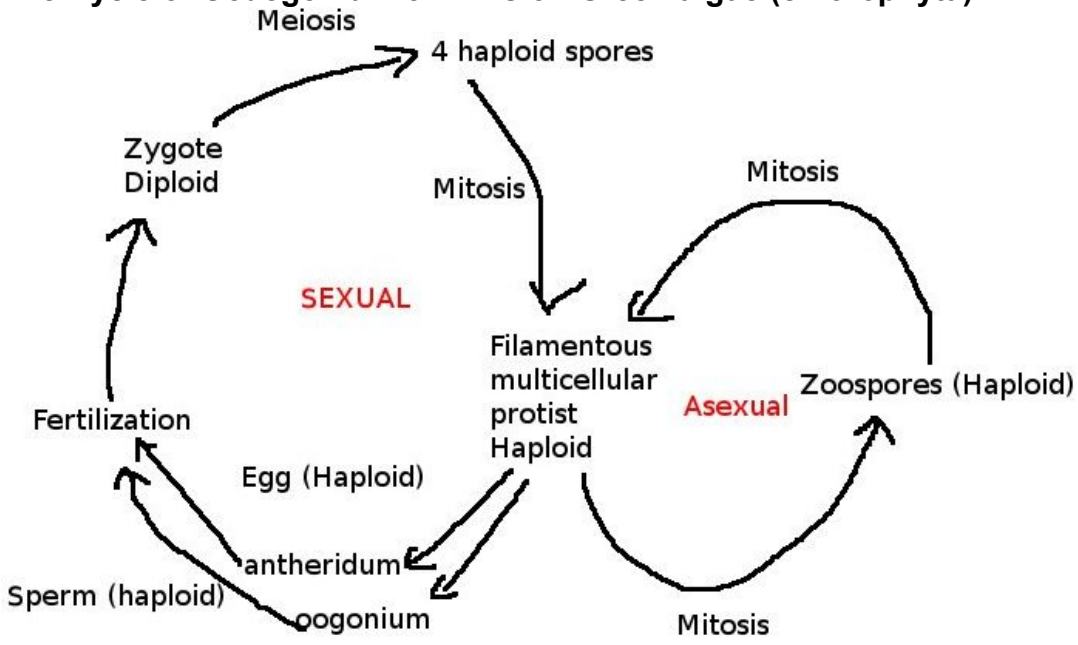
Lab 2 – Bacteria, Protists, and Fungi

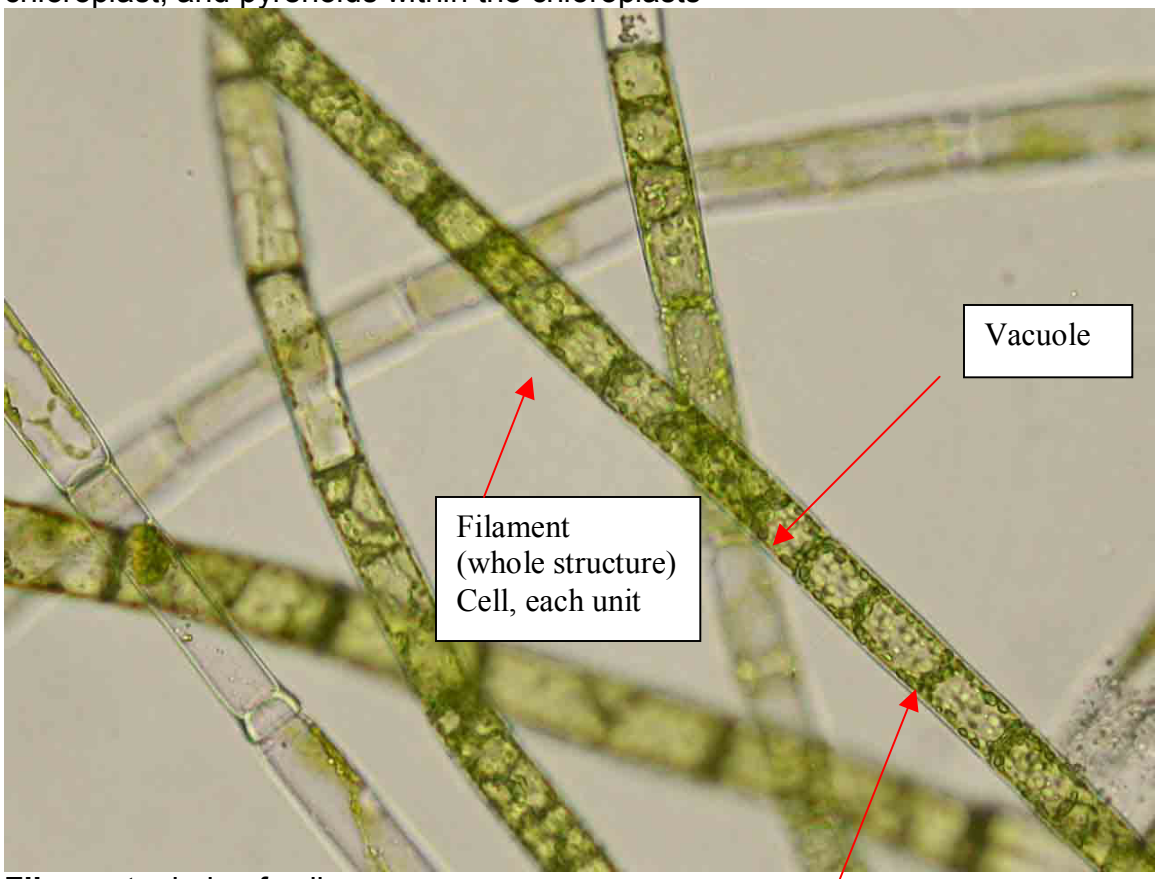
Bacteria: Lack nucleus and membrane bounded organelles, less than 10 micrometers in size
Spirillum volutans: Large species visible under low power, curved rod shape
Coccus: (Coccnut is spherical), spherical, appear singly, chains or clusters
Bacillus: (Bat is a rod), rod shaped, singly, chains, but no clusters
Spirillum: spirally curved rods. Occur singly, chains, or clusters
Algae: A group of photosynthetic protists, unicellular or multicellular, form basic link in food chain. Important food sources and useful research organisms
Common characteristics of algae:

1) presence of chlorophyll a
2) single celled reproductive structures (Oogonium rather than archegonium)
3) no roots, stems, or leaves

Phytoplankton: microscopic floating algae, produce 50% of world's oxygen and involved in water pollultion
Low O2 in lake: Excess nutrients run off to lakes, river etc.. Algae boom on those nutrients. When the algae die, O2 is required to decompose them. The O2 will be taken from water, and thus suffocating the aquatic organisms etc..
Mitosis: 2 daughter cells, with same number of chromosomes as the parent
Meiosis: 4 daughter cells, with half the number of chromosomes as the parent
Haploid: single set of chromosomes, produced by haploid → mitosis or diploid → meiosis
Diploid: double set of chromosomes, produced by diploid → mitosis
Ploidy: Number of chromosomes sets, when asked for ploidy, say diploid or haploid
Life Cycle of Oedegonium of Division Green algae (chlorophyta)



Vegetative Structure of oedegonium: More advanced than phytoplanktons due to multicellular organization in the form of unbranched chain of cells called a filament. (Unbranched filament, one of the simplest form of multicellular organization in Protists) Each cell undifferentiated. Each has a nucleus, a net like chloroplast, and pyrenoids within the chloroplasts



