

Chapter 9 Biodiversity 2: Fungi and Plants Module Hyperlinks

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- [9.2. Fungi structure and reproduction](#)
- [9.3. Plant adaptations](#)
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9.1 Opening Questions: Name the “ist”

Match the subject with the scientist:

- | | |
|-------------------|-------------------|
| 1. Microorganisms | A. Phycologist |
| 2. Fungi | B. Paleontologist |
| 3. Plants | C. Botanist |
| 4. Algae | D. Mycologist |
| 5. Fossils | E. Microbiologist |

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9.1 Fungi are a diverse group of eukaryotes

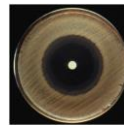
- There are over 1,000 identified species.
- Fungi decompose dead organisms.
- Decomposers break down large molecules and absorb the resulting small molecules.



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9.1 There is a wide variety of fungi, both helpful and harmful.



Penicillium mold is an antibiotic.



Yeast leavens bread.



Bread mold spoils food.



Athlete's foot is a fungal disease.



Fungi are also a food source.

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9.2 Opening Questions: Night of the living fungi?

- Do fungi, such as mushrooms, need sunlight to live?
- Explain your answer.

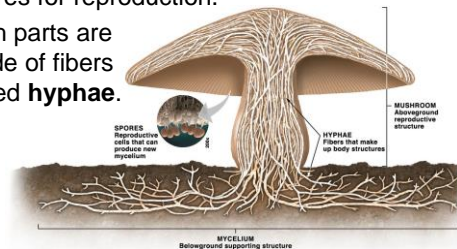


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9.2 Fungi consist of structures both below and above ground.

- Below ground, a **mycelium** digests food.
- Above ground, **mushrooms** produce spores for reproduction.
- Both parts are made of fibers called **hyphae**.

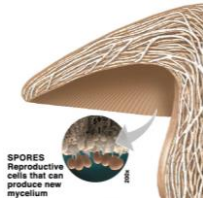


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9.2 Fungi can reproduce asexually or sexually.

- In asexual reproduction, **spores**, sex cells that contain a single (haploid) set of chromosomes, are produced on the underside of the mushroom cap.
- The spores are released germinate to produce a new haploid mycelium



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9.2 Fungi reproduce sexually when the hyphae of two parents join.

- In some species, the haploid cells of two hyphae fuse to form diploid cells.
- These diploid cells then divide to produce genetically distinct haploid spores.



Stinkhorns attract flies to disperse spores.

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9.3 Opening Questions: What makes a plant a plant?

- Name at least one way that plants are different from animals.
- Name at least one way that plants are different from fungi.
- Name something unique about plants.



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9.3 Plants are eukaryotes with unique adaptations for survival on land.

- Around 500 mya, ancestral plants began to evolve adaptations for survival on dry land.
- A **plant** is a terrestrial multicellular eukaryote that conducts photosynthesis.



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9.3 Plants have adaptations that allow them to thrive on land.

Shoot system

Photosynthetic structures exposed to light and air above ground

Root system

Below ground anchorage structures exposed to water and minerals in soil



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9.3 Plants have adaptations that allow them to thrive on land.



Pollen

Protects sperm, allowing them to be carried by wind or animals

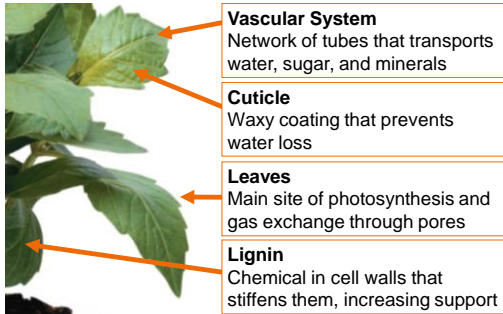
Egg

Remains in female reproductive organ, allowing the embryo to develop within the mother plant's body

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9.3 Plants have adaptations that allow them to thrive on land.

