Summary of Protists and Fungi

Archaezoa
- Lack mitochondria
- Three Phyla comprised of extant representatives of relict organisms
- Phylums: Diplomonada, Trichomonada, Microsporidia
- Mostly parasitic

Actinopoda – Radiolarians and Heliozoans
- Actinopods have a pseudopodia called an axopodia that is part of an ornate skeleton, which is mainly internal
- Most actinopods are planktonic
- Their projections place an extensive area of cellular surface in contact with the surrounding water, which helps the organism to feed and float
- There are two types of actinopods, the radiolarians which live in marine habitats, and the heliozoans which live in freshwater habitats

Ascomycota – Sac Fungi
- The Ascomycota are comprised of 32,300 different species, and they get their name from their unique, sexual reproductive structures, which are the asci and ascospores
- They are the molds that cause food spoilage, some yeasts, the edible morals and truffles
- They are used as antibiotics (penicilium), they are also used in genetic research, and they are also used to produce beverages through the fermentation of yeast
- Major characteristics: Hyphae: septate reproduction: budding, conidia (nonmotile spores), fragmentation; Sexual Spores: ascospore; Common Diseases: powdery mildew, brown rot of stone fruits. Dutch elm disease

Apicomplexa (Sporozoa) – Non-Motile Protists
- Parasites whose infectious stages have an apical complex of organelles that penetrate the host cell obtain nutrients by absorption from host
- Intricate life cycles with both sexual and asexual reproduction, which often require two or more different host species for completion
- They disseminate as tiny infectious cells called sporozoites, with the apex end having the complex end of organelles that are used to penetrate the host cells and tissues
- Plasmodium, which is the parasite that causes malaria, is an apicomplexa

Bacillariophyta – Diatoms
- Diatoms have unique glasslike walls consisting of hydrated silica embedded in an organic matrix, with each wall having two parts (frustules) that overlap
- They live in freshwater and marine environments, about 6000 – 10,000 species, abundant fossils (diatomaceous earth)
- Diatoms are photosynthetic, and the pigments include chlorophyll a, fucoxanthins and carotenes
- They store food in the form of a glucose polymer called laminarin, or they may also store food in the form of leucosin which is an oil
Basidiomycota – Club Fungi
- The basidiomycota consists of about 25,000 species, they all have a transient diploid stage in the organism's life, and they all have a club-like shape
- They have a fruiting body called a basidiocarp, which produces the basidia that is the mushroom shape we recognize
- They are important decomposers of wood and other plant material, they also make mycorrhizae
- The basidia are the sources of sexual spores, with asexual reproduction being much less common compared to ascomycetes

Chlorophyta – Green Algae
- Scientists believe that green algae are the direct links to plants, and that they derived from a common ancestor, due to their similarities such as pigment (chlorophyll a and b, carotenoids)
- There are 7000 species of green algae, they mostly live in fresh water, but they also live in marine waters, as well as on land
- Three separate evolutionary trends probably produced the diverse forms of the green algae: 1) formation of colonies of individual cells (Volvox); 2) repeated division of nuclei with no cytoplasmic division, as seen in multinucleate filaments (Caulerpa); 3) the formation of true multinucleate form (Ulva)
- Reproduction is both sexual and asexual, with nearly all reproducing sexually by way of biflagellated gametes that have cup-shaped chloroplasts

Chytridiomycota – Water Molds
- The chytrids are the most primitive of the fungi, which are predominantly an aquatic group, consisting of about 790 species
- Motile cells (zoospores and gametes), which have a single, posterior, whiplash flagellum (only fungi with flagellum)
- Some parasitize protists, plants or invertebrate animals
- Major characteristics: Hyphae: aseptate, coenocytic; Reproduction: zoospores; Sexual Spores: none; Common diseases: brown spot of corn, black wart of potato

Ciliophora – Ciliated Protists
- Ciliophora are characterized by their ability to use cilia to move and feed, and the cilia are moved by a sub-membrane system of microtubules
- A unique feature of ciliates is the presence of two types of nuclei, a large macronucleus and usually several tiny micronuclei
- They usually reproduce by binary fission, during which the macronucleus elongates and splits rather than divides, at the time the genes get shuffled around and the process is called conjugation
- They are predators who feed by moving their cilia around and get the food to flow into their gullet

Deuteromycota – Fungi Imperfecti
- They reproduce asexually by producing spores, not all sexual structures have been found for the members of this group
- Some members of this group are predators who consume small worms and parasites
- Some of the members are used as sources of antibiotics
- Main habitat is terrestrial and in most cases in soil
Dictyosteliomycota (Acrasiomycota) – Cellular slime molds
- The cells of cellular slime molds maintain their identity and remain separated by their membranes
- They are haploid organisms, except in the zygote stage of their life
- They have fruiting bodies that function in asexual reproduction
- Most cellular slime molds have no flagellated stages

