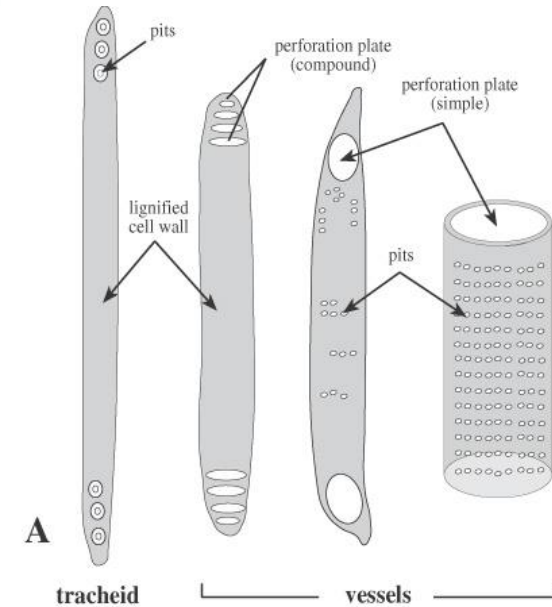
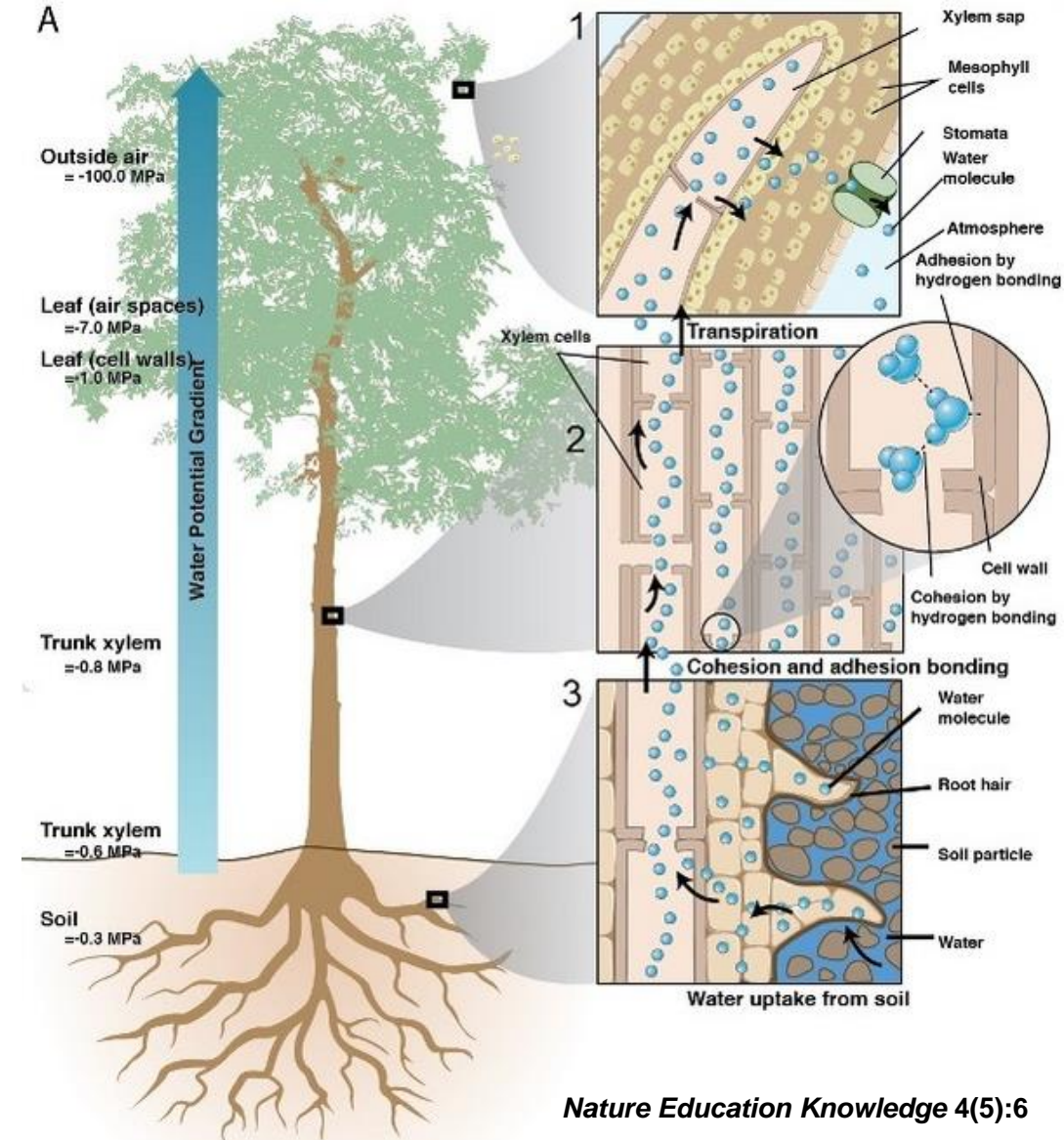


Figure 7-15
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Water evaporated from stomata...



...and pulled through xylem cells



Watch Video:
go.ncsu.edu/transpiration