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Biology

Interactive Classroom



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Chapter 21 Introduction to Plants

Section 1: Plant Evolution and Adaptations

Section 2: Nonvascular Plants

Section 3: Seedless Vascular Plants

Section 4: Vascular Seed Plants

EXIT

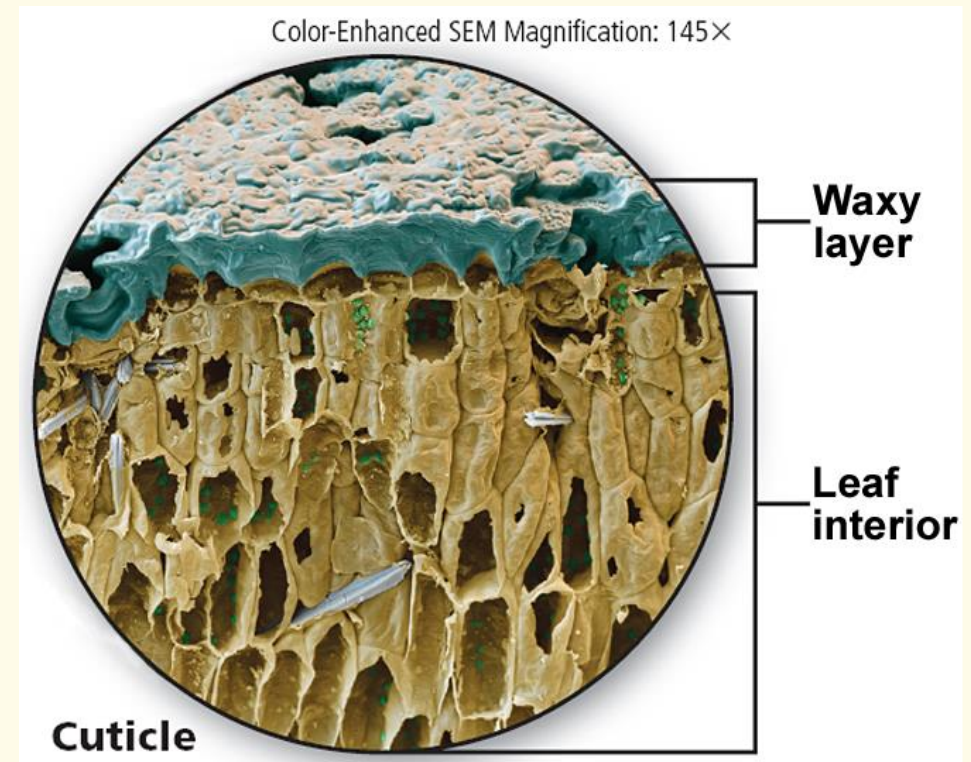
21.1 Plant Evolution and Adaptations

- When scientists compare present-day plants and present-day green algae, they find the following common characteristics:
 - cell walls composed of cellulose
 - cell division that includes the formation of a cell plate
 - the same type of chlorophyll used in photosynthesis
 - similar genes for ribosomal RNA
 - food stored as starch
 - the same types of enzymes in cellular vesicles