Dinophyta (Pyrrophyta) – Dinoflagellates
- They are an abundant component of vast aquatic pastures of phytoplankton that float near the water surface and provide the foundation of most marine and many freshwater food chains
- Most dinoflagellates are unicellular, but some are colonial forms
- Each dinoflagellate species has a characteristic shape reinforced by internal plates of cellulose, with two flagella in the perpendicular grooves, and that produces a spinning movement
- Two flagella in grooves in the periplast, formed by cellulose plates (which are very distinctive in micrographs)
- These guys are responsible for the disease red tide, which occurs during their blooming season, this releases their toxins which can be fatal to humans

Euglenophyta – Photosynthetic Flagellates
- They are characterized by an anterior pocket from which one or two flagella emerge
- They also have a glucose polymer called paramylum, which is used as a storage molecule
- Most are autotrophic, but some are mixotrophic, because they absorb molecules from their surroundings
- They engulf prey by phagocytosis

Foraminifera – Forams
- They are almost all marine species that live in the sand or attach themselves to rocks and algae, but some are also abundant in plankton
- They are named for their porous shells, which are generally multi-chambered and consist of hardened calcareous shells
- They are now 90% fossils which make up huge land formation, such as chalk cliffs, and they are also used as tracers for oil deposits
- They have strands of cytoplasm that extend through the pores, which function in swimming, shell formation, and feeding

Kinetoplastida – Heterotrophic Flagellates
- Their unique feature is a single large mitochondrion, which is associated with a unique organelle
- They are symbiotic and some are pathogenic to their hosts
- Helps to digest cellulose with its endobacteria
- One disease which they cause is African sleeping sickness
Lichens
- Lichens are usually mistaken for mosses or other simple plants, but they are actually a symbiotic association of millions of photosynthetic microorganisms held in a mesh of fungal hyphae.
- The photosynthetic partners are usually green algae or cyanobacteria.
- Over 25,000 different lichens have been described, with the fungus accounting for its shape and its mass.
- The fungus reproduces by sexual division, while the algae reproduces asexually, and sometimes they have soredia which is small clusters of haphae with embedded algae in it.

Myxomycota – Plasmodial slime molds
- The plasmodium of myxomycota is a single mass of cytoplasm undivided by membranes and containing many nuclei.
- In most species the nuclei of the plasmodium are diploid and divisions are synchronous, with thousands of nuclei going through each phase of mitosis at the same time.
- They are all heterotrophic, they engulf their food by the process of phagocytosis.
- If the environment becomes unfavorable, the slime mold will cease growth and differentiates into a stage of the life cycle that functions in sexual reproduction.

Oomycota – Egg Fungi
- They are heterotrophic stramenopiles that lack chloroplasts.
- Some organisms are unicellular, while others consist of coenocytic hyphae, they all have cell walls made of cellulose.
- They are motile, with some having two flagella, which may encyst.
- They are decomposers that grow as cottony masses on dead algae and animal, they are also important decomposers in aquatic environments.

Phaeophyta – Brown Algae or Kelps
- They are the largest and most complex algae, with all being multicellular, and most being marine.
- Their brown olive color is due to the accessory pigments of chloroplast which is similar to that of diatoms.
- They live in marine tidal zones to 75 feet deep in temperate waters, and can grown to sizes of 100 feet, they prefer cool temperate coasts.
- They have many functions, such as food thickeners, lubricants for drilling, and as agar which is a gel forming base.

Rhizopoda – Amoebas
- They are all unicellular and use pseudopodia to move and feed.
- The cytoskeleton which consist of microtubules and microfilaments also functions in amoeboid movement.
- They reproduce asexually by various mechanisms or cell divisions.
- Amoebas inhabit both freshwater and marine environments, and some even live in soils.
Rhodophyta – Red Algae
- They have no flagellated cells in their life cycles, it’s believed that they lost their flagella during their evolution
- Their reddish color comes from the pigments known as phycobilins, but not all rhodophyta are red, some are purple or black
- Most red algae live in warm coastal waters of the tropical oceans, but there are also some freshwater as well as soil species, with sizes up to three feet, and can live up to depths of 260 M
- They have no flagella so they depend on water currents to get together, they usually have alternation of generations

Amoeba-Like Protists (Sarcodina)
- They are mostly free living, heterotrophic amoebas
- They move by using their pseudopodia, as well as using it to eat (through the process of phagocytosis)
- They are asexual organisms, who secrete shells

Zygomycota – Bread Molds
- There are about 600 zygomycotes, living in mostly terrestrial areas such as soil, decaying plants and decaying animals
- Their hyphae are coenocytic with septa found only where reproductive cells are formed, the name of this division comes from the zygosporangia
- When the environment is bad the zygosporangia formed are resistant to freezing and drying and are metabolically inactive, but once the environment becomes favorable the zygosporangia releases haploid cells that colonize the new substrate
- Some zygomycotes can actually aim their spores