The Protistans

Includes protozoans and algae
All single celled eukaryotes

Protozoa

- Unicellular, eukaryotic, heterotrophic
- Inhabit water and soil
- Some normal microbiota of animals
- Few cause disease

Three most important phyla: based on mode of locomotion

1. Sarcomastigophora: includes the amebas and the flagellates
2. Apicomplexa: all parasitic
3. Ciliophora: ciliates

Maintaining Homeostasis for a Single Cell

1. Locomotion:
    a. Pseudopodia (false feet) amoeboid movement, also used for food gathering and defense
    b. Cilia (hair like) and flagella (whip like), also used for feeding, reproduction, respiration, excretion, and Osmoregulation
2. Nutrition/Digestion:
    a. Autotrophic = make their own food
    b. Heterotrophic = obtain food from other sources
        i. Phagotrophs = ingest solid particles of food
        ii. Osmotrophs = ingest food in a soluble form
3. Excretion/Osmoregulation:
    a. Excess water and some nitrogenous wastes are expelled by **contractile vacuoles**

4. Respiration:
    a. Respiration and most waste elimination are through the cellular membrane
5. Reproduction: (*All protozoa can reproduce asexually*)
    a. **Asexual Reproduction** (fission)
        i. Binary fission = one cell divides into two equal and identical cells
        ii. Schizogony = multiple divisions
        iii. Budding = unequal fission of cells
    b. **Sexual Reproduction**
        i. Syngamy = fertilization of a gamete by another, different gamete
        ii. Autogamy = fusion of nuclei from the same gametes to form a zygote within the same organism
        iii. Conjugation = the full or partial exchange of genetic material between two organisms, no offspring

<u>Life Cycles</u>

- Consist of active or vegetative phases and cyst phases (encystment)
- *Trophozoite* = the vegetative form of a protozoan
- Cyst = a resistant, quiescent (sleeping) stage in a cyst wall

II. <u>Phyla of Protozoa</u>

A. **<u>Phylum Sarcomastigophora</u>** (amoeboflagellates)

- Includes protozoa that move by flagella (Mastigophorans) and those that move by pseudopodia (Sarcodinans)

Subphylum Mastigophora (flagellates) *Ex. Euglena*
- Have one or more flagella, undulates
- Found in fresh and marine water
- Reproduce asexually by *longitudinal* binary fission
- important producers in marine communities
- some are photosynthetic
- have a **stigma**, or eyespot, a light sensitive receptor
- Pathogenic examples:
  Trichomonas vaginalis = genitourinary infections,
  Giardia lamblia = giardiasis, excreted in feces
  Trypanosoma brucei = causes African sleeping sickness, transmitted by the tsetse fly

Subphylum Sarcodina (amoebas)
- Move and feed by means of pseudopodia
- Some have protective shells called **tests**
- Found in fresh and marine water, moist soils
- Some are planktonic
- A few are parasitic, transmitted through feces
- Use cytoplasmic streaming to move
- Feed by **phagocytosis**
- Reproduce by binary fission and budding
- Pathogenic examples:
  Entamoeba histolytica = amoebic dysentery
  Acanthamoeba = causes blindness

Special Groups of Sarcodinans
Foraminiferans:
- Many chambered tests of calcium carbonate and
Radiolarians:
- Tests made of siliceous (glass) material

B. Phylum Ciliophora

- Move by cilia
- Found in fresh and marine water
- Most are free living, though some are commensalistic or parasitic
- Usually solitary and motile
- Are always multinucleated, possessing at least one *macronucleus* and one *micronucleus*:
    a) Macronuclei: metabolic and cellular functions
    b) Micronuclei: used for sexual reproduction
- **Pellicle**: thickened cell membrane or tough outer sheath
- Possess **cytostome** (cell mouth) and **cytopharynx** (gullet)
- Contractile vacuole typically present
- Reproduce by binary fission and sexual conjugation
    Ex. Paramecium

C. Phylum Apicomplexa

- Nonmotile, obligate intracellular parasites of animals
- Both asexual and sexual reproduction
- Very complex life cycles
- Multiple hosts, definitive hosts and intermediate hosts
- Some point develop spore (oocyst) which is infective for the next host
- Pathogenic examples:

- *Plasmodium vivax* = malaria
    - Grows by asexual reproduction in red blood cells and liver cells of humans
    - Sexual reproduction occurs in the *Anopheles* mosquito
- *Toxoplasma gondii* = toxoplasmosis

Ecological Relationships:

~ 10,000 species are symbiotic

Mutualism = both partners benefit

Commensalism = one partner benefits without affecting the other

Parasitism = one partner benefits at the expense of the other