21.1 Plant Evolution and Adaptations

Cuticle

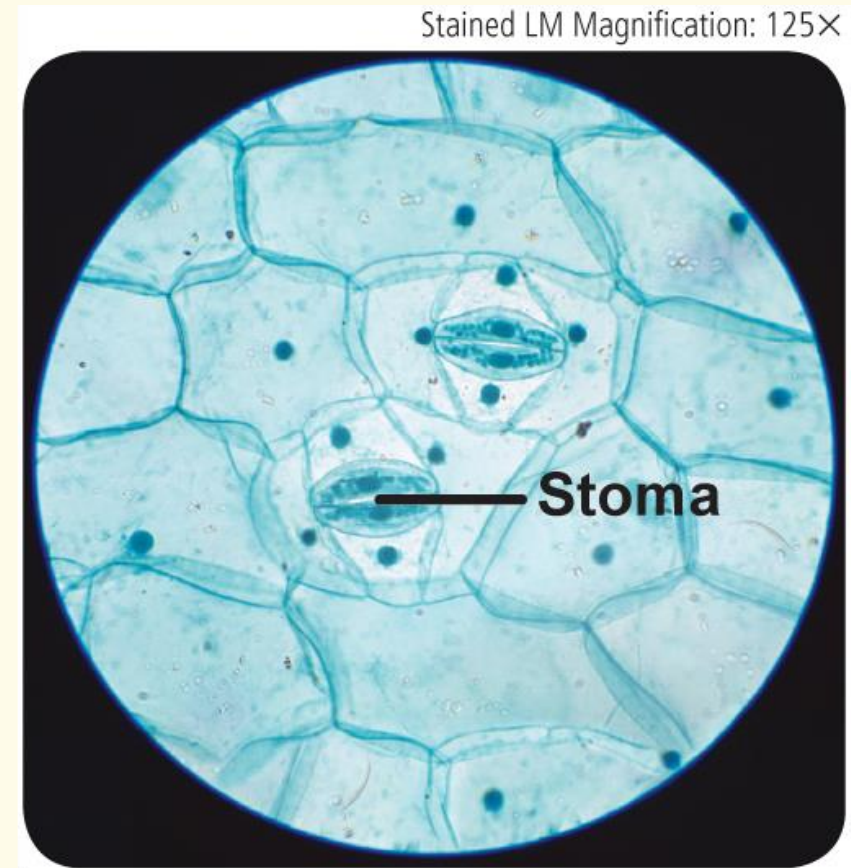
- Helps prevent the evaporation of water from plant tissues
- Acts as a barrier to invading microorganisms



21.1 Plant Evolution and Adaptations




Stomata

- Adaptations that enable the exchange of gases even with the presence of a cuticle on a plant
- Openings in the outer cell layer of leaves and some stems



21.1 Plant Evolution and Adaptations

Vascular Tissues

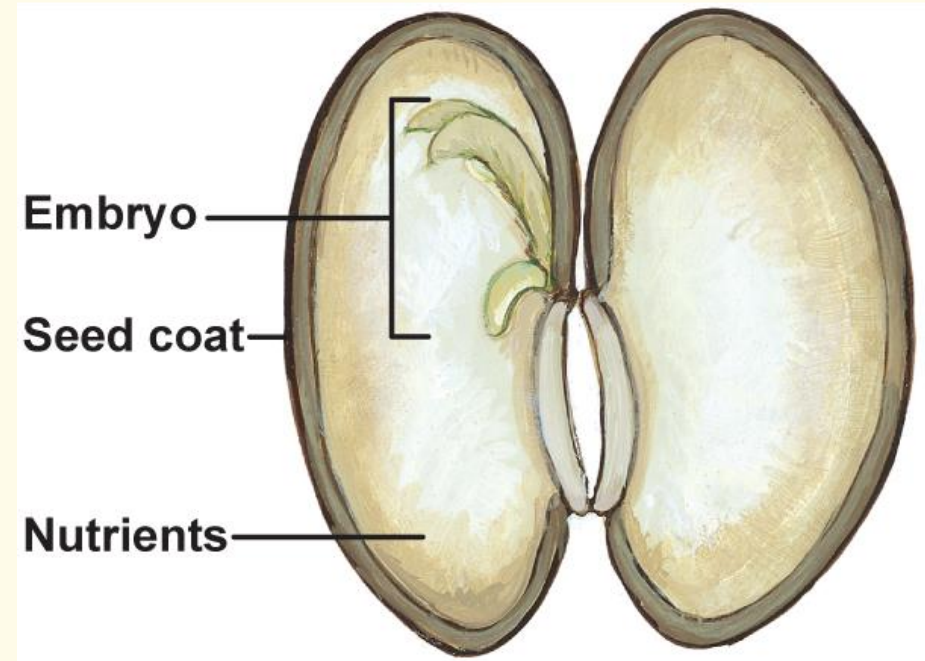
- **Vascular tissue** enables faster movement of substances than by osmosis and diffusion, and over greater distances. 
- Vascular tissue provides support and structure, so **vascular plants** can grow larger than **nonvascular plants**.  

21.1 Plant Evolution and Adaptations

Seeds



- A plant structure that contains an embryo, contains nutrients for the embryo, and is covered with a protective coat
- These features enable seeds to survive harsh environmental conditions and then sprout when favorable conditions exist.