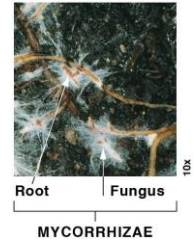


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9.3 The evolution of plants and fungi is interconnected.

- Together, fungi and plant roots form a symbiotic association called **mycorrhizae**.
- The fungus provides the plant with water and minerals absorbed from the soil.
- The plant provides sugars as nourishment for the fungus.

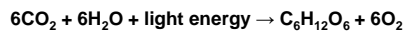


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9.4 Opening Questions: Where does the mass of a plant come from?

- As a plant grows, where does the bulk of its mass come from?
- Hint: Use the equation for photosynthesis to answer the question.



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9.4 Plants thrive in terrestrial environments because they have roots and shoots.

- The **roots** of a plant anchor it in the soil, absorb water and minerals, transport nutrients to other parts of the plant, and store food.



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9.4 Plants thrive in terrestrial environments because they have roots and shoots.

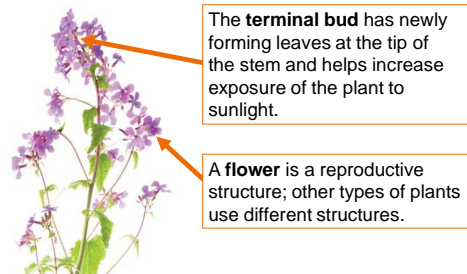
- The **shoots** of a plant are the above ground structures.
- Parts of the shoot include:
 - Stems
 - Leaves
 - Structures for reproduction, such as cones or flowers



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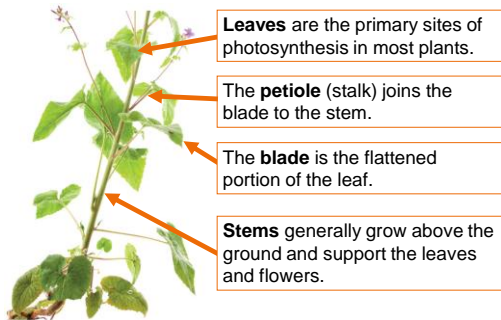
9.4 Plant shoots have unique structures that allow them to thrive on land.



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9.4 Plant shoots have unique structures that allow them to thrive on land.



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9.5 Opening Questions: True or false?

Explain your choice:

- **True or false:** Plant leaves take in water.
- **True or false:** Sunlight helps plants grow by keeping them warm.
- **True or false:** The main function of the root is to get food for the plant.

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9.5 Plant bodies are organized into a structural hierarchy.

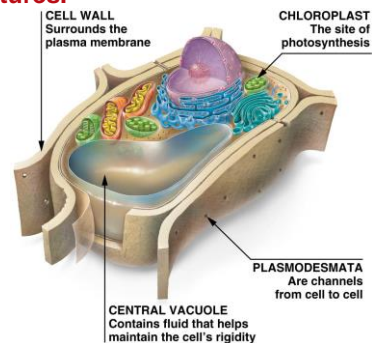
- Plants **cells** work together to form **tissues**.
- Tissues can join together to form **organs** and can be organized by **tissue systems**.



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9.5 Plant cells have some unique structures.

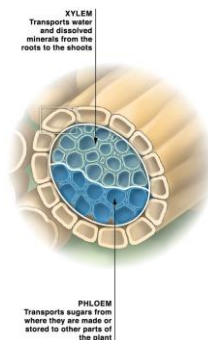


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9.5 Plant cells work together to form tissues.

- Two of the most important tissues in plants are **xylem** and **phloem**.



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9.5 Plant tissues join to form organs.

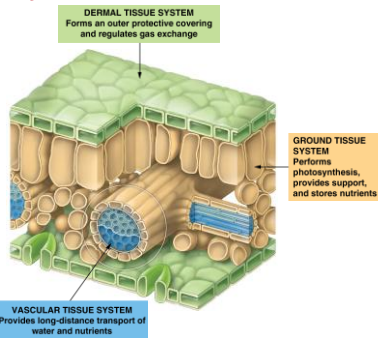
- Several types of plant tissues that work together to carry out a particular function are considered an **organ**.
 - A **leaf** is a plant organ for photosynthesis; it contains xylem and phloem tissues.
 - Other plant organs include roots and stems.



