

Study Tip

Divide the class into small groups, and ask each group to write a list of review questions that address all the Vocabulary words and Key Concepts. Then, have groups exchange lists and answer one another's questions.

Thinking Visually

1. Life cycle includes zygospore; have rhizoids and stolons; reproduce both sexually and asexually
2. Hyphae form a gametangium
3. Cup fungi, some yeasts
4. Conidia on conidiophores
5. Hyphae form a gametangium
6. Mycelia form a secondary mycelium
7. No observed sexual phase of life cycle
8. Unknown

Chapter 21 Assessment**Reviewing Content**

1. a 5. b 9. d
2. b 6. c 10. c
3. c 7. c
4. a 8. d

Understanding Concepts

11. The cells of fungi are similar to the exoskeletons of insects in that both contain chitin.
12. Hyphae are tiny filaments that are only one cell thick, whereas a mycelium is a thick mass composed of many hyphae tangled together.
13. Spores are produced in sporangia, which are found at the tops of specialized hyphae called sporangio-phores. Spores can grow into new organisms.
14. Many fungi produce dry, almost weightless spores, which scatter easily in the wind. Other fungi are specialized to lure animals, which disperse fungal spores.
15. Spores must land in a favorable environment. There must be a proper combination of temperature, moisture, and food.
16. Fungi are classified according to their structure and method of reproduction.

21-1 The Kingdom Fungi**Key Concepts**

- Fungi are eukaryotic heterotrophs that have cell walls made of chitin.
- The bodies of multicellular fungi are composed of many hyphae tangled together into a thick mass called a mycelium.
- Most fungi reproduce both asexually and sexually.

Vocabulary

chitin, p. 527 • hypha, p. 527
mycelium, p. 528 • fruiting body, p. 528
sporangium, p. 528 • sporangiophore, p. 528

21-2 Classification of Fungi**Key Concepts**

- Zygomycetes have life cycles that include a zygospore.
- The phylum Ascomycota is named for the ascus, a reproductive structure that contains spores.
- The phylum Basidiomycota, or club fungi, gets its name from the basidium, a specialized reproductive structure that resembles a club.
- Deuteromycota are fungi that cannot be placed in other phyla because researchers have never been able to observe a sexual phase in their life cycles.

Vocabulary

zygospore, p. 530 • rhizoid, p. 530
stolon, p. 530 • gametangium, p. 530
conidium, p. 532 • ascus, p. 532
ascospore, p. 532 • budding, p. 533
basidium, p. 534 • basidiospore, p. 535

21-3 Ecology of Fungi**Key Concepts**





- Fungi play an essential role in maintaining equilibrium in nearly every ecosystem, where they recycle nutrients by breaking down the bodies and wastes of other organisms.
- Parasitic fungi cause serious plant and animal diseases. A few fungi cause diseases in humans.
- Some fungi form symbiotic relationships in which both partners benefit. Two such mutualistic associations, lichens and mycorrhizae, are essential to many ecosystems.

Vocabulary

saprobe, p. 537
lichen, p. 540
mycorrhiza, p. 541

Thinking Visually

Use the information in Section 21-2 to complete the following compare-and-contrast table about the different phyla of Fungi:

Four Phyla of Fungi					
Phylum	Examples	Characteristics	Reproduction		
			Asexual	Sexual	
Zygomycota (common molds)	 <i>Rhizopus stolonifer</i> (black bread mold)	1	Spores in sporangiophores	2	
Ascomycota (sac fungi)	 3	Long stage in which cells have two nuclei; yeasts are unicellular	4	5	
Basidiomycota (club fungi)	 Mushrooms, puffballs, earthstars, shelf fungi, jelly fungi, rusts	Extremely variable; long stage in which cells have two nuclei	None or conidia on conidiophores	6	
Deuteromycota (imperfect fungi)	 <i>Penicillium</i> , ringworm, and athlete's foot fungus	7	Conidia on conidiophores	8	

**CHAPTER RESOURCES****Print:**

- **Teaching Resources**, Chapter Vocabulary Review, Graphic Organizer
- **Chapter Tests: Levels A and B**, Chapter 21 Test
- **Laboratory Assessment**, Laboratory Assessment 6

Technology:

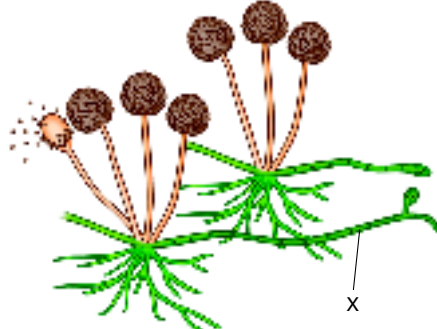
- **Computer Test Bank**, Chapter 21 Test
- **iText**, Chapter 21 Assessment

Chapter 21 Assessment

Reviewing Content

Choose the letter that best answers the question or completes the statement.