21.1 Plant Evolution and Adaptations

Alternation of Generations

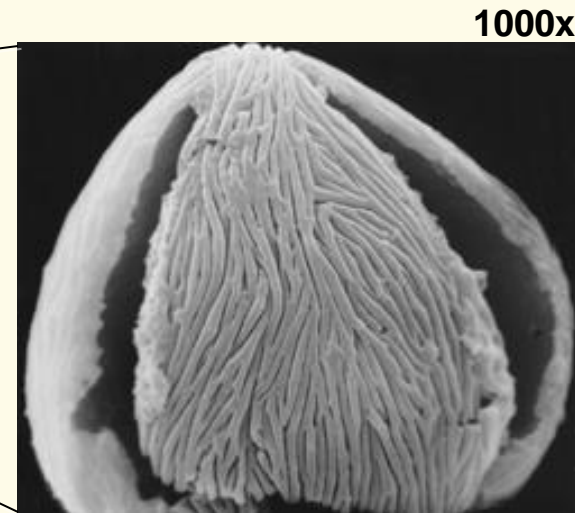
- Gametophyte generation produces gametes.
- Sporophyte generation produces spores that can grow to form the next gametophyte generation.

21.1 Plant Evolution and Adaptations



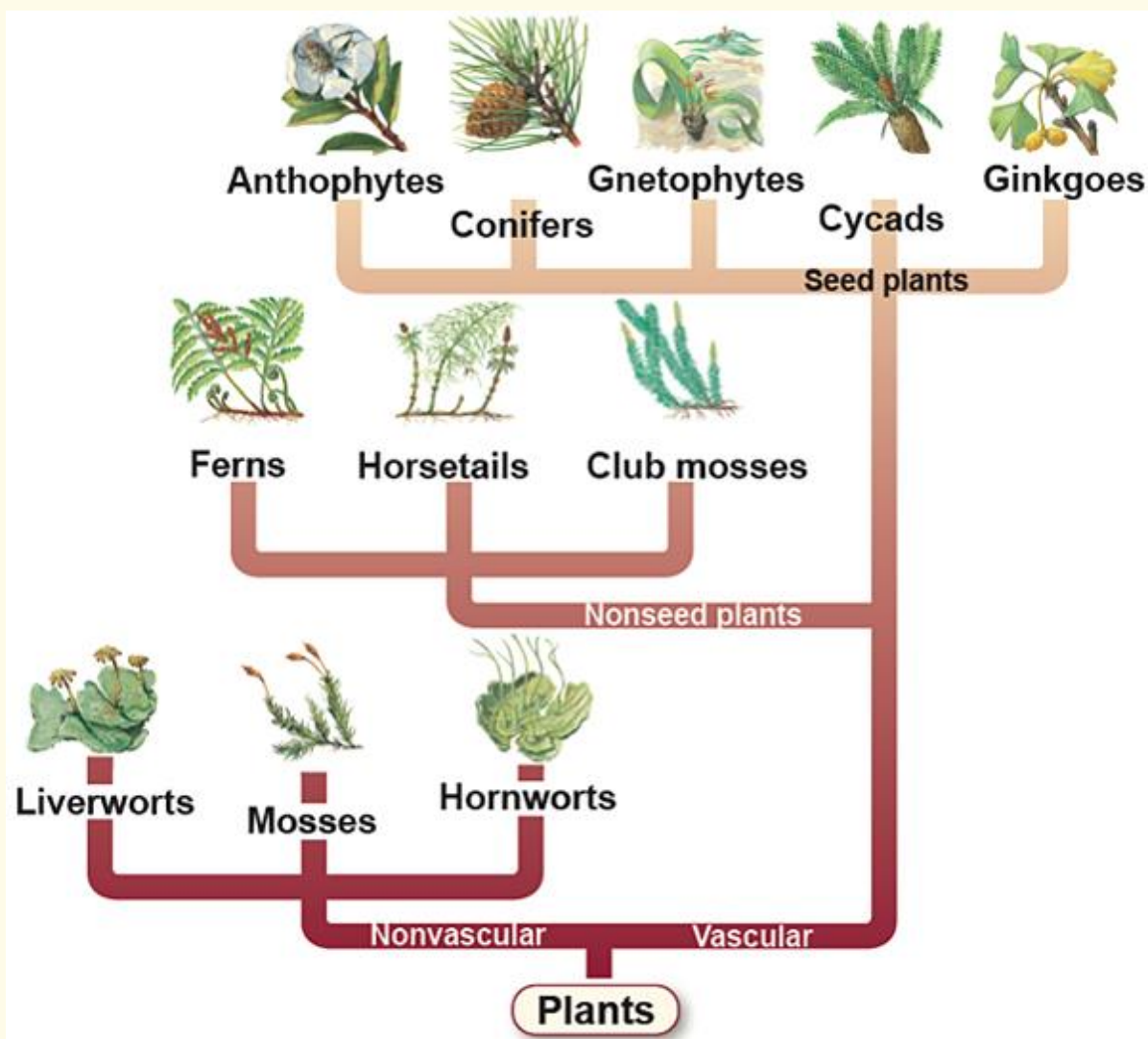
Sporophyte generation—maple tree

- During plant evolution, the trend was from dominant gametophytes to dominant sporophytes that contain vascular tissue.



Gametophyte generation—maple pollen

21.1 Plant Evolution and Adaptations



Concepts In Motion
Animation

Visualizing the
Plant Kingdom

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21.1 Plant Evolution and Adaptations

Plant Classification

- Nonvascular plants lack specialized transport tissues.
 - Bryophytes
 - Anthocerophytes
 - Hepaticophytes

21.1 Plant Evolution and Adaptations

Seedless Vascular Plants

- Lycophytes
- Pterophytes

21.1 Plant Evolution and Adaptations

Seed-producing Vascular Plants

- Cycadophytes
- Gnetophytes
- Ginkgophytes
- Coniferophytes
- Anthophytes

21.2 Nonvascular Plants

Diversity of Nonvascular Plants

- Division Bryophyta
 - Most familiar bryophytes are the mosses.
 - Structures that are similar to leaves



Carpet of moss



Leafy stems



Rhizoids

