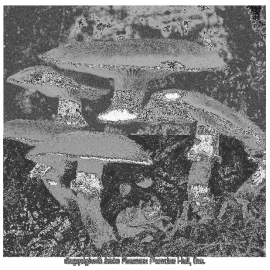
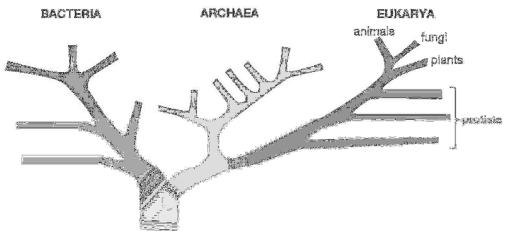
The Diversity of Fungi

Chapter 20

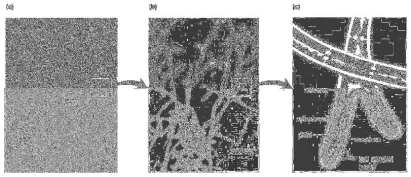


Fungi are in Domain Eukarya



Key features of fungi

- Mycelium is the body of a fungus
  - Made of **hyphae**
    - Single, elongated cells with multiple nuclei OR
    - Subdivided by **septa**
    - Cell walls made of ***chitin***



Key features of fungi

- Obtain nutrients from other organisms
  - Secrete enzymes to break down food
  - Absorb dissolved nutrients via hyphae
  - May be decomposers, parasites, in mutualistic relationships, or (rarely) predators

Decomposers

- Most fungi are decomposers.
  - Important in all ecosystems.
  - Break down nutrients so other organisms can use them.
    - Natural recycling!

Parastic fungi

- Ergot
  - Parasitic fungus on grains, particularly rye and barley
- Causes Ergotism in humans when consumed.
  - Ergotism may have been the cause of the Salem Witch trials.
- Small doses is used medicinally
  - Migraines

Parasitic fungi

- Silver Leaf disease
  - Caused by a parasitic fungi
- Used to biocontrol "weed" trees.

Parasitic fungi

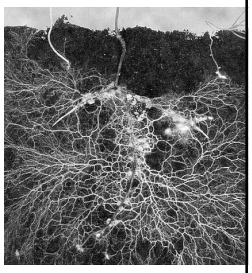
- ***Cordyceps unilateralis***
  - Infects ant brains, creating new pheromones
  - Causes ant to climb trees, hang upside down, and dies while still clamped to leaf or stem

Mutualistic fungi

- Lichens
  - All lichens are tight symbioses of fungi and algae.
- Fungi breaks down minerals from rocks
- Algae photosynthesizes, feeding both the fungi & algae

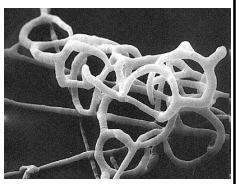
Mutualistic fungi

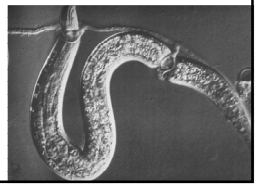
- Mycorrhizae
  - Lives in tight symbiosis with plants
- Attaches to roots
  - Helps plant to absorb phosphorus and nitrogen.
- 95% of plants are dependent on mycorrhizae for life.



Predaceous fungi

- Trap and feed on prey
- Many feed on nematodes (roundworms)
- Some feed insects



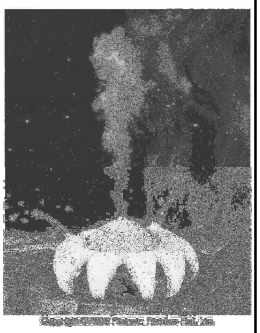


Fungi can be large

- The world's largest organism lives in Oregon!
  - Covers 2,200 acres underground
  - Produces golden mushrooms from the underground source
  - Kills trees, which is how it was discovered

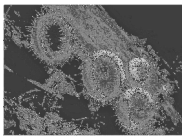
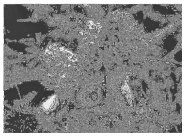
Key features of fungi

- Fungi propagate by spores
  - Many actively eject their spores
  - Many means of dispersal
    - Wind
    - Hitchhikers in fur
    - Within digestive systems
  - Can be produced in large numbers
    - Puffball may contain 5 trillion spores!



Club fungi

- Form club-shaped reproductive structures
  - Structure itself made of densely-packed hyphae
- These are the common mushrooms, puffballs, shelf fungi and "stinkhorns."


Types of fungi

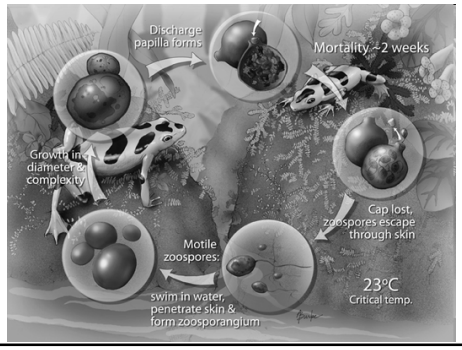
- Chytridiomycota
  - Aquatic fungi.
  - Ancestral to all other fungi
- Zygomycota
- Basidiomycota
  - Club fungi
- Ascomycota
  - Sac fungi

chrytids

- Can be parasitic
  - One cause of amphibian die-off
    - Extinction of golden toad in Central America
- Most chrytids feed on detritus (dead matter from plants and animals)

