

Prokaryotes, Viruses, and Fungi  
Chapters 13 and 14

Prokaryotes

- What do we already know about this group of organisms?
- most abundant organisms worldwide
- metabolically diverse
- rapid rate of cell division
  
- some can live in extreme cold or heat, darkness, or anaerobic environments
- a form of “sexual” reproduction
- metabolic diversity
  - autotrophs
  - heterotrophs

Prokaryotes: *Bacteria*

- 17 kingdoms/major lineages
- cyanobacteria
  - a.k.a. blue-green algae
- purple and green bacteria
  - colors from photosynthetic pigments
  - very different photosynthesis
- cause disease in plants

Prokaryotes: *Archaea*

- three large groups
  - extreme halophiles
  - methanogens
  - extreme thermophiles

Viruses

- Is a virus alive?
- primarily a genome (DNA or RNA) that replicates within a host cell
- almost all organisms can be infected by viruses, including plants
- plant viruses carried by insects
  - aphids, leafhoppers, whiteflies
- cause >2000 plant diseases
- most plant viruses are RNA viruses
- move through plant

## Fungi

- What do we already know about fungi?

### Importance of Fungi

- ecological
- medical
- economic
- symbiotic relationships
  - mycorrhizae
  - lichens
  - endophytes

## Fungi

- most composed of hyphae
  - hyphae
  - mycelium
- most species have hyphae divided by septa
  - septate
  - aseptate or coenocytic
- very high surface area-to-volume ratio
- heterotrophic absorbers
  - saprophytes
  - parasites
  - mutualistic symbionts
- some fungi are fermenters
- unique variations of mitosis and meiosis
- reproduce both asexually and sexually
  - asexually: most commonly by spores
  - sexually: protoplasts fuse, nuclei fuse, then meiosis occurs
  - only diploid phase is zygote, just before meiosis occurs

### Kingdom *Fungi*

- *Chytridiomycota* (chytrids)
- *Zygomycota* (zygomycetes)
- *Ascomycota* (ascomycetes)
- *Basidiomycota* (basidiomycetes)

### Phylum *Chytridiomycota*

- previously considered protists
- predominantly aquatic
- varied in form, sexual interactions, life histories

- characteristic motile cells
- can be parasites or pathogens of plants

#### Phylum *Zygomycota*

- most are saprophytes, some parasites or symbiotic
- most coenocytic
- asexual reproduction via haploid spores
- example
  - *Rhizopus stolonifer*
- zygospores
  - sexually produced resting spores
- some cause diseases of plants
  - soft rot of flowers, fruits, seeds
- endomycorrhizae
- some are insect parasites
  - biological control

#### Phylum *Ascomycota*

- some familiar fungi
  - blue-green, red, brown molds on food
  - plant diseases including powdery mildews, chestnut blight, Dutch elm disease
  - many yeasts
  - edible morels and truffles
- filamentous (except for yeasts)
- perforated septa
- asexual reproduction
- sexual reproduction
  - formation of ascus (resembles a sac) within which ascospores are formed from meiosis

#### Phylum *Basidiomycota*

- most familiar fungi
  - “mushrooms”
  - toadstools
  - stinkhorns
  - puffballs
  - shelf fungi
  - rusts
  - smuts
- may constitute 2/3 of biomass in soil
- produce basidiospores in a basidium

- “mushroom” is a basidioma
- include gill fungi
  - common field mushroom
  - button mushroom
  - *Amanita*
  - *Psilocybe*
- rusts
  - many pathogens of plants
    - black stem rust of wheat
  - some require two hosts
- smuts
  - sooty appearance of masses of spores
  - attack approximately 4000 species of plants

#### Predaceous Fungi

#### Yeasts

- unicellular
- reproduce by budding
- not a formal taxonomic group
- economic importance
- some human pathogens

#### Conidial Fungi (anamorphs)/ Deuteromycetes

- “Fungi Imperfecti”
- only exist in asexual reproducing state
- *Penicillium*
- *Aspergillus*
- some are plant pathogens
- some cause human disease

#### Symbiotic Relationships of Fungi

- parasitic
- mutualistic
- lichens
- mycorrhizae
- endophytes

#### Lichen

- mycobiont

- photobiont
- scientific name is the fungus
- forms
  - crustose
  - foliose
  - fruticose
- can dry out very rapidly
- mutualism?
- ecological importance

### Mycorrhizae

- fungi and plant roots
  - almost all vascular plants
  - not in Brassicaceae or Cyperaceae
- increase host plants' ability to capture water and elements
  - especially phosphorus
- can protect against root pathogens
- types
  - endomycorrhizae
    - 80% of all vascular plants
    - zygomycete
  - ectomycorrhizae
    - certain families
      - Fagaceae
      - Salicaceae
      - Betulaceae
      - Pinaceae
- types
  - endomycorrhizae
  - ectomycorrhizae
  - Ericaceae
  - Orchidaceae

### Summary

- viruses
- prokaryotes
  - *Bacteria*
  - *Archaea*
- fungi
  - four phyla
  - others
  - importance