21.2 Nonvascular Plants

- Produce rootlike, multicellular rhizoids that anchor them to soil or another surface
- Water and other substances move throughout a moss by osmosis and diffusion.

21.2 Nonvascular Plants

Division Anthocerophyta

- Anthocerophytes are called hornworts.
- Water, nutrients, and other substances move in hornworts by osmosis and diffusion.



Hornwort

21.2 Nonvascular Plants

Identifying Features

- One large chloroplast in each cell of the gametophyte and sporophyte
- Spaces around cells are filled with mucilage, or slime.
- Cyanobacteria grow in this slime.

21.2 Nonvascular Plants

Division Hepaticophyta

- Hepaticophytes are referred to as liverworts.
- Found in a variety of habitats
- Water, nutrients, and other substances are transported by osmosis and diffusion.

21.2 Nonvascular Plants

- Most primitive of land plants



Leafy liverwort



Thallose liverwort

21.3 Seedless Vascular Plants

Diversity of Seedless Vascular Plants

- Division Lycophyta
 - Sporophyte generation of lycophytes is dominant.
 - Reproductive structures produce spores that are club-shaped or spike-shaped.



Lycopodium—wolf's claw

21.3 Seedless Vascular Plants

- Have roots, stems, and small, scaly, leaflike structures
- Two genera—*Lycopodium* and *Selaginella*