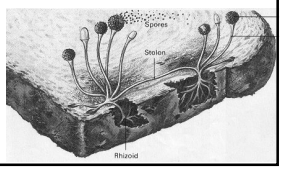
Declared extinct in 1989

Life cycle of chytridomycetes

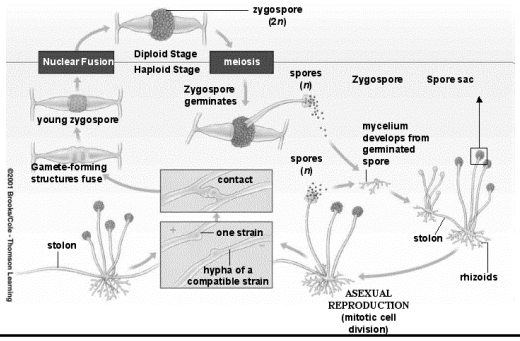


zygomycetes

- Generally live in soil or decaying matter
  - Includes black bread mold
- Spores disperse through the air
  - Keep bread products tightly wrapped

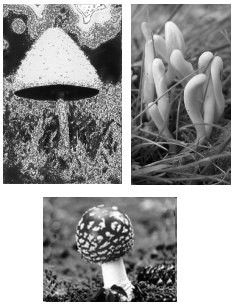



Life cycle of Zygomycetes



Club fungi

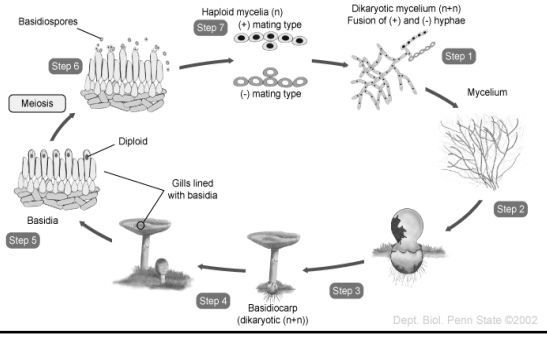
- Forms club like structures
  - Most mushrooms!
- Can be very old
  - The Oregon club fungus is estimated to be 2400 years old.
- Reproduces through spores in the "gills" of the mushroom



Club fungi

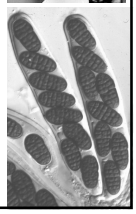
- Mushroom fairy ring: form at the edges of a giant, underground mycelium.

Life cycle of club fungi

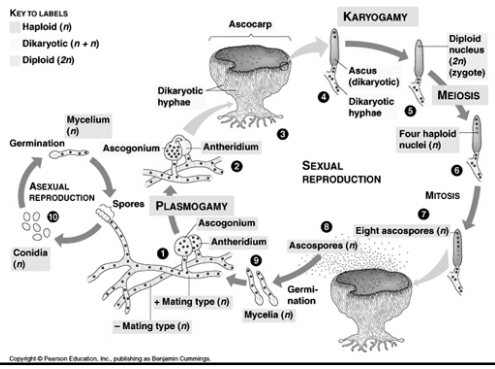


Sac fungi

- Ascomycetes
  - Form asci
    - saclike cases that contain spores
- Includes Morel mushrooms
  - Despite club like appearance.



Life cycle of sac fungi



Humans and Fungi

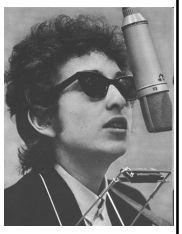
- Fungi attack important crops and trees
  - Corn smut
  - Dutch elm disease

Human fungal diseases

- Fungi attack humans directly
  - Athlete's foot
  - Candida
    - Cause of yeast infections
    - Can outcompete intestinal bacteria
    - Can be deadly to those with AIDS or cancer

Human fungal diseases

- Histoplasmosis
  - Caused by sac fungi
  - Humans breathe in spores
  - Can infect lungs & heart
    - Nearly killed Bob Dylan in 1997
- Valley fever
  - Another sac fungi
  - Infects many southwestern US residents



Humans & fungi

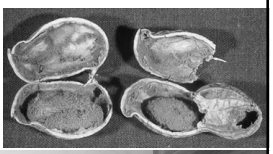
- Fungi can produce toxins
  - Occur especially when food is stored in moist conditions.
  - **Aflatoxins**: peanuts seem especially susceptible
    - One of the most toxic substances to man.
  - Ergot
- Grain fungal toxins are hypothesized to be the cause of the death of the firstborn in Egypt (last of the 10 plagues)

Humans and fungi

- **Ergot poisoning**
  - One type infects rye and
  - Vasoconstriction due to toxin can cause **gangrene**
    - What is gangrene?
  - Some ergot toxins cause burning sensation, vomiting, convulsions and hallucinations
  - LSD is derived from ergot toxins…

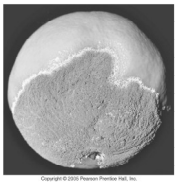
Aflatoxin

- Fungus attacks roots, particularly peanuts.
- Extremely toxic to humans and dogs
- Strict FDA regulations on peanut products and other grains.



Humans and Fungi

- Many antibiotics are derived from fungi
  - Example: *Penicillium* (from which Penicillin is made)
- Fungi are important as foods
  - Eaten directly
  - Important in some cheeses



Key ecological role

- Fungi are important decomposers
  - Break down dead organisms and release nutrients back into the environment (recycling!)

- Yeasts are fungi used to make food
  - Wine-making and beer-brewing
    - Fermentation (sugars → alcohol)
    - Produce carbon dioxide bubbles in beer!
  - Bread-making
    - Produce carbon dioxide bubbles that make bread rise