- Which of the following is NOT a characteristic of the kingdom Fungi?
 - All are unicellular.
 - All have cell walls.
 - All are eukaryotic.
 - All are heterotrophs.
- The body of a typical fungus consists of a tangled mass of filaments called a(an)
 - basidium.
 - mycelium.
 - hypha.
 - antheridium.
- When hyphae of opposite mating types of fungi meet, each hypha forms a
 - sporangium.
 - zygospore.
 - gametangium.
 - zoospore.
- In the diagram of bread mold shown below, X is pointing to what structure?



- stolon
 - rhizoid
 - basidium
 - ascus
- The asexual spores of ascomycetes are called
 - zygospores.
 - conidia.
 - ascospores.
 - zoospores.
 - In baking, yeast cells bud and carry out the process of
 - lactic acid fermentation.
 - aerobic respiration.
 - alcoholic fermentation.
 - digestion.
 - A mushroom that you see above the ground is actually a
 - basidiospore.
 - gametangium.
 - fruiting body.
 - basidium.
 - Sexual reproduction has never been observed in
 - zygomycetes.
 - ascomycetes.
 - basidiomycetes.
 - deuteromycetes.

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- Organisms that obtain food from decaying organic matter are called
 - mutualists.
 - autotrophs.
 - parasites.
 - saprobies.
- A symbiotic association between a fungus and an alga or a cyanobacterium is a
 - mycorrhiza.
 - fruiting body.
 - lichen.
 - mushroom.

Understanding Concepts

- How are the cell walls of fungi similar to the exoskeletons of insects?
- Distinguish between the terms *hyphae* and *mycelium*.
- How does a sporangiophore function in the reproduction of fungi?
- Describe one way in which fungi are adapted to disperse spores.
- What conditions are necessary for fungal spores to germinate?
- Explain the basis for the classification of fungi.
- Describe the reproductive cycle of bread mold.
- Compare the structure and function of rhizoids and stolons.
- Yeasts are unicellular fungi. In which phylum are most yeasts classified? What is the basis of this classification?
- Why is it dangerous to eat wild mushrooms?
- Why do many biologists think that *Penicillium* evolved from an ascomycete?
- Distinguish between a saprobe and a parasite. Give an example of each.
- How does the method by which fungi obtain nutrients help in recycling nutrients and essential chemicals?
- Describe two symbiotic relationships involving fungi and members of another kingdom.
- What is the evolutionary significance of mycorrhizae?



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(Continued from page 544)

- Two hyphae from different mating types come together, forming gametangia. Haploid gametes produced in the gametangia fuse with gametes of the opposite mating type to form diploid nuclei. A thick wall develops around the nuclei, producing a zygospore that may remain dormant for months. When conditions become favorable, the zygospore germinates, undergoes meiosis, and develops into a new individual.
- Rhizoids: rootlike hyphae that penetrate surfaces, anchor fungi, release digestive enzymes, and absorb digested matter; stolons: stemlike hyphae that run along surfaces and are used in reproduction
- Most yeasts are classified in the phylum Ascomycota because they form asci with ascospores during the sexual phase of their life cycle.
- Many species of poisonous mushrooms look like edible mushrooms.
- Like ascomycetes, *Penicillium* reproduces asexually via conidia.
- A saprobe, such as a mushroom, obtains food from decaying organic matter. A parasite, such as wheat rust, harms other organisms while living directly on or within them.
- The mycelia of fungi produce digestive enzymes that speed the breakdown of dead organisms, thereby helping to recycle nutrients and essential chemicals.
- A lichen is a symbiotic association between a fungus and an alga or a cyanobacterium. The alga or cyanobacterium provides the fungus with a source of energy; the fungus provides the alga or cyanobacterium with water and minerals. Mycorrhizae are mutualistic relationships between plant roots and fungi. The fungi aid plants in absorbing water and minerals; the plants provide the fungi with the products of photosynthesis.
- Mycorrhizal associations may have been critical in the evolution of land plants from aquatic ancestors.



HOMEWORK GUIDE

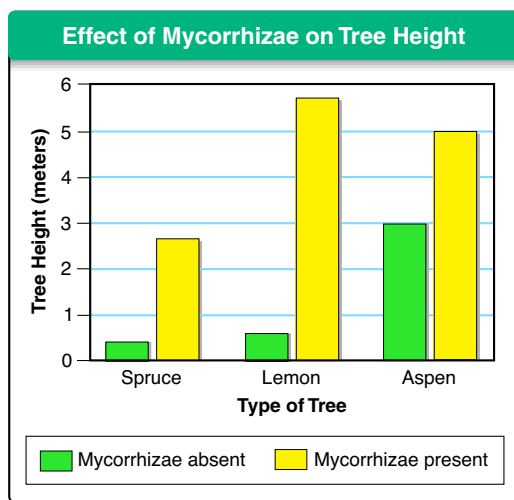
Section:	Questions:
Section 21-1	1-3, 11-15, 26, 27, 29, 32, 33, 37
Section 21-2	4-8, 16-21, 28, 30, 35
Section 21-3	9, 10, 22-25, 31, 34, 36