21.3 Seedless Vascular Plants

Division Pterophyta

- Plant division includes ferns and horsetails



Aquatic fern



Staghorn fern

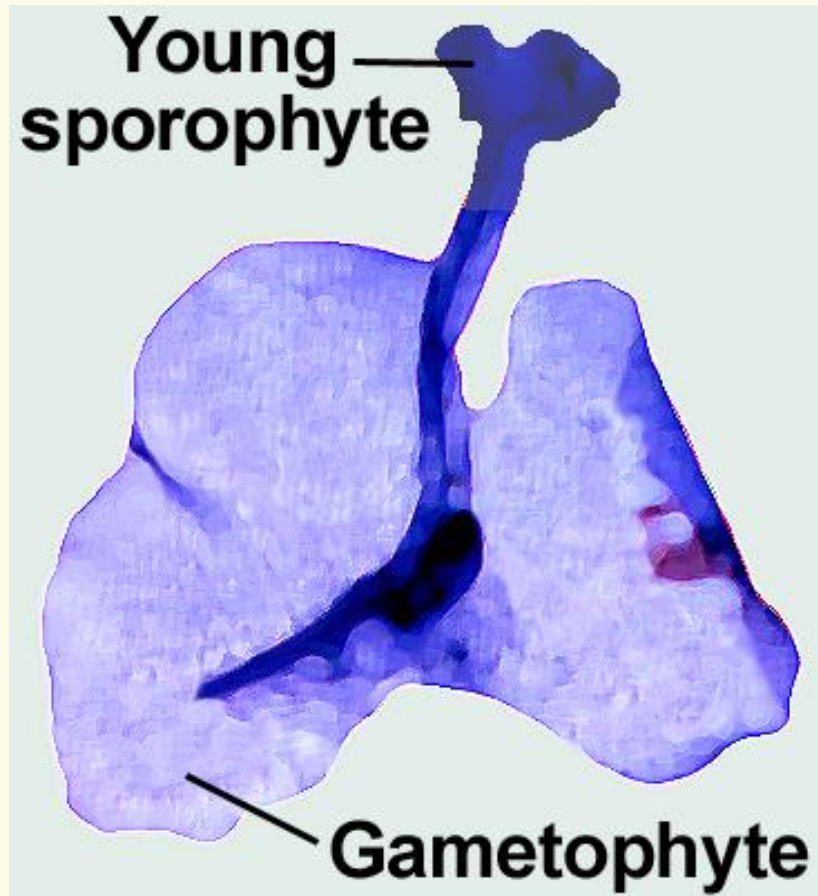



Hawaiian fern



Dryopteris

21.3 Seedless Vascular Plants



- Sporophyte produces roots and a thick underground stem called a **rhizome**, a food-storage organ. 
- The frond is part of the sporophyte generation of ferns.

21.3 Seedless Vascular Plants

- Fern spores form in a structure called a **sporangium**. 🔊
- Clusters of sporangia form a **sorus**. 🔊
- Sori usually are located on the undersides of fronds.



Bird's nest fern

21.4 Vascular Seed Plants

Diversity of Seed Plants

- A variety of adaptations for the dispersal or scattering of their seeds throughout their environment
- The sporophyte is dominant in seed plants and produces spores.

Cocklebur




Witch hazel

Pine seed



21.4 Vascular Seed Plants

Division Cycadophyta

- **Cones** contain male or female reproductive structures of cycads and other gymnosperm plants. 
- Evolved before plants with flowers
- The natural habitats for cycads are the tropics or subtropics.

21.4 Vascular Seed Plants

Division Gnetophyta

- Can live as long as 1500–2000 years
- Three genera of gnetophytes
- Ephedrine is a compound found naturally in gnetophytes.



Welwitschia

21.4 Vascular Seed Plants

Division Ginkgophyta

- Only one living species, *Ginkgo biloba*
- Has small, fan-shaped leaves
- Male and female reproductive systems are on separate plants



Male



Female

21.4 Vascular Seed Plants

Division Coniferophyta

- Reproductive structures of most conifers develop in cones.
- Male and female cones on different branches
- Waxlike coating called cutin reduces water loss.



Douglas fir—woody cones



Juniper—berrylike cones



Pacific yew—fleshy cones

21.4 Vascular Seed Plants

Division Anthophyta

- First appeared in the fossil record about 130 million years ago
- Botanists classify anthophytes as monocots, dicots, or eudicots.

21.4 Vascular Seed Plants

- A **biennial** plant's life spans two years. 🔊
- **Perennial** plants can live for several years and usually produce flowers and seeds yearly. 🔊



First-year growth



Second-year growth



Virtual Lab

**Knocking
Out Genes**

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Chapter Resource Menu



Chapter Diagnostic Questions



Formative Test Questions



Chapter Assessment Questions



Standardized Test Practice



biologygmh.com



Glencoe Biology Transparencies



Image Bank



Vocabulary



Animation

Click on a hyperlink to view the corresponding lesson.

