

Fungi has specialized lifestyles that evolved independently

- ❑ Four fungal forms: molds, yeasts, lichens, and mycorrhizae, have evolved morphological and ecological adaptations for specialized ways of life.
 - These have occurred independently among the zygote fungi, sac fungi, and club fungi.
- ❑ A **mold** is a rapidly growing, asexually reproducing fungus.
 - The mycelia of these fungi grow as saprobes or parasites on a variety of substrates.
 - Early in life, a mold, a term that applies properly only to the asexual stage, produces asexual spores.
 - Later, the same fungus *may* reproduce sexually, producing zygosporangia, ascocarps, or basidiocarps.
- ❑ Some molds cannot be classified as zygomycetes, ascomycetes, or basidiomycetes because they have ***no known sexual stages***.
- ❑ Collectively called deuteromycetes, or **imperfect fungi**, these fungi ***reproduce asexually*** by producing haploid spores.
 - Many of these fungi are predatory.
 - This is an informal grouping without phylogenetic basis.
- ❑ Whenever a sexual stage for one of these fungi is discovered, it is moved to the phylum that matches its type of sexual structures.
- ❑ **Yeasts** are unicellular fungi that inhabit liquid or moist habitats, including plant sap and animal tissues.
 - Yeasts reproduce asexually by simple cell division or budding off a parent cell.
 - Some yeast reproduce sexually, forming asci (Ascomycota) or basidia (Basidiomycota), but others have no known sexual stage (imperfect fungi).
- ❑ Humans have used yeasts to raise bread or ferment alcoholic beverages for thousands of years.
- ❑ Various strains of the yeast *Saccharomyces cerevisiae*, an ascomycete, have been developed as baker's yeast and brewer's yeast.
 - Baker's yeast releases small bubbles of CO₂ that leaven dough.
 - Brewer's yeast ferment sugars into alcohol.
- ❑ Researchers have used *Saccharomyces* to investigate the molecular genetics of eukaryotes because they are easy to culture and manipulate.
- ❑ Some yeasts cause problems for humans.
 - A pink yeast, *Rhodotorula*, grows on shower curtains and other moist surfaces in our homes.
 - Another yeast, *Candida*, is a normal inhabitant of moist human epithelial surfaces, such as the vaginal lining.
 - An environmental change, such as a change in pH or compromise to the human immune system, can cause *Candida* to become pathogenic by growing too rapidly and releasing harmful substances.

- ❑ While often mistaken for mosses or other simple plants when viewed at a distance, **lichens** are actually a symbiotic association of millions of photosynthetic microorganisms held in a mesh of fungal hyphae.
- ❑ The fungal component is commonly an ascomycete, but several basidiomycete lichens are known.
- ❑ The photosynthetic partners are usually unicellular or filamentous green algae or cyanobacteria.
- ❑ The merger of fungus and algae is so complete that they are actually given genus and species names, as though they were single organisms.
 - Over 25,000 species have been described.
- ❑ The fungal hyphae provides most of the lichen's mass and gives it its overall shape and structure.
- ❑ The algal component usually occupies an inner layer below the lichen surface.
- ❑ In most cases, each partner provides things the other could not obtain on its own.
 - For example, the alga provides the fungus with food by “leaking” carbohydrate from their cells.
 - The cyanobacteria provide organic nitrogen through nitrogen fixation.
 - The fungus provides a suitable physical environment for growth, retaining water and minerals, allowing for gas exchange, protecting the algae from intense sunlight with pigments, and deterring consumers with toxic compounds.
 - The fungi also secrete acids, which aid in the uptake of minerals.
- ❑ Lichens are important pioneers on newly cleared rock and soil surfaces, such as burned forests and volcanic flows.
 - The lichen acids penetrate the outer crystals of rocks and help break down the rock.
 - This allows soil-trapping lichens to establish and starts the process of succession.
- ❑ Some lichens survive severe cold or desiccation.
- ❑ Lichens are particularly sensitive to air pollution and their deaths can serve as an early warning of deteriorating air quality.
 - Lichens are particularly sensitive to sulfur dioxide and other aerial poisons.
- ❑ **Mycorrhizae** are mutualistic associations of plant roots and fungi.
 - The anatomy of this symbiosis varies, and depends on the type of fungus.
- ❑ The extensions of the fungal mycelium from the mycorrhizae greatly increases the absorptive surface of the plant roots.
- ❑ The fungus provides minerals from the soil for the plant, and the plant provides organic nutrients.
- ❑ Mycorrhizae are enormously important in natural ecosystems and in agriculture.
 - Almost all vascular plants have mycorrhizae and the Basidiomycota, Ascomycota, and Zygomycota all have members that form mycorrhizae.
 - The fungi in these permanent associations periodically form fruiting bodies for sexual reproduction.
 - Plant growth without mycorrhizae is often stunted.