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9.5 Plant tissues are organized into three tissue systems.



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9.6 Opening Questions: A world without plants?

Around 500 million years ago (mya), algae carpeted the damp edges of lakes and oceans, but the land was bare. There were no terrestrial plants or animals.

- What would our life be like today if plants had not evolved to live on land? Explain.
- Could humans live on an Earth that had no plants, but maybe still had algae?

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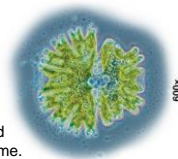
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9.6 The evolutionary history of plants records adaptations for living on land.

- There are four major groups of modern plants:

- Bryophytes
- Seedless vascular plants
- Gymnosperms
- Angiosperms

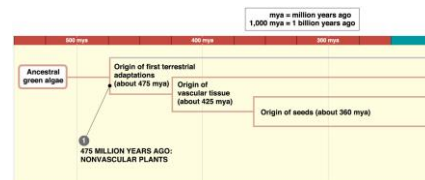
Modern-day charophyte algae may resemble the algal ancestors to all land plants that lived at that time.



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9.6 Major events in the evolution of plants highlight adaptations for dry land.

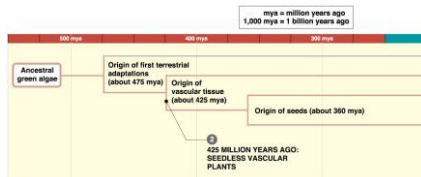


The evolution of a waxy outer layer reduced water loss; however, bryophytes are still dependent on water for reproduction.

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9.6 Major events in the evolution of plants highlight adaptations for dry land.

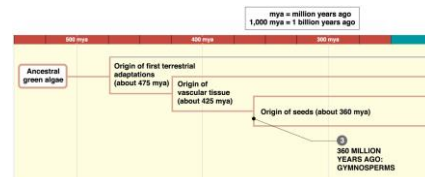


The evolution of vascular tissue and cell walls allowed plants to grow taller.

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9.6 Major events in the evolution of plants highlight adaptations for dry land.

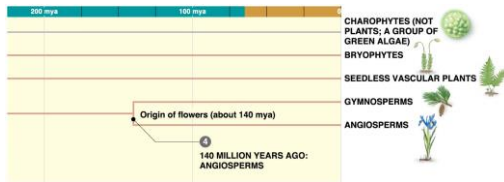


The evolution of seeds freed gymnosperms from the need to reproduce near water, opening up new habitats.

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9.6 Major events in the evolution of plants highlight adaptations for dry land.



The evolution of flowers allowed angiosperms to dominate the land.

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9.7 Opening Questions: True or false?

Explain your choice:

- **True or false:** Mosses were some of the first plants to colonize land.
- **True or false:** There are approximately 12,000 species of moss.
- **True or false:** Moss can grow in temperatures just above zero degrees.

All true!

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9.7 Mosses are the most common bryophytes.

- Bryophytes are seedless, nonvascular plants.
- Bryophytes have adaptations for land:
 - A waxy outer layer that helps to retain moisture
 - Structures that provide internal protection for gametes and embryos
- They lack seeds and vascular tissue.
- Modern bryophytes can survive only in watery environment.



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9.7 Bryophytes come in two distinct forms representing an alternation of generations.

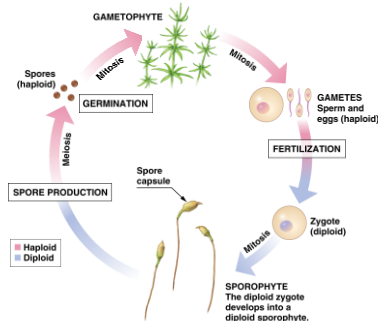
- **Spores** (produced by sporophyte cells) are tough haploid cells that can survive harsh conditions.
- Unlike most plants, in bryophytes the haploid **gametophyte** is dominant.



