Eucaryotic cells and microorganisms

External Structures
- Locomotor appendages
  - Flagella
    - Long, sheathed cylinder containing microtubules in a 9+2 arrangement
    - Covered by an extension of the cell membrane
    - 10X thicker than prokaryotic flagella
    - Function in motility
  - Cilia
    - Similar in overall structure to flagella, but shorter and more numerous
    - Found only on a single group of protozoa and certain animal cells
    - Function in motility, feeding, and filtering

Cell Wall
- Rigid to provide structural support & shape
- Fungi have thick inner layer of polysaccharide fibers composed of chitin or cellulose & a thin layer of mixed glycans
- Algae — varies in chemical composition; substances commonly found include cellulose, pectin, mannans, silicon dioxide, & calcium carbonate

Cell Membrane
- Bilayer of phospholipids and proteins
- Sterols confer stability
- Serve as selectively permeable barriers in transport
- Eucaryotic cells also contain membrane-bound organelles that account for 60-80% of their volume

Nucleus
- Compact sphere, most prominent organelle of eucaryotic cell
- Nuclear envelope is composed of two parallel membranes separated by a narrow space & is perforated with pores
- Contains chromosomes
- Nucleolus — dark area for rRNA synthesis & ribosome assembly
Nucleus

Mitochondria
- Consists of an outer membrane & an inner membrane with folds called cristae
- Cristae hold the enzymes & electron carriers of aerobic respiration
- Divide independently of cell
- Contain DNA and procaryotic ribosomes
- Function in energy production

Mitochondria

Chloroplast
- Found in algae & plant cells
- Outer membrane covers inner membrane folded into sacs, thylakoids, stacked into grana
- Larger than mitochondria
- Contain photosynthetic pigments
- Convert the energy of sunlight into chemical energy through photosynthesis
- Primary producers of organic nutrients for other organisms

Chloroplast

Cytoskeleton
- Flexible framework of proteins, microfilaments & microtubules form network throughout cytoplasm
- Involved in movement of cytoplasm, amoeboid movement, transport, & structural support

Cytoskeleton
Survey of Eucaryotic Microbes

- Fungi
- Algae
- Protozoa
- Parasitic helminths

Kingdom Fungi

- 100,000 species divided into 2 groups:
  - macroscopic fungi (mushrooms, puffballs, gill fungi)
  - microscopic fungi (molds, yeasts)
- Majority are unicellular or colonial, a few have cellular specialization

Microscopic Fungi

- Exist in 2 morphologies
  - yeast – round ovoid shape, asexual reproduction
  - hyphae – long filamentous fungi or molds
- Some exist in either form (dimorphic); characteristic of pathogens

Fungal Nutrition

- All are heterotrophic
- Majority are harmless saprobes living off dead plants & animals
- Some are parasites, living on the tissues of other organisms, but none are obligate
- Growth temperature 20°C-40°C
- Extremely widespread distribution in many habitats

Ribosomes

- Composed of rRNA and proteins
- 40S and 60S subunits form 80S ribosomes
- Larger than procaryotic ribosomes
- Function in protein synthesis
Nutritional sources for fungi

Roles of Fungi
- Decomposers of dead plants and animals
- Sources of antibiotics
- Used in making foods & in genetic studies
- Adverse impact – food spoilage, mycoses (infections), toxin production

Protista
- Algae
- Protozoa

Algae
- Photosynthetic organisms
- Kelps, seaweeds, Euglenids, green algae, diatoms, dinoflagellates, brown algae, & red seaweeds
- Contain chloroplasts with chlorophyll & other pigments, cell wall; may or may not have flagella
- Microscopic forms are unicellular, colonial, filamentous
- Macroscopic forms are colonial and multicellular
- Most are free-living in fresh and marine water

Algae
- Provide basis of food web in most aquatic habitats
- Produce large proportion of atmospheric O₂
- Used for cosmetics, food & medical products
- Dinoflagellates cause red tides & give off toxins
**Protozoa**
- 65,000 species
- Most are unicellular, colonies are rare
- Most have locomotor structures – flagella, cilia, or pseudopods
- Vary in shape
- Lack a cell wall & chloroplasts
- Can exist as trophozoite-motile feeding stage, or cyst – a dormant resistant stage

**Protozoa**
- All are heterotrophic
- Most are free-living in a moist habitat
- Food by engulfing other microbes & organic matter
- Some are animal parasites & can be spread by insect vectors
- Asexual and sexual reproduction

**Protozoan Identification**
- Classification is difficult because of diversity
- Simple grouping is based on method of motility, reproduction, and life cycle
  1. Mastigophora – primarily flagellar motility, some flagellar and ameboid; sexual reproduction
  2. Sarcodina – primarily amoeboid; asexual by fission; most are free-living
  3. Ciliophora – cilia; trophozoites and cysts; most are free-living, harmless
  4. Apicomplexa – motility is absent except male gametes; sexual and asexual reproduction; complex life cycles – all are parasitic

**Mastigophora – Flagellates**

**Sarcodina – Amoebas**
Ciliophora - Ciliates

- Contractile vacuoles
- Macronucleus
- Food vacuoles

(3) Power stroke
(4) Recovery stroke

Apicomplexa

- Macronucleus
- Contractile vacuole
- Macronucleus
- Food vacuole

Parasitic Helminths

- Multicellular animals, organs for reproduction, digestion, movement, protection
- Parasitize host tissues
- Have mouthparts for attachment to or digestion of host tissues
- Most have well-developed sex organs that produce eggs and sperm
- Fertilized eggs go through larval period in or out of host body

Major Groups of Helminths

- Flatworms - flat, no definite body cavity; digestive tract a blind pouch; simple excretory & nervous systems
- Cestodes (tapeworms)
- Trematodes or flukes, are flattened, nonsegmented worms with sucking mouthparts
- Nematodes (roundworms), round, a complete digestive tract, a protective surface cuticle, spines & hooks on mouth; excretory & nervous systems poorly developed

Parasitic Flatworms

Helminths

- 50 species parasitize humans
- Acquired through ingestion of larvae or eggs in food: from soil or water; some are carried by insect vectors
- Afflict billions of humans