

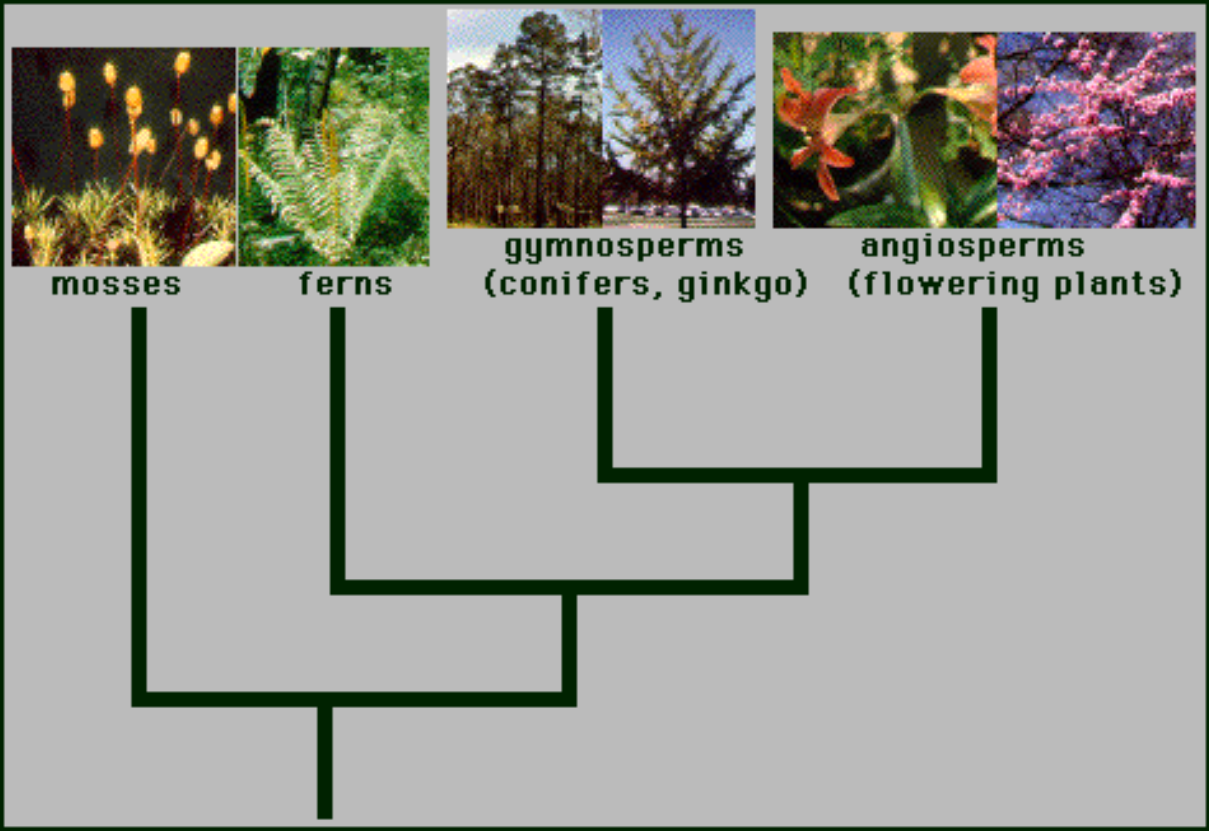


# Kingdom Plantae



# Plant Evolution

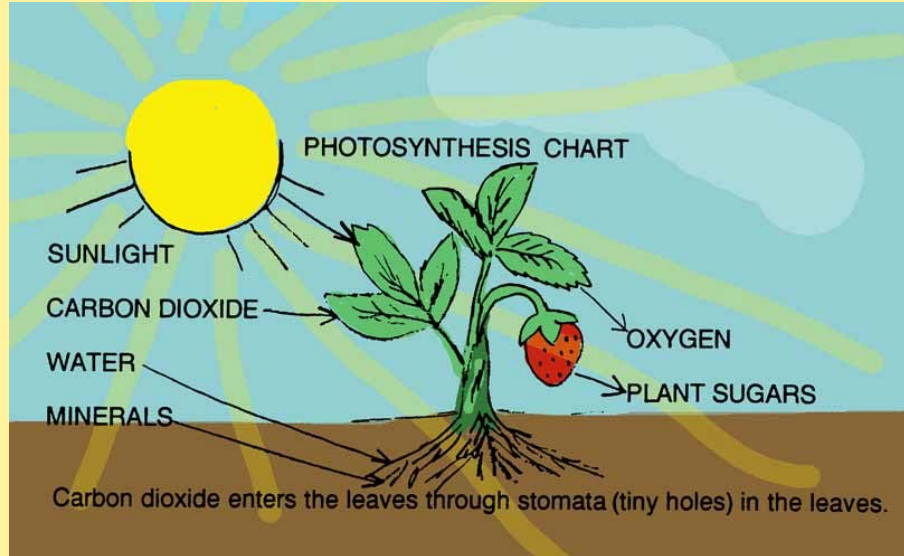
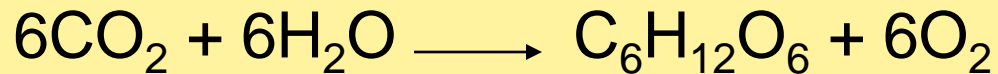
Least Evolved



