**References:** Reece, J. B., & Campbell, N. A. (2011). *Campbell biology*. Boston: Benjamin Cummings / Pearson.
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# INTRODUCTION TO FUNGI

Fungi are rich and diverse groups of organisms on earth. The kingdom includes some of the most important organisms because of their important roles in human life, such as their beneficial and harmful effects on forests, their use in the pharmacology industry, and the mass production of cultivated fungi in the food industry, as well as their vital role in biodegradation. They include symbionts of plants, animals, or other fungi and also parasites. They have long been used as a direct source of human food, in the form of mushrooms and truffles; as a leavening agent for bread; and in the fermentation of various food products, such as wine, beer, and soy sauce. Fungi have been used for the production of antibiotics since 1940. Recently, various enzymes produced by fungi are used industrially and in detergents. They are also used as biological pesticides to control weeds, plant diseases, and insect pests. Many species produce bioactive compounds called mycotoxins, such as alkaloids and polyketides, that are toxic to animals including humans. Approximately 100 000 species of fungi have been described; however, some estimates of total numbers suggest that 1.5 million species may exist. Fungi show a great diversity in morphology and habitat. They obtain their nutrients by absorption. Their cell walls are mostly made up of carbohydrate chitin, while the cell wall in plants is made of cellulose. The carbohydrates are stored in fungi as glycogen. Nutrition in fungi is by absorbing nutrients from the organic material in which they live. Fungi digest their food before it passes through the cell wall into the hyphae. The hyphae secrete enzymes and acids that break down the organic material into simple compounds. The kingdom fungi reproduce by means of spores Reproduction in fungi is both by sexual and asexual means. The sexual state is referred to as teleomorph, asexual state is referred to as anamorph. The kingdom has a worldwide distribution, and they grow in a wide range of

habitats such as deserts or areas with high salt concentrations or ionizing radiation as well as in deep- sea sediments. Some can survive the intense UV and cosmic radiation encountered during space travel. Most grow in terrestrial environments, though several species live partly or solely in aquatic habitats, such as the chytrid fungus. Kingdom fungi is classified into four divisions (Chytridiomycota, Zygomycota, Ascomycota and Basidiomycota).

Based on their lifestyle, fungi may be circumscribed by the following set of characteristics (Webster& Weber, 2007)

1. Nutrition. Heterotrophic (lacking photosynthesis), feeding by absorption rather than ingestion.
2. Vegetative state. On or in the substratum, typically as a non-motile mycelium of hyphae showing internal protoplasmic streaming. Motile reproductive states may occur.
3. Cell wall. Typically present, based on glucans and chitin,
4. Nuclear status. Eukaryotic, uni- or multinucleate, the thallus being homo- or heterokaryotic, haploid, dikaryotic or diploid, the latter usually of short duration (but exceptions are known from several taxonomic groups).
5. Life cycle. Simple or, more usually, complex. Reproduction. The following reproductive events may occur: sexual (i.e. nuclear fusion and meiosis) and/or parasexual (i.e. involving nuclear fusion followed by gradual de-diploidization) and/or asexual (i.e. purely mitotic nuclear division).
6. Propagules. These are typically microscopically small spores produced in high numbers. Motile spores are confined to certain groups.
7. Sporocarps. Microscopic or macroscopic and showing characteristic shapes but only limited tissue differentiation.
8. Habitat. Ubiquitous in terrestrial and freshwater habitats, less so in the marine environment.
9. Ecology. Important ecological roles as saprotrophs,mutualistic symbionts, parasites, or hyperparasites.

**Nutrition and Ecology**

Fungi are heterotrophs and absorb nutrients from outside of their body. Fungi use enzymes to break down a large variety of complex molecules into smaller organic compounds. The versatility of these enzymes contributes to fungi's ecological success.

Fungi exhibit diverse lifestyles

1. Decomposers
2. Parasites
3. Mutualists

**Body Structure**

The most common body structures are multicellular filaments and single cells (yeasts). Some species grow as either filaments or yeasts; others grow as both. The morphology of multicellular fungi enhances their ability to absorb nutrients .Fungi consist of mycelia, networks of branched hyphae adapted for absorption. A mycelium's structure maximizes its surface area-to-volume ratio.