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9.7 Bryophyte alternation of generations requires a moist environment.



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9.8 Opening Questions: What to pack?

Imagine that one day in the future a group of humans are setting off for another planet. You are chosen to participate and tasked with planning the voyage.

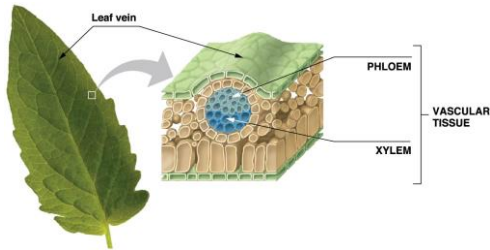
- There is only room for ten plants. What plants would you take?
- Explain your choices.

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9.8 Vascular tissue was an important evolutionary adaptation.

- Nearly all plants (except for bryophytes) have vascular tissue.

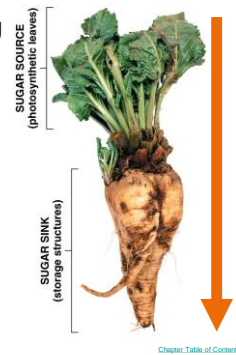


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9.8 Phloem primarily transports sugars.

- Phloem** contains living cells that transport sugars from where they are made or stored to other parts of the plants.
- Phloem sap always flows from a **sugar source** to a **sugar sink**.

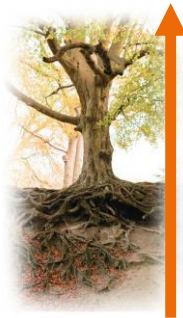


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9.8 Xylem primarily transports water and minerals from the roots.

- Xylem** is made of dead cells acting as tiny pipes.
- Xylem sap is moved through the plant body via **transpiration**.
 - Water evaporates into the atmosphere from the leaves and stems, pulling up more water from the roots.

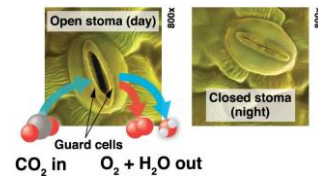


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9.8 Tiny pores in the leaf called stomata facilitate transpiration of water.

- During the day, leaf stomata remain open.
- At night, guard cells close the pores to prevent unnecessary water loss.



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9.9 Opening Questions: Why ferns?

During the Carboniferous period (360 to 300 mya), ancient ferns and other seedless vascular plants formed vast tropical forests. The fossilized remains of these plants gradually hardened into coal.

Name a reason why vascular tissue might provide an evolutionary advantage.



Artist reconstruction of a Carboniferous forest

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9.9 Ferns are an example of a type of seedless vascular plant.

- Seedless vascular plants have important adaptations for living on land:
 - Vascular tissue
 - Lignin-hardened cell walls



Lycopytes



Carboniferous forest



Modern ferns

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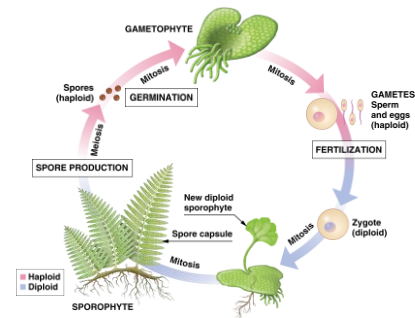
9.9 Anatomy of a fern



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9.9 Fern alternation of generations requires a moist environment.



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9.10 Opening Questions: Going, going gymnosperms?

Boreal forests of gymnosperms cover much of the Northern Hemisphere and contain more carbon than temperate or tropical forests, averaging more than 180 tons per acre.

- What would the disappearance of these vast conifer forests mean for global CO₂ levels?
- Explain.