Most Evolved

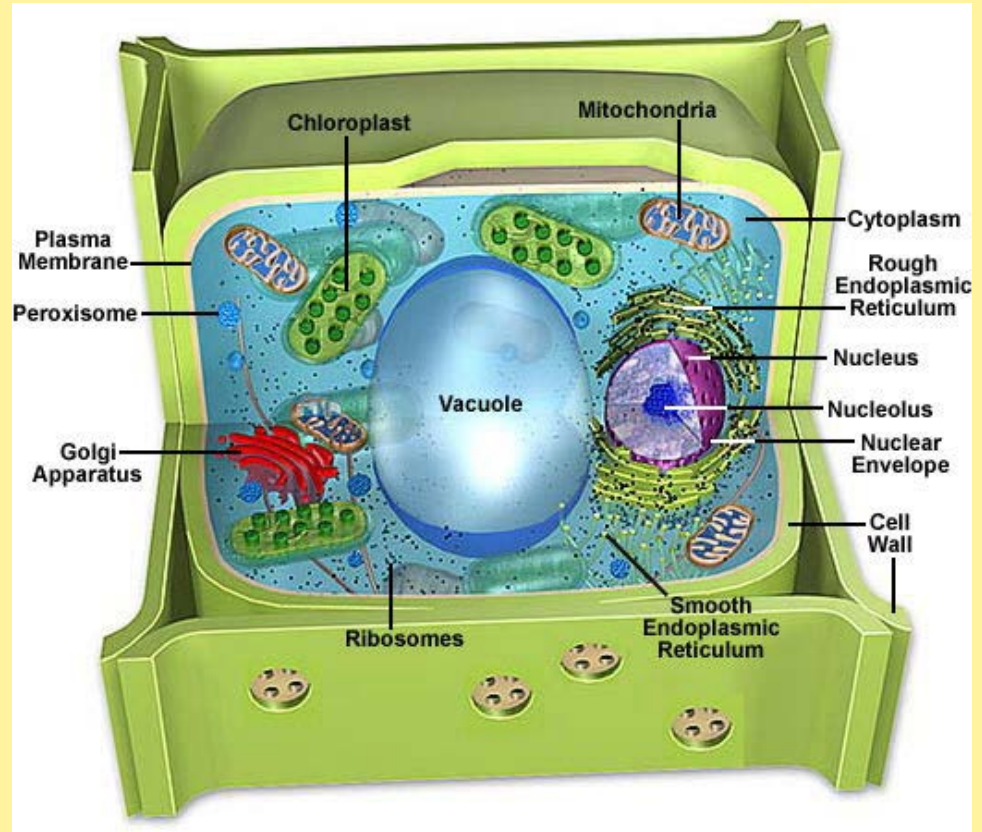
# Characteristics of Plants

- Plants are photosynthetic.
- Chloroplasts
  - convert light energy into chemical energy: food/sugar.