Critical Thinking

26. All of the structures listed are used in sexual reproduction except conidia and yeast buds.
27. Fungi obtain food by absorbing nutrients from decaying matter in the soil or by absorbing nutrients from the bodies of their hosts. Humans obtain food by ingesting plants and animals.
28. The division to which an unknown fungus belongs can be determined by examining its structures for sexual production. Common molds produce zygospores. Club fungi have basidia, and sac fungi have asci. Imperfect fungi do not have known structures for sexual reproduction.
29. Tropical regions are warmer and have more moisture, which are conditions that favor fungal growth.
30. Answers may vary. A typical answer might suggest that bacteria and fungi compete for the same food source, and as a result fungi evolved a mechanism for killing bacteria.
31. The trees with mycorrhizae grew taller. Plants with mycorrhizae have a faster rate of growth than those without mycorrhizae.
32. With both methods of reproduction, fungi increase their chance of reproducing in different environmental conditions. Asexual reproduction is adaptive to more constant, favorable conditions, whereas sexual reproduction is adaptive to those that are harsh and unstable.
33. Students might suggest that the soil in the area where the mushrooms grow must contain a lot of nutrients. Some students may mention the possibility that the mushrooms are evidence of mycorrhizae in that area.
34. A principal role of fungi in the environment is to decompose dead organisms and recycle nutrients. If a lake contains few fungi, little decomposition and recycling will occur, and the water will become a less hospitable place for other organisms to survive.
35. During asexual reproduction of ascomycetes, spores called conidia are formed at the tips of specialized hyphae called conidiophores. If a conidium lands in a suitable environment, it grows into a haploid mycelium. During sexual

Critical Thinking

26. **Classifying** Fungi can reproduce both sexually and asexually. Identify which of the following structures can be involved in a process of asexual reproduction: hyphae, fruiting bodies, sporangia, gametangia, zygospores, conidia, ascospores, basidiospores, yeast buds.
27. **Comparing and Contrasting** Both humans and fungi are heterotrophs. Compare the way fungi obtain food with the way humans do.
28. **Classifying** Suppose someone gave you an unknown fungus to classify. What criteria would you use to determine the phylum to which the fungus belongs?
29. **Applying Concepts** Why are fungi a more serious problem to agriculture in tropical regions of the world than they are in temperate regions?
30. **Formulating Hypotheses** The antibiotic penicillin is a natural secretion of a certain kind of fungus—a green mold called *Penicillium*. Penicillin kills bacteria. Why might a mold species have evolved a way of killing bacteria?
31. **Interpreting Graphics** The graph below illustrates the growth rates of three species of trees—two individuals of each. One tree of each species grew with mycorrhizae, and one grew without mycorrhizae. For each species, how does the growth of the two plants compare? Make a generalization about the growth rate of plants with mycorrhizae.



reproduction, haploid hyphae of two different mating types grow close together. The N + N hyphae then produce a fruiting body. The ascus forms within the fruiting body. Within the ascus, two nuclei of different mating types fuse to form a diploid zygote, which soon divides by meiosis, producing four haploid cells. In most ascomycetes, meiosis is followed by a cycle of mitosis, so that ascospores are produced. In a favorable environment, an ascospore can germinate and grow into a haploid mycelium.

32. **Inferring** Most fungi have evolved the ability to produce spores through both sexual and asexual reproduction. How is this an advantage to fungi?
33. **Inferring** Suppose mushrooms appeared repeatedly in only one small part of your yard. What would this indicate about the soil in that area?
34. **Predicting** Heavily polluted fresh water contains few fungi. How might this affect life in a lake?
35. **Comparing and Contrasting** Compare sexual and asexual reproduction in ascomycetes. Explain the role of meiosis and mitosis in the life cycle.
36. **Applying Concepts** A debate is raging in your classroom. Some students argue that because fungi cause human diseases and damage crops, they should be eradicated from Earth. Their case seems compelling. You, however, are responsible for defending the opposing viewpoint. Let the fungi be, you maintain. Write the script of an argument you would present in this debate.
37. **Connecting Concepts** How do fungal cells differ from the cells of plants or animals? Draw a diagram or make a chart that compares the cells of multicellular organisms in these three kingdoms: Animalia, Plantae, and Fungi. Use the information in Chapters 7 and 18 to help in answering this question.

Writing in Science

Write a paragraph explaining how fungi either maintain or disrupt the equilibrium of an ecosystem. Use examples from each of the groups of fungi described in this chapter. (Hint: To organize your ideas, develop a table before you begin writing your paragraph.)

Performance-Based Assessment

In Your Community Use a field guide to find and identify fungi growing near your home. Sketch what you find, but do not touch or collect them. Note the environment in which each fungus is growing. What do you think is their source of nutrition? Share your field notebook with your class.

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