Types of Microorganisms

Nomenclature – scientific name binomial system of Linnaeus
Genus species
ex. *Escherichia coli, E. coli*

I. **Eubacteria (**Bacteria) prokaryotic cell type
1. Size: .1-2 μm, average 1 μm (micrometer)
2. Shapes:
coccus (spherical or round)
pairs – diplococcus
chains – streptococcus
clusters – staphylococcus
bacillus (rod shaped)
spiral (helical)
pleomorphic – irregular rods
3. Reproduction – binary fission
4. Unusual types of bacteria
a. Rickettsia – obligate intracellular parasites, live in host cells, pathogenic, very small, spread by vectors
b. Chlamydia – obligate intracellular parasites, very small, pathogenic
c. mycoplasmas – no cell wall, pneumonia

Cyanobacteria – aerobic bacteria that do photosynthesis
1. Size: varies greatly; generally larger than normal bacteria
2. Shape: single cell to filamentous
3. Cellular Anatomy:
a. chlorophyll a – photosynthesis
phycocyanin – blue pigment
photosynthetic lamellae – folds in cell membrane
no chloroplasts
b. motility – gliding motion, no flagella
c. some live in extreme conditions – temperature, salt

II. Archaea – prokaryotic cell type
1. single cells, microscopic

2. many live in extreme environments
3. cellular components more like eukaryotic cells

III. Eukarya – eukaryotic cell type

A. *Algae* – primary producers (utilize light and CO_2)

1. Size: microscopic to 200 feet
2. Shape: widely variable
3. Cellular Anatomy:
   a. Chlorophyll a in chloroplasts
   b. Many other pigments; red, brown
      Classification based on auxiliary pigments
   c. Some are motile – gliding or flagella
   d. Asexual and sexual reproduction
4. Special types:
   a. Diatoms – silica cell walls
      diatomaceous earth – filters
      abrasives, insulation, food additives
   b. "Seaweeds" – food source, alginates, food additives
      agar for Petri plates
   c. Lichens – symbiosis of mold/fungi and algae (mutualism)
      very hardy, soil formation, pollution indicators, drugs

B. Fungi

Common Traits

1. Absorptive growth
2. Growth as hypha
3. Chitin-containing cell walls

Role: recycling biomass, produce enzymes to degrade wide range of substrates

Some are pathogenic for humans, many pathogenic for plants.

1. Size: microscopic to visible
2. Shape: coccus to filamentous
3. Cellular Anatomy: no photosynthesis
   a. no true roots, leaves, and stems
   b. organic cell wall
   c. asexual and sexual reproduction

Yeasts – unicellular fungi (lost ability to form hypha yet some pathogens can form filaments)

a. oval cells – 5 μm diameter
b. reproduce by budding
c. uses: brewing, baking, industrial fermentations, food supplements

Molds – multicellular, filamentous
a. Hyphae - coenocytic, septate, non-septate
b. Hypha – chain of cells, filament
mycelium – mass of hyphae
c. Fruiting heads – very characteristic for a genus (*sporangium*)
d. Reproduction – usually asexual spores dormant, resistant
can cause allergic reactions
sexual – hyphal cell fusion, sexual spores
e. Grow in many environments, require low amounts of water
mildew, food spoilage

Specific Examples:
Mycorrhizae – mutualism between soil fungus and plant roots
Mushrooms – fruiting bodies of soil fungi

C. Protists (Protozoa)
Heterotrophs - uses external organic carbon sources for biosynthesis
Usually predators or parasites
1. Size: microscopic, much larger than bacteria
2. Shape: unicellular, varies
3. No organic cell wall
4. Holozoic nutrition – most ingest solid masses of food rather than soluble nutrients
5. Four Groups based on motility
a. Amoeba – very flexible, pseudopodia, phagocytosis
some have mineral shells
b. Flagellates – one or more flagella
c. Ciliates – numerous cilia
good swimmers
d. Sporozoa – non-motile parasites, complex life cycles,
ex. malaria
6. Some are serious human pathogens
7. Some have undergone evolutionary reduction
(ex. lack mitochondria)

Specific Examples:
Dinoflagellates – motile, marine, red tide

Evolutionary reductionism – chloroplast to an apicoplast
Toxoplasma – toxoplasmosis, cats
Plasmodium – malaria
Trypanosomes – African sleeping sickness, Chagas disease
Microsporidia –
Giardia – cause giardiasis, found in deer and sheep

Viruses

Bacteriophage (phage) – viruses that infect bacteria

1. Size: 0.01-0.2 μm (submicroscopic)
2. Obligate intracellular parasites – host cell
3. No independent metabolism
4. Host specific
5. Virion (virus outside a host cell)
    a. core of DNA or RNA
    b. coat (capsid) of protein
6. Replication methods:
    a. **Lytic Cycle** (active infection)
        1. Virus attaches to cell
        2. DNA or RNA enters cell
        3. Replication of virus parts by cell machinery
        4. Assembly of virus particle
        5. Virions released from cell
    b. **Lysogenic Cycle** (Latent)
        1. Attachment of virus
        2. Entry of DNA/RNA
        3. Integration of DNA into host cell DNA
        4. Induction – stress causes viral DNA to be released and an active (lytic) infection results
7. Viruses are pathogenic to the host.
    All living organisms have viral infections.
8. Prevention – immunization
9. Treatment – primarily symptomatic

Viroids

1. 10X smaller than viruses
2. “naked” RNA molecules
3. Only plant pathogens presently known
4. 12 types – each causes a different plant disease

5. Economically significant, ex. potato disease

Prions

1. 100X smaller than viruses
2. Contain only protein, no DNA or RNA has been found
3. Cause human and animal infections.

Examples:
scrapie – sheep
Creutzfeldt-Jakob – human dementia
Kuru
Mad cow disease
Chronic wasting disease (CWD)