

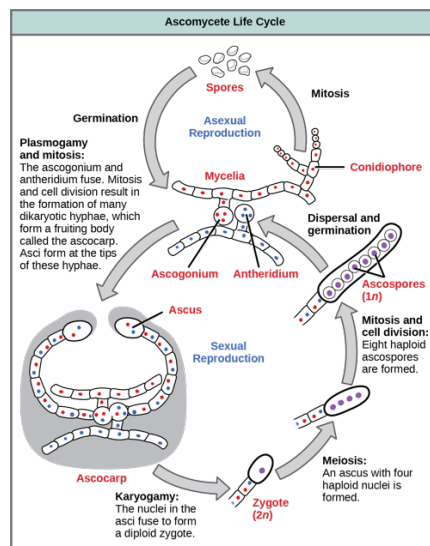
**Biology 2e**

## Unit 5: Biological Diversity

## Chapter 24: Fungi

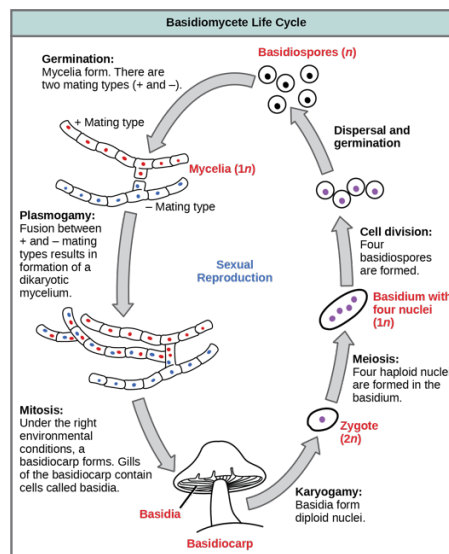
**Visual Connection Questions**

1. Which of the following statements is true?



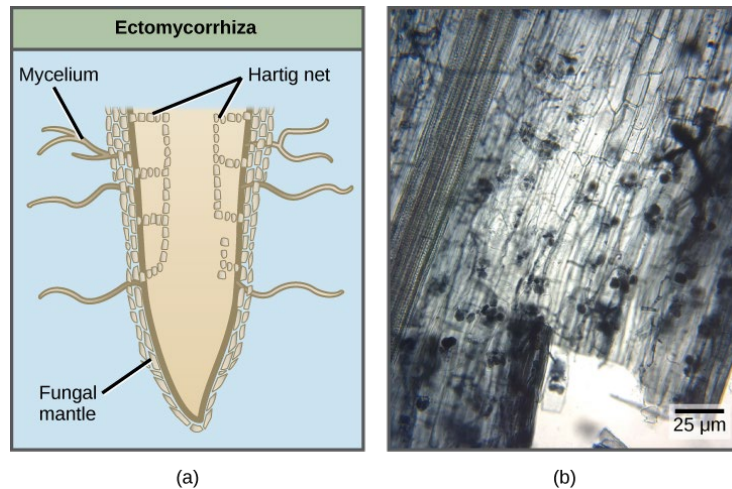
a. A dikaryotic ascus that forms in the ascocarp undergoes karyogamy, meiosis, and mitosis to form eight ascospores.

2. Which of the following statements is true?



D. A basidiocarp is the fruiting body of a mushroom-producing fungus.

3. If symbiotic fungi are absent from the soil, what impact do you think this would have on plant growth?



Without mycorrhiza, plants cannot absorb adequate nutrients, which stunts their growth. Addition of fungal spores to sterile soil can alleviate this problem.