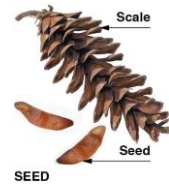


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9.10 The gymnosperms were the first plants to evolve seeds contained within cones.

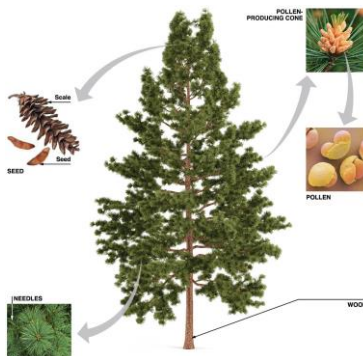
- A **seed** consists of an embryo and food supply inside a protective coating.
- Seeds are one of the key adaptations that allowed plants to spread across the land.



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9.10 Anatomy of a gymnosperm



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9.10 A gallery of gymnosperms



Conifers



Cycads



Bristlecone pines

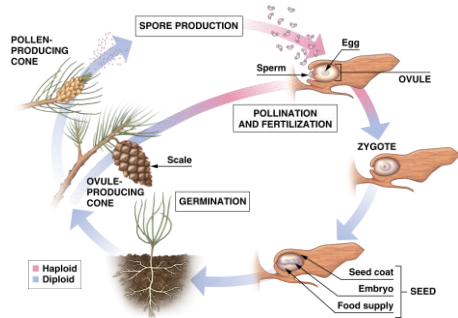


Redwoods

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9.10 Gymnosperm reproduction includes two types of cones (male and female).



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9.11 Opening Questions: What are plants good for?

Domain Eukarya: Kingdom Plantae

- Discuss three ways that organisms, or products from those organisms, impact our lives.
- Name both positive or negative impacts.



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9.11 Angiosperms dominate the modern landscape.

- The vast majority of modern plants (over 250,000 species) are **angiosperms**, the flowering plants.



Grass



Bean



Coconut palms

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9.11 The flower is a key adaptation for life on land.

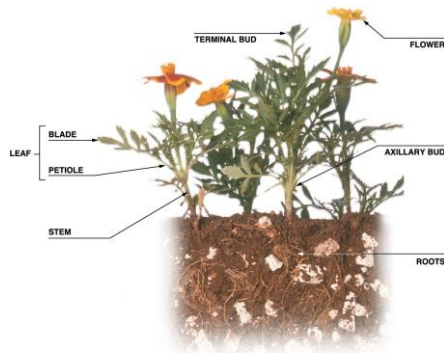
- The **flower** is a complex reproductive organ that houses the ovary and develops into fruit and seed.



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9.11 Anatomy of an angiosperm



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9.11 A gallery of angiosperms



Coconut palms



Melon cactus



Grass

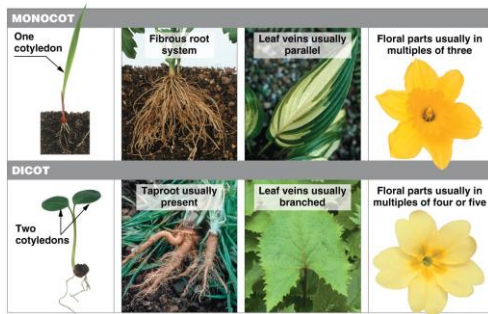


Bean

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9.11 Two groups of angiosperms, monocots and dicots, differ in their anatomy.



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9.12 Opening Questions: Why does popcorn pop?

- Write a hypothesis to explain why a popcorn seed pops, but a regular corn seed does not.
- Design an experiment to test your hypothesis.

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9.12 Flowers, fruit, and seeds aid angiosperm reproduction.