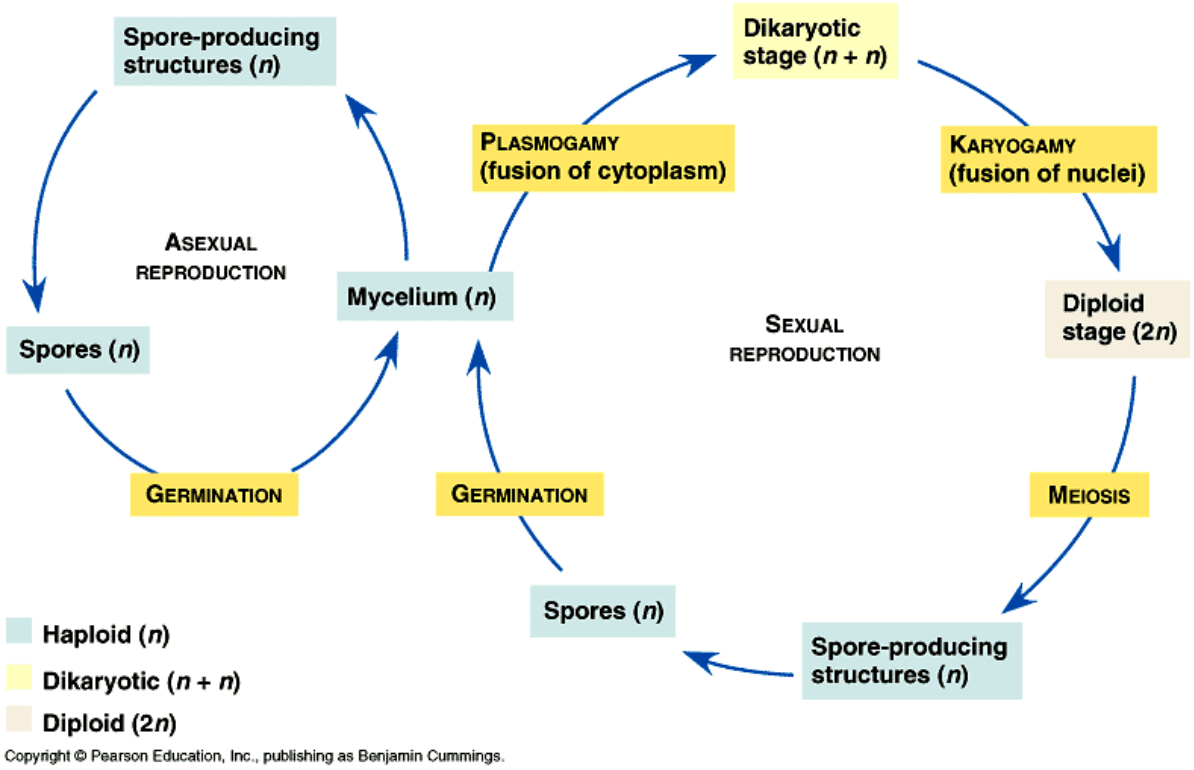
Fungal cell walls contain chitin. Most fungi have hyphae divided into cells by septa, with pores allowing cell-to-cell movement of organelles. Coenocytic fungi lack septa and have a continuous cytoplasmic mass with hundreds or thousands of nuclei.

Some unique fungi have specialized hyphae called haustoria that allow them to penetrate the tissues of their host.

Mycorrhizae are mutually beneficial relationships between fungi and plant roots. Ectomycorrhizal fungi form sheaths of hyphae over a root and also grow into the extracellular spaces of the root cortex. Arbuscular mycorrhizal fungi extend hyphae through the cell walls of root cells and into tubes formed by invagination of the root cell membrane.

## LIFE CYCLES OF FUNGI

Fungi propagate themselves by producing vast numbers of spores, either sexually or asexually. Fungi can produce spores from different types of life cycles.




**Sexual Reproduction**

Fungal nuclei are normally haploid, with the exception of transient diploid stages formed during the sexual life cycles. Sexual reproduction requires the fusion of hyphae from different mating types. Fungi use sexual signaling molecules called pheromones to communicate their mating type. Plasmogamy is the union of cytoplasm from two parent mycelia. In most fungi, the haploid nuclei from each parent do not fuse right away; they coexist in the mycelium, called a heterokaryon. In some fungi, the haploid nuclei pair off two to a cell; such a mycelium is said to be dikaryotic.

Karyogamy is nuclear fusion and During karyogamy, the haploid nuclei fuse, producing diploid cells. The diploid phase is short-lived and undergoes meiosis, producing haploid spores. The paired processes of karyogamy and meiosis produce genetic variation.

## Asexual Reproduction

In addition to sexual reproduction, many fungi can reproduce asexually. Molds produce haploid spores by mitosis and form visible mycelia. Other fungi that can reproduce asexually are yeasts, which are single cells. Instead of producing spores, yeasts reproduce asexually by simple cell division and the pinching of "bud cells" from a parent cell. Some fungi can grow as yeasts and as filamentous mycelia.

## REFERENCES

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