Home

Resources



Chapter Diagnostic Questions



Which is *not* a function of a plant's cuticle?

- A. reflects heat
- B. prevents the evaporation of water
- ☒ C. aids in photosynthesis
- D. prevents invasion by microorganisms

Chapter Diagnostic Questions



Vascular plants are further divided into what two categories?

- ☒ A. seed and non-seed producing
- ☐ B. mosses and ferns
- ☐ C. flowering and non-flowering
- ☐ D. aquatic and land

Chapter Diagnostic Questions



Which is *not* an example of a plant's adaptation to living on land?

- A. seeds
- ☒ B. leaves
- C. vascular tissue
- D. stomata

21.1 Formative Questions



With what organisms do land plants likely share a common ancestor?

- A. club fungi
- B. cyanobacteria
- ☒ C. green algae
- D. yeast

21.1 Formative Questions



What plant tissue is specialized for transporting substances?

- A. arterial tissue
- B. sap-carrying tissue
- C. thallose tissue
- ☒ D. vascular tissue

21.1 Formative Questions



What generation is dominant in most plants that you can see?

- ☒ A. gametophyte generation
- ☐ B. sporophyte generation

21.1 Formative Questions



Which plant does *not* produce seeds?

- ☒ A. fern
- ☐ B. ginkgo
- ☐ C. maple
- ☐ D. pine

21.2 Formative Questions



What characteristic of nonvascular plants enables them to survive without specialized transport tissues?

- ☒ A. small size
- ☐ B. vinelike stems
- ☐ C. leaflike structures
- ☐ D. rootlike rhizoids

21.2 Formative Questions



What are the most familiar bryophytes?

- A. hornworts
- B. horsetails
- C. liverworts
- ☒ D. mosses

21.2 Formative Questions



Which organism has one large chloroplast in each of its cells and cyanobacteria living in between the cells?

- A. cycad
- B. fern
- ☒ C. hornwort
- D. liverwort

21.2 Formative Questions



Which observation suggests that liverworts are the most primitive of land plants?

- A. They have unicellular rhizoids.
- B. They have very flat, thin leaflike structures.
- ☒ C. They lack DNA sequences that other plants have.
- D. Their body resembles a thallose, or lobed structure.

21.3 Formative Questions



What spore-bearing structures are found on many seedless vascular plants?

- A. rhizomes
- B. sori
- C. stomata
- ☒ D. strobili

21.3 Formative Questions



Which group contains the seedless vascular plants?

- A. hornworts and liverworts
- B. liverworts and club mosses
- ☒ C. club mosses and ferns
- D. ferns and pines

21.3 Formative Questions



Which type of club moss does not root in the soil but grows aboveground using other plants for support?

- A. aerophyte
- ☒ B. epiphyte
- C. gametophyte
- D. hemiphyte

21.3 Formative Questions



Which organ enables a fern to resume growth after the aboveground part of the plant has died?

- ☒ A. rhizome
- ☐ B. root
- ☐ C. sorus
- ☐ D. sporangium

21.4 Formative Questions



Which vascular seed plants are the angiosperms?

- A. firs
- B. pines
- ☒ C. flowering plants
- D. sago palms

21.4 Formative Questions



How are angiosperms different from all of the other seed plants?

- A.** Their seeds are part of a fruit.
- B.** The sporophyte generation is dominant.
- C.** Their seeds have one or more cotyledons.
- D.** They have adaptations for seed dispersal.

21.4 Formative Questions



Why is seed dispersal important?

- A. It improves the organism's habitat.
- B. It is part of sexual reproduction.
- ☒ C. It limits competition within the species.
- D. It reduces the scattering of seeds.

21.4 Formative Questions



Which division of seed-producing vascular plants has only one living species, *biloba*?

- A. firs
- B. cycads
- ☒ C. ginkgoes
- D. sago plants

Chapter Assessment Questions



Which statement best describes plants from the division Pterophyta?

- A. Reproductive structures are club-shaped.
- B. They are sometimes called ground pines.
- ☒ C. Leafy structures are called fronds.
- D. They grow from seeds.