### Review Questions

4. Which polysaccharide is usually found in the cell wall of fungi?

c. chitin

5. Which of these organelles is not found in a fungal cell?

a. chloroplast

6. The wall dividing individual cells in a fungal filament is called a

d. septum

7. During sexual reproduction, a homothallic mycelium contains

c. both mating types

8. The life cycles of perfect fungi are most similar to which other organism?

c. Haploid-dominant green algae

9. The most primitive phylum of fungi is the \_\_\_\_\_.

a. Chytridiomycota

10. Members of which phylum produce a club shaped structure that contains spores?

b. Basidiomycota

11. Members of which phylum establish a successful symbiotic relationship with the roots of trees?

d. Glomeromycota

**12.** The fungi that do not reproduce sexually use to be classified as \_\_\_\_\_.

b. Deuteromycota

**13.** A scientist discovers a new species of fungus that introduces genetic diversity during reproduction by creating a diploid zygote. This new species cannot belong to which modern phylum of fungi?

b. Glomeromycota

**14.** What term describes the close association of a fungus with the root of a tree?

c. a mycorrhiza

**15.** Why are fungi important decomposers?

d. They recycle carbon and inorganic minerals by the process of decomposition.

**16.** Consider an ecosystem where all the fungi not involved in mycorrhizae are eliminated. How would this effect nitrogen intake by plants?

c. Nitrogen intake would decrease.

**17.** A fungus that climbs up a tree reaching higher elevation to release its spores in the wind and does not receive any nutrients from the tree or contribute to the tree's welfare is described as a \_\_\_\_\_.

a. commensal

**18.** A fungal infection that affects nails and skin is classified as \_\_\_\_\_.

c. superficial mycosis

**19.** The targets for anti-fungal drugs are much more limited than antibiotics or anti-viral medications. Why?

d. Human cells are much more similar to fungi cells than bacteria or viruses.

**20.** Yeast is a facultative anaerobe. This means that alcohol fermentation takes place only if:

a. the atmosphere does not contain oxygen

**21.** The advantage of yeast cells over bacterial cells to express human proteins is that:

C. yeast cells are eukaryotic and modify proteins similarly to human cells

**22.** Why are fungal insecticides an attractive alternative to chemical pesticides for growing food crops?

a. Human consumption of fungal insecticides would not make a person sick, but ingestion of chemical pesticides can be harmful to humans.

**Critical Thinking Questions**

**23.** What are the evolutionary advantages for an organism to reproduce both asexually and sexually?

Asexual reproduction is fast and best under favorable conditions. Sexual reproduction allows the recombination of genetic traits and increases the odds of developing new adaptations better suited to a changed environment.

**24.** Compare plants, animals, and fungi, considering these components: cell wall, chloroplasts, plasma membrane, food source, and polysaccharide storage. Be sure to indicate fungi's similarities and differences to plants and animals.

Animals have no cell walls; fungi have cell walls containing chitin; plants have cell walls containing cellulose. Chloroplasts are absent in both animals and fungi but are present in plants. Animal plasma membranes are stabilized with cholesterol, while fungi plasma membranes are stabilized with ergosterol, and plant plasma membranes are stabilized with phytosterols. Animals obtain N and C from food sources via internal digestion. Fungi obtain N and C from food sources via external digestion. Plants obtain organic N from the environment or through symbiotic N-fixing bacteria; they obtain C from photosynthesis. Animals and fungi store polysaccharides as glycogen, while plants store them as starch.

**25.** Why is the large surface area of mycelium essential for nutrient acquisition by fungi?

Fungi break down decaying matter in their environment to serve as their food source. Since the digestion occurs externally, the large mycelium can secrete exoenzymes over a large area. The fungi must be able to absorb the small molecules released by digestion, so having a large surface area increases the amount of digested molecules that are captured by the fungi.

**26.** What is the advantage for a basidiomycete to produce a showy and fleshy fruiting body?

By ingesting spores and disseminating them in the environment as waste, animals act as agents of dispersal. The benefit to the fungus outweighs the cost of producing fleshy fruiting bodies.

**27.** For each of the four groups of perfect fungi (Chytridiomycota, Zygomycota, Ascomycota, and Basidiomycota), compare the body structure and features, and provide an example.