# Characteristics of Plants

- Plant cells are eukaryotic – they have a nucleus and membrane-bound organelles.
- Plant cells possess cell walls made of cellulose which provide rigidity and structure to the cell.






# Why are plants important?

- **Ecology** – basis of the food chain, plants are produces.... They produce glucose (sugar) and oxygen
- **Food** – plants are an important food source for a variety of organisms
- **Shelter** – for a variety of organisms





# Why are plants important?

- **Medicine** – many medicines are derived from plant material
- **Fuels**
  - **Fossil fuels** – coal deposits formed from decaying plants
  - **Biodiesel** – plants can be used to make fuel – (Surrey Biofuel does this)
- **Esthetics** – many cosmetics are derived from plant material and plants make great decorations!

A photograph showing sunlight filtering through tall grasses, creating a bright, hazy effect. The sun is visible as a bright spot in the upper left corner, with rays of light spreading across the scene.

# What Do Plants Need to Survive?

- **Sunlight** – energy source for the photosynthesis reaction
- **Water** – a reactant in the photosynthesis reaction
- **Minerals** – to facilitate growth
- **Gas exchange** – to bring in  $\text{CO}_2$  for photosynthesis and remove  $\text{O}_2$
- **Transport of Water and Nutrients** – around the plant to nourish cells not directly in contact with water




# Plants in water

- Life is a bit easier for aquatic plants because:
  - The plant is supported by the buoyancy of water
  - Every cell has easy access to water and nourishment through diffusion
  - Reproduction can occur via the release of sperm and eggs into water







# Algae: 2 Classifications

## Plant-like protists

- Blue-green algae
- Unicellular algae
- Kingdom Protista



## Sea Weed or Kelp

- Sometimes classified as Kingdom Plantae
- *Non-Vascular Plant* when studied in Kingdom Plantae
- Other classifications are often used





# Non-Vascular Plants

- Lack internal transport system
  - No ‘piping’
  - Cannot transport water or food around the plant
- Due to lack of water transport **non-vascular** plants are
  - Small
  - Grow low to ground (not tall)
  - Grow in moist or wet areas
- Mosses (land) and Algae (water)

# Phylum: Bryophyta

- Bryophytes
- Non-Vascular
- Land Plants

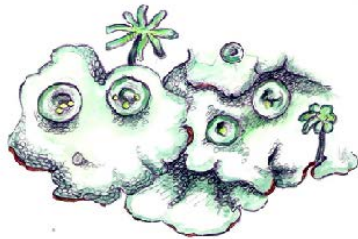
Mosses



Liverworts



Moss



Liverwort



Hornwort

Hornworts



# Phylum: Bryophyta

## Asexual Reproduction

- Spores
  - Haploid ( $n$ ), one set of chromosomes
  - Don't need to meet up with another to reproduce

## Sexual Reproduction

- Gametes ( $n$ )
  - Sperm must **swim** to egg,
  - moist environment only
  - Fertilize to form zygote (Diploid,  $2n$ )





