

IV. Fungi (Chapter 29)

I. General Characteristics of Fungi

- A. Fungi are absorptive heterotrophs that secrete digestive enzymes and are major decomposers of dead organic material.
- B. Fungi can be divided into four major groups based on molecular data and differences in their reproductive structures.
 - 1. Chytridiomycota—aquatic with flagellated spores and gametes.
 - 2. Zygomycota—mycelia that "yoke together" during reproduction.
 - 3. Basidiomycota
 - a. Reproductive structures are mushrooms, puffballs, or bracket fungi.
 - b. Meiosis and spore formation occurs in basidia, which are like "little pedestals."
 - 4. Ascomycota—Meiosis and spore formation occurs in asci, which are elongated sacs.
- C. Phylogeny of Fungi
 - 1. The ancestor to fungi is thought to be a protist very similar to the ancestor of animals.
 - 2. The Chytridiomycota and Zygomycota represent early branches from the fungal lineage. Neither is a monophyletic group.
 - 3. The Ascomycota and Basidiomycota represent late branches on the fungal lineage, and each group appears to be monophyletic.

II. The Absorptive Lifestyle of Fungi

- A. Fungal morphology is associated with their absorptive method of heterotrophy—The fungal mycelium maximizes surface area in relation to volume.
- B. Fungi secrete digestive enzymes externally.
 - 1. Fungi can break down almost any type of organic substance.
 - 2. Fungal decomposition of wood is essential to the global carbon cycle.
 - a. Fungi digest lignin in order to gain access to energy-rich cellulose.
 - b. Before lignin and cellulose-digesting fungi evolved, enormous amounts of carbon were locked up in the wood of early land plants, which did not decompose.

III. Mutualism—Relationships between Fungi and Hosts That Are Mutually Beneficial

- A. Mycorrhizae are fungi that associate with plant roots and receive sugars from them.
 - 1. Ectomycorrhizae grow on the surface of plant roots without penetrating the cells.
 - a. They are common in colder northern climates where decomposition is slow.

- b. The fungus breaks down organic material and delivers nitrogen to the plant.
 - 2. Arbuscular mycorrhizae penetrate the cells of the plant root.
 - a. They are common in warmer grasslands and forests where decomposition is rapid.
 - b. The fungus delivers phosphorus to the plant.
 - B. Increasing the diversity of mycorrhizae in a given habitat increases plant species richness and productivity.
 - C. Endophytes and Lichens
 - 1. Endophytes are fungi that live in the surfaces of plants without causing disease.
 - a. Some may be mutualistic in that they deter insect herbivory.
 - b. Others are apparent commensals.
 - 2. Lichens are associations of a fungus with either an alga or cyanobacterium.
 - a. Lichens are the dominant species in tundra habitats and are important in breaking down rock to form soil.
 - b. Evidence suggests the fungus may sometimes be parasitic to its photosynthetic partner.

IV. Parasitism

- A. Although many fungi infect humans, relatively little human disease is due to fungi.
- B. Parasitic fungi cause major damage to crops such as wheat, corn, and barley.
 - 1. Many have evolved resistance to fungicides.
 - 2. A new approach to blocking fungal infections in crops may be to infect the crop first with a benign strain of the pathogen, that is, a "live vaccine."