

Eukaryotes: The Other Guys Part II: Fungi

There's a Fungus Among Us!

- The study of fungi is called mycology
- Fungi have traditionally been included in the plant kingdom
 - However, there are significant differences between fungi and plants
 - Fungi are heterotrophs
 - Fungi have filamentous bodies
 - Fungi have nonmotile sperm
 - Fungi have cell walls made up of chitin
 - Fungi have nuclear mitosis
- Fungi are aerobic or facultatively anaerobic chemoheterotrophs.
- Most of them are decomposers and a few have parasitic relationships with plants and animals.

The Kingdom Fungi

- Approximately 5 million species of fungi can be divided into two groups:
 - **Macroscopic fungi:** mushrooms, puffballs, gill fungi
 - **Microscopic fungi:** molds, yeasts

Microscopic Morphology

- Yeast cell
 - Round to oval shape
 - Uses asexual reproduction
- Hyphae
 - Long, thread-like cells found in filamentous fungi or molds
 - Pseudohyphae: chains of yeast
- Dimorphic
 - Some fungi can take either form

Fungal Nutrition

- **Heterotrophic**
 - Acquire nutrients from a wide variety of substrates
- **Saprobies**
 - Obtain substrates from dead plants and animals
- **Parasites**
 - Live on the bodies of living animals or plants

Organization of Microscopic Fungi

- Most microscopic fungi grow in loose associations or colonies
 - Mycelium: the woven, intertwining mass of hyphae that makes up the body or colony of a mold
 - Septa: cross walls dividing hyphae into segments
 - Spores: fungal reproductive bodies
- Functional Types of Hyphae Using the Mold *Rhizopus* as an Example

Reproductive Strategies and Spore Formation

- Fungi have many complex and successful reproductive strategies
 - Simple outward growth of existing hyphae
 - Fragmentation: separated piece of mycelium can generate a whole new colony
 - Primary reproductive mode: spore formation
 - Fungal spores should not be confused with the more resistant, nonreproductive bacterial endospores

Asexual Spore Formation

- Sporangiospores
 - Formed by successive cleavages within a sporangium
- Conidiospores or Conidia
 - Free spores not enclosed by a spore-bearing sac

Sexual Spore Formation

- Purpose of sexual spores
 - Important variations occur when fungi of different genetic makeup combine their genetic material
 - Slight variations in the form and function are potentially advantageous to the adaptation and survival of the species

Fungal Identification and Cultivation

- Identification in medical specimens
 - Isolation on special media
 - Observation microscopically and macroscopically
 - Sexual spores difficult to detect
 - Asexual spore-forming structures used to identify genus and species
 - Hyphal type, colony texture, pigmentation, physiological characteristics, genetic makeup

Medical Conditions Caused by Fungi

- Most human fungal infection occurs through accidental contact with soil, water, or dust
- Pathogenic fungi
 - Community-acquired infections caused by environmental pathogens
 - Hospital-associated infections caused by fungal pathogens in clinical settings
 - Opportunistic infections caused by pathogens infecting already weakened individuals
- Other medical conditions caused by fungi
 - Allergies
 - Neurological conditions due to toxin production

Other Impacts of Fungi

- Negative industrial impact:
 - A number of species are pathogenic to corn and grain
 - 40% of the fruit crop each year is consumed by fungi

- Positive industrial impact:
 - Essential role in decomposing organic matter and returning essential minerals to the soil
 - Form stable associations with plant roots that increase water and nutrient absorption
 - Production of antibiotics, alcohol, organic acids, and vitamins
 - Food flavoring
 - Alcohol in beer and wine, gas that causes bread to rise

Ecological Roles of Fungi

- Fungi, together with bacteria, are the principal decomposers in the biosphere.
 - Fungi are virtually the only organisms that can break down lignin.
- Fungi cause animal diseases.
- Fungi are the most harmful pests of living plants.
- Many commercial products are dependent on the biochemical activities of fungi
 - Bread, beer, cheese, soy sauce, and penicillin.

Fungal Associations

- Mutualism is a form of symbiosis in which each partner benefits
- Two kinds of mutualistic associations between fungi and autotrophic organisms are ecologically important
 - 1. Mycorrhizae
 - 2. Lichens

Mycorrhizae

- Symbiotic association between a fungus and the roots of plants
 - Fungus helps plant absorb minerals and nutrients
 - Plant provides fungus with food (organic molecules).

Lichens

- Symbiotic association between a fungus and a green algae or cyanobacterium.
- Lichens are found in the harshest of habitats.
- Indeed, they are often the first colonists in such harsh areas.
- Lichens are pollution indicators.