# Moss Life Cycle

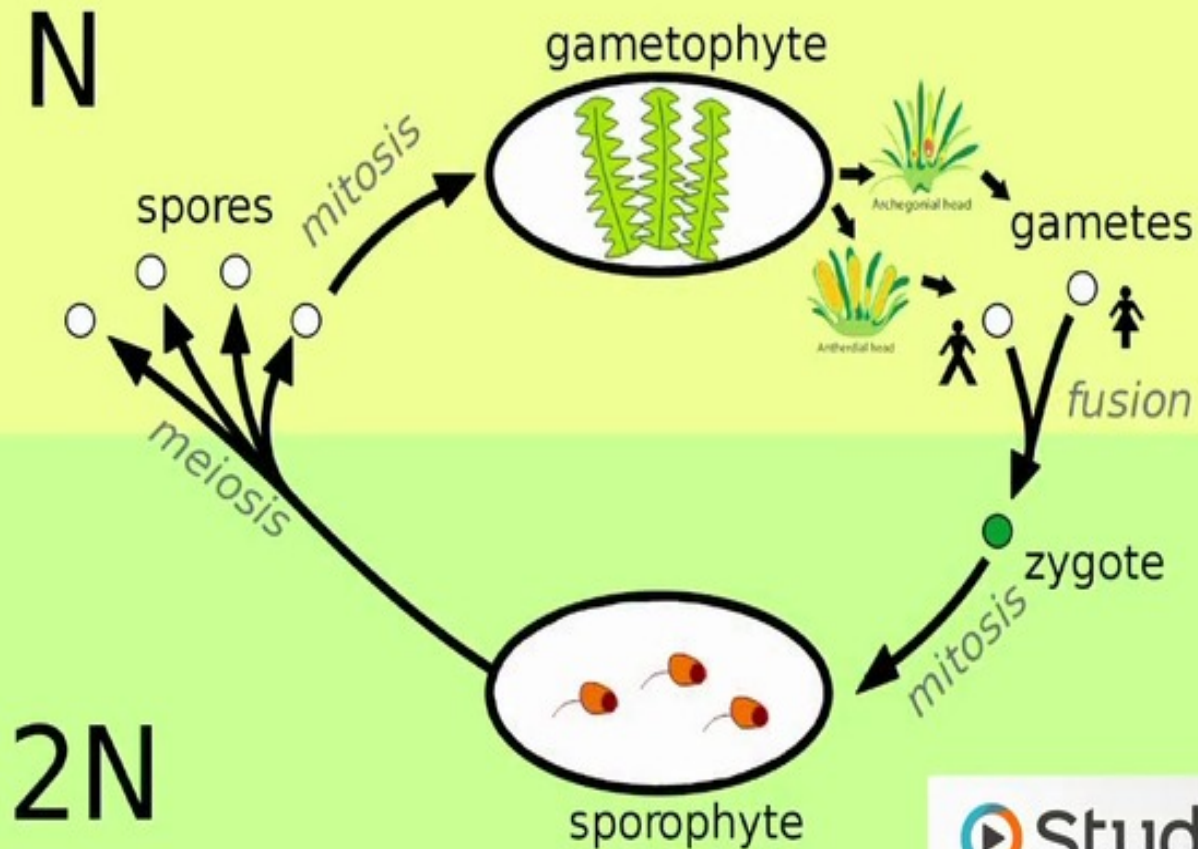
Haploid =  
Asexual

- spores

Diploid =  
Sexual

- gametes
- zygote

## THE HAPLOID STAGE





# Demands of Living in a Terrestrial Environment

- Limited supply of water
- Require support to remain upright
- Movement of nutrients and water from one part of the plant to the other
  - Sugars are made in the leaves and nutrients are absorbed by the roots
- Water loss during gas exchange
- Reproduction with little or no water