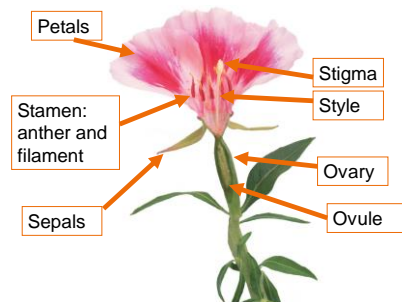
- The flower is the reproductive organ of angiosperms.
- Flowers produce and receive pollen.
- Flower structures house the developing embryo, which is eventually dispersed as a seed.



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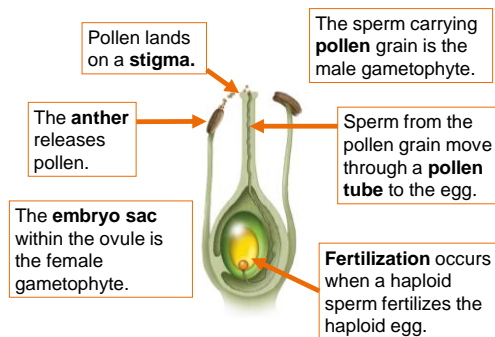
9.12 Anatomy of a flower



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9.12 Angiosperm reproduction

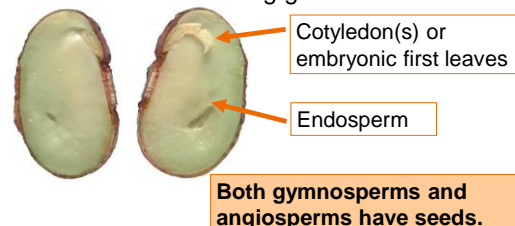


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9.12 A seed is an embryonic plant.

- A seed consists of a dormant embryonic plant and **endosperm**, a food supply that will be absorbed during germination.



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9.12 Follow-up Questions: Why does popcorn pop?

- A popcorn seed has two types of endosperm: a hard outer layer and soft, moist core.
- What do you think happens when the seed is heated?
- Heating turns the water in the soft endosperm to steam, which expands, leading the kernel to explode! POP!
- The white, puffy endosperm then solidifies into tasty treats that go great with butter.

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9.12 A fruit is a mature ovary.

- After fertilization, the ovary may expand and thicken to form a protective container around the seeds, now called a **fruit**.



How is a fruit different from a nut?

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9.13 Opening Questions: How do you age a *Sequoiadendron giganteum*?

- One of the biggest trees in the world is a giant sequoia. Here are its statistics:
 - 83.8 m (275 feet) tall
 - Girth at breast height of 24 m (79 feet)

- If a sequoia adds 0.01 m (1 cm) of girth per year, how old might this tree be?
- Is this a good method for aging a tree? Why or why not?
- Brainstorm another method for aging ancient trees.



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9.13 Flowering plants can be grouped into three categories based on life spans.

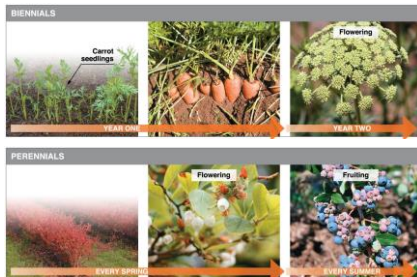
- Annuals grow for one season.
- Biennials grow for two seasons.
- Perennials grow for many seasons.



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9.13 Flowering plants can be grouped into three categories.



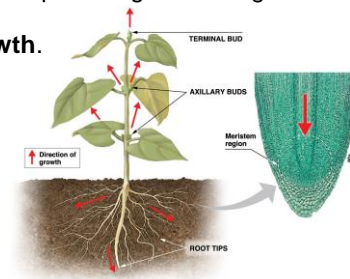
Is a sequoia an annual or perennial?

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9.13 Plants can grow in length.

- **Meristem** tissue at the tips of roots and stems enables a plant to grow in length.
- This is called **primary growth**.



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9.13 Plants can grow in thickness.

- Each year, meristem tissues produce new layers of cells, and old cells die.
- Over the years, the layers accumulate to form wood.

Growth rings are the boundary pattern between spring and summer cells and can be used to estimate tree age.