Chytridiomycota (Chytrids) may have a unicellular or multicellular body structure; some are aquatic with motile spores with flagella; an example is the *Allomyces*. Zygomycota (conjugated fungi) have a multicellular body structure; features include zygospores and presence in soil; examples are bread and fruit molds. Ascomycota (sac fungi) may have unicellular or multicellular body structure; a feature is sexual spores in sacs (asci); examples include the yeasts used in bread, wine, and beer production. Basidiomycota (club fungi) have multicellular bodies; features includes sexual spores in the basidiocarp (mushroom) and that they are mostly decomposers; mushroom-producing fungi are an example.

**28.** Why does protection from light actually benefit the photosynthetic partner in lichens?

Protection from excess light that may bleach photosynthetic pigments allows the photosynthetic partner to survive in environments unfavorable to plants.

**29.** Ambrosia bark beetles carry *Ambrosiella* fungal spores to trees, then bore holes and lay their eggs with the fungus. When the new larvae hatch, they eat the fungus that has germinated in the holes. Describe how this relationship can be classified as mutualistic.

The bark beetles and the fungus have a mutualistic relationship since each partner benefits from interacting with the other. The beetle can provide food for its offspring, while the fungus can spread to new trees.

**30.** Ecologists often attempt to introduce new plants to restore degraded land. In an arid climate, scientists recommend introducing plants with arbuscular mycorrhizae. How would the mycorrhizae increase the plants' survival compared to plants without mycorrhizae?

Plants with arbuscular mycorrhizae are colonized by fungi that penetrate root cells, and exchange metabolites with the plant. The network of fungal hyphae extends from the root cells out into the environment, covering a larger area than the plant's root system alone. This allows the plant to draw water from a larger area, increasing the likelihood that it can meet its daily needs.

**31.** Why can superficial mycoses in humans lead to bacterial infections?

Dermatophytes that colonize skin break down the keratinized layer of dead cells that protects tissues from bacterial invasion. Once the integrity of the skin is breached, bacteria can enter the deeper layers of tissues and cause infections.

**32.** Explain how the Red Queen Hypothesis describes the continuously evolving relationship between red grapes and *Botrytis cinerea*.

The Red Queen Hypothesis describes the biological stalemate between a predator and prey. The two populations are constantly applying evolutionary pressure on each other, forcing each population to adapt to counter an adaptation of the other population. In the case of the fungi *B. cinerea* and the red grape plant, the grapes are the prey and the fungi are the predator in the Red Queen Hypothesis. The grapes develop defenses to prevent infection by the fungi, ensuring that the *B. cinerea* that survive to colonize the red grapes have developed adaptations to overcome the plant defenses. The red grapes that then survive the infection are the plants that have additional adaptations that limit the pathogenicity of *B. cinerea*. This cycle continues to repeat unless one population evolves an adaptation that cannot be countered by the other population, which would wipe out the later population.

**33.** Historically, artisanal breads were produced by capturing wild yeasts from the air. Prior to the development of modern yeast strains, the production of artisanal breads was long and laborious because many batches of dough ended up being discarded. Can you explain this fact?

The dough is often contaminated by toxic spores that float in the air. It was one of Louis Pasteur's achievements to purify reliable strains of baker's yeast to produce bread consistently.

**34.** How would treating an area of a forest with a broad-spectrum fungicide alter the carbon and nitrogen cycles in the area?

Fungi are important decomposers in ecosystems, ensuring that dead plants and animals are broken down into smaller molecules that can be used by other members of the ecosystem.

Without fungi, decaying organic matter would accumulate in the forest. In the carbon cycle, fungi decompose organic matter into small carbon-containing compounds. This process releases carbon dioxide back into the air for plants to use during the carbon-fixation steps of photosynthesis. In the nitrogen cycle, decomposition by fungi also releases nitrogen for use by living organisms. In this cycle, the nitrogen is released from organic compounds in the form of ammonia.