# Advantages to terrestrial living

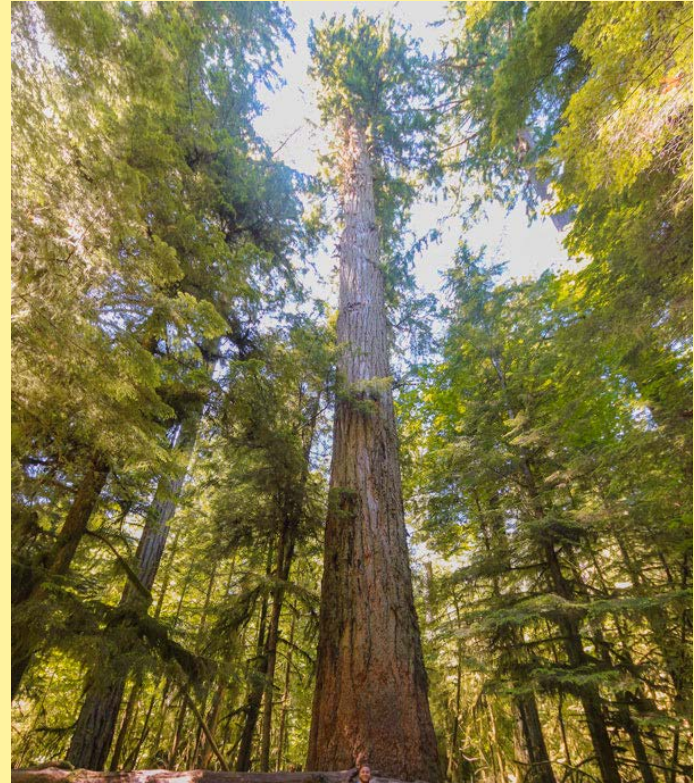
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Given the challenges, why would plants have evolved to live in terrestrial environments?

- Greater quantity of light
- Initially no predators
- Readily available minerals in soil
- Greater concentration of CO<sub>2</sub> in air than in water

# Vascular Plants

- Have “piping” system
- Transports water and food around the plant
- Grow taller
  - Can move water from roots to top of plant.
  - Can move food from leaves to roots



# Phylum Tracheophyta

- Vascular Plants
- Tracheophytes require moist environments
  - sperm must swim to egg



- Ferns



- Fiddleheads
  - Immature ferns

- Horsetails



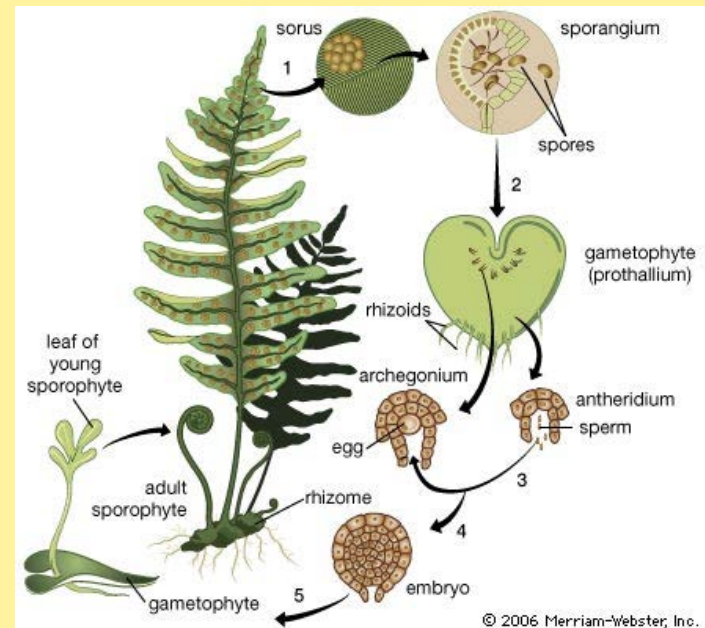


# Phylum Tracheophyta

- Asexual Reproduction
  - Spores



- Sexual Reproduction
  - Sperm must swim to egg







# Spores vs. Seeds

- Moss and Ferns can reproduce asexually by spores
- Higher Plants reproduce with SEEDS
  - Sexual reproduction
  - -seeds result after egg and sperm unite
- Two Major Types of Seed Producing Plants
  - Gymnosperms
  - Angiosperms

# Gymnosperms

Evolved before  
the dinosaurs

## Conifers



## Ginkgoes



## Cycads

Look like fern or palm, but  
has cones



# Gymnosperms

- “Naked Seeds”
  - Seed not enclosed in a fruit
  - Have CONES

## Male Cones

-produce pollen



## Female Cones

-produce ovule



Before fertilization



Open to release seeds



# Angiosperms

- Flowering Plants
- Flower is the reproductive part
- Seeds enclosed in a “vessel” or fruit