Chapter Assessment Questions



Which division of seed plants produces flowers?

- A. Cycadophyta
- B. Gnetophyta
- C. Ginkgophyta
- ☒ D. Anthophyta

Chapter Assessment Questions



Which statement does *not* describe plants in the division Gnetophyta?

- A. They can live 1500-2000 years.
- B. They have unusual adaptations to the environment.
- ☒ C. They live only in the United States.
- D. They are used for medicinal purposes.

Standardized Test Practice



Which is *not* a characteristic that biologists use to describe plants?

- ☒ A. Plants live on land.
- ☐ B. Plants are eukaryotes.
- ☐ C. Plants are multicellular.
- ☐ D. Plants have specialized organs.

Standardized Test Practice



What was the earliest adaptation in the evolution of present-day plants?

- A. flowers
- B. seeds
- ☒ C. embryo protection
- D. vascular tissue

Standardized Test Practice



Which adaptation enables a plant to conserve water?

- ☒ A. cuticle
- ☐ B. stomata
- ☐ C. seed dispersal
- ☐ D. vascular tissues

Standardized Test Practice



Which adaptation evolved first?

- ☒ A. cones
- ☐ B. flowers
- ☐ C. fruits
- ☐ D. monocots

Standardized Test Practice



Why are flowering plants the most widely distributed plants?

- A. They have longer life spans.
- ☒ B. They live on land and in the water.
- C. They are highly adapted for seed dispersal.
- D. They carry out photosynthesis throughout the year.

Standardized Test Practice



Why are the fleshy storage roots of biennials harvested after the first growing season?

- A. Storage roots die before the second growing season.
- B. Stems and leaves die during the second growing season.
- C. Biennials produce flowers and seeds in the first growing season.
- ☒ D. Storage nutrients are used up during the second growing season.

Glencoe Biology Transparencies

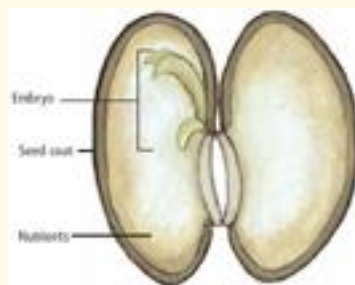
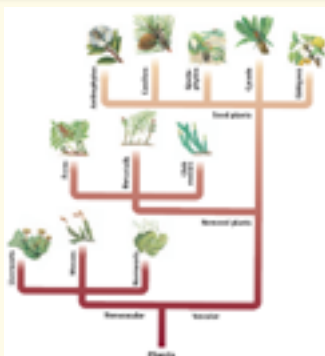


Image Bank

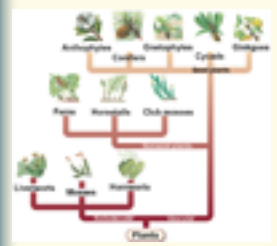
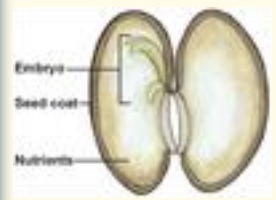
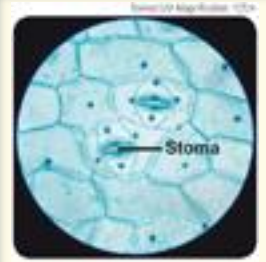
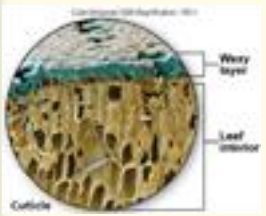
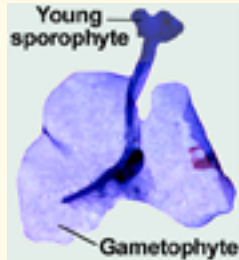







Image Bank



Vocabulary

Section 1

-  stomata
-  vascular tissue
-  vascular plant
-  nonvascular plant
-  seed

Vocabulary






Section 2



thallose






Vocabulary

Section 3

-  strobilus
-  epiphyte
-  rhizome
-  sporangium
-  sorus

Vocabulary

Section 4

-  cotyledon
-  cone
-  annual
-  biennial
-  perennial

Animation



- Visualizing the Plant Kingdom