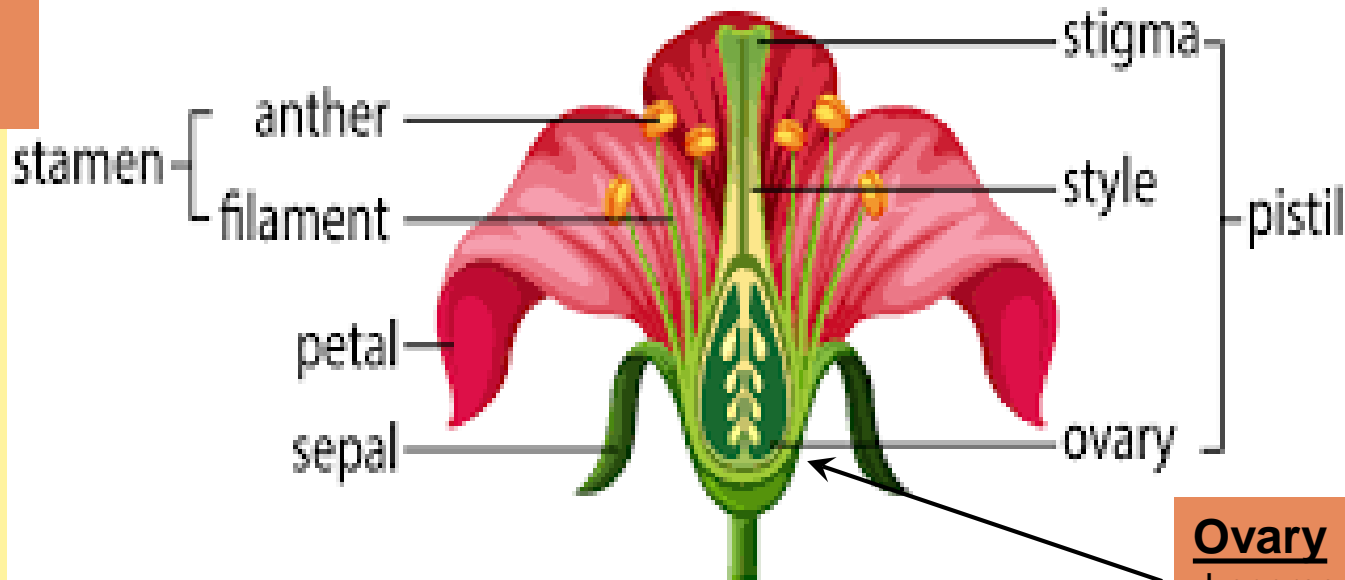
# Angiosperms

- **Parts of a Flower**

- Find a typical flower in your garden and see if you can identify the parts

## Common Flower Parts

**Male**  
-stamen



**Female**  
-pistil

### **Ovary**

-becomes the "Fruit"  
-seeds form inside





# Angiosperm Diversity

- Angiosperms are more successful than Gymnosperms because:
  - Co-evolution with insects
    - Colourful flowers attract insects
  - Seeds are protected by fruit
  - Animals eat fruit and spread and disperse seeds in their “poop”

# Adaptations for life on land

- Waxy **cuticle** to protect leaves from water loss



# Adaptations for life on land

**Stomata** –  
pores on the  
underside of  
the leaves  
regulate gas  
exchange to  
limit water  
loss

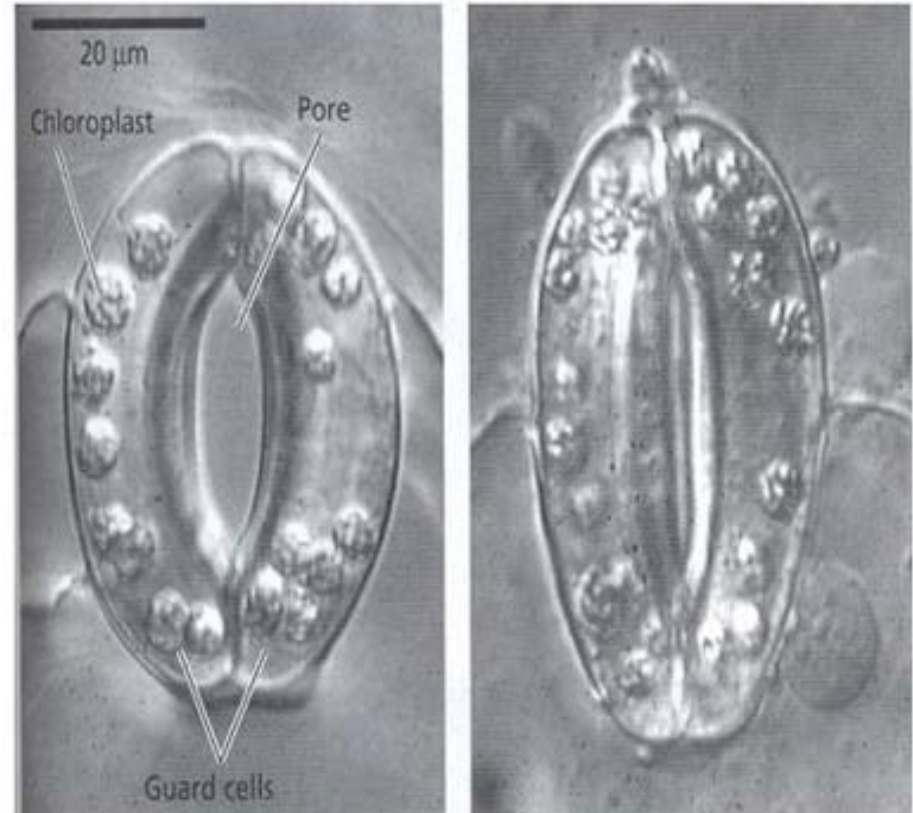
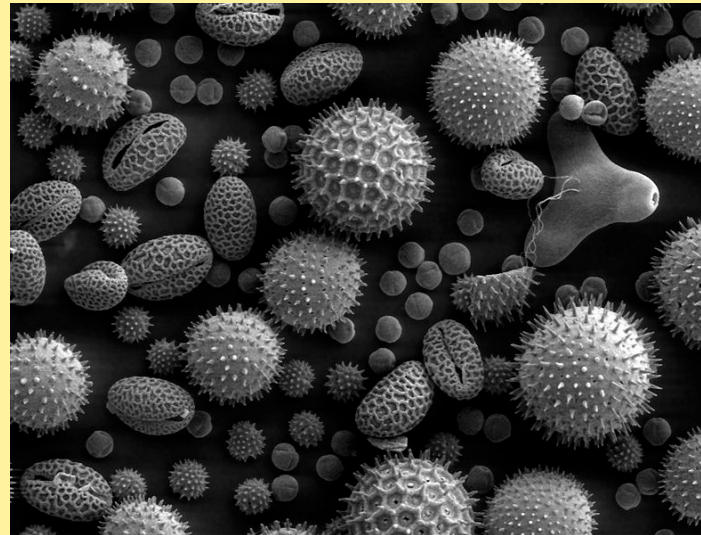


Image reproduced from Plant Physiology, Eds: L. Taiz and E. Zeiger,  
2nd edition, Sinauer Associates, Inc. Publisher, Sunderland MA, USA. p. 523

# Adaptations for life on land

- Development of **seeds** and **pollen grains** to prevent reproductive cells from drying out





# Adaptations for life on land

- **Vascular tissue** to transport nutrients and water throughout the plant
  - **Xylem:** moves water and nutrients up from the roots
  - **Phloem:** moves sugars from the leaves to the rest of the plant