Filament: chain of cells

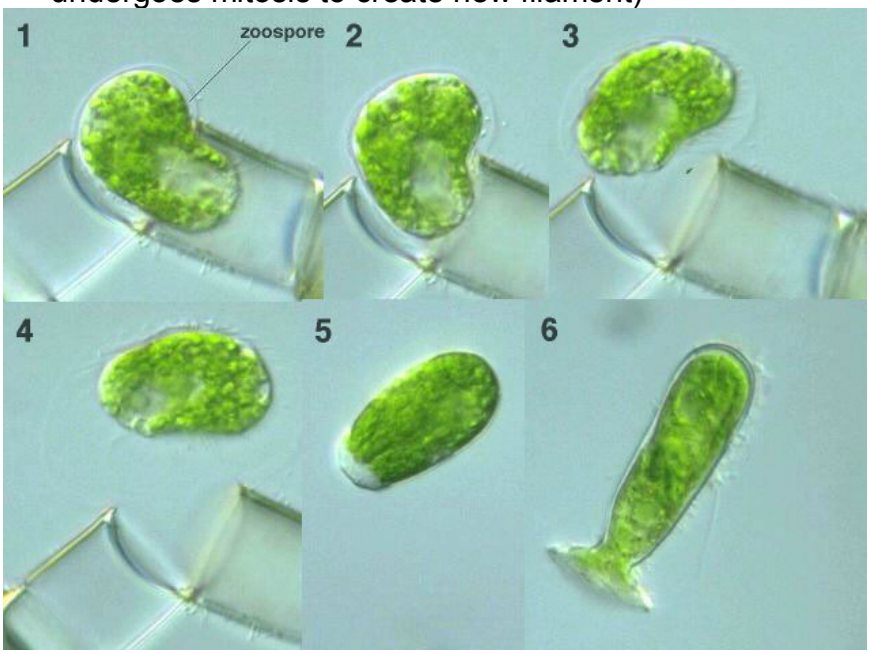
Advanced Multicellular organization (Protists):

a) Branched filament
b) Parenchymatous thallus (an undifferentiated body (unspecalized) that is usually flat and prostrate

<u>Asexual reproduction:</u>

- Filament increases in length through mitotic division, # of cell divisions undergone by one cell = # of apical caps in the filament (here is how it works, each zoospore (cell) undergoes mitosis to create a filament, # of apical caps in the entire filament = how many times that original cell undergoes mitosis. Apical caps are located at the apex.)

- New filaments are produced by the production of multiflagellated zoospores from old filaments (detailed process: contents of a cell on a filament round up and give rise to zoospore, old wall breaks and zoospores pops up and swim, then it settles down, lose flagella and undergoes mitosis to create new filament)



Sexual Reproduction:

Oogamous: a type of sexual reproduction with large non motile eggs and small multiflagellated sperms

Homothallic: Filaments are homothallic if anteridium and oogonium on the same filament
Heterothallic: Filaments are heterothallic if the two sexual structures are on separate filaments
Sexual process:

- At sexual maturity, cells along the filament at regular intervals enlarge to form oogonia or antheridium. In homothallic filaments, the oogonia and antheridium would alternate between each other.
- Sperm travels to the egg, enter through pore in the wall and fuses with the egg
- Fertilization results in a diploid zygote
- Zygote matures, undergoes meiosis to produce 4 haploid spores that develop into new filaments
- On heterothallic filaments, two of the zoospores form male filaments and other two form female filaments
- This 2:2 segregation of sexes indicate that there is a single pair of genes that control sex determination

Zygotic meiosis and **Haploid vegetative phase**

Chlorophyll a and algal biomass: chlorophyll a is often measured to get an idea of the total phytoplankton abundance because it can be easily measured. Chlorophyll a α algal biomass.

Transmittance: Amount of light that passes through a solution
Absorbance: amount of light that does not pass through a solution
Transmittance + absorbance = 100%
Blank solution: Used to zero the spectrophotometer because substances other than the solution been tested will affect transmittance and absorbance.
Food vacuole: In unicellular organisms, this is the organelle that is responsible for digestion
Pseudopods: "False feets", they are extensions of the body that the cytoplasm flows in to create locomotion in the amoeboid forms.
Amoeba: live in freshwater, marine, moist soils, and as symbionts or parasites in the digestive tract of larger animals. Most are around 300 micrometers in size
Plasmalemma: Thin, external plasma membrane surrounding the whole cell. Gas exchange takes place here.
Ectoplasm: a think layer of cytoplasm near the surface of the cell
Endoplasm: the inner, rougher portion of the cytoplasm
Plasmagel: Outer portion of the endoplasm, gel state
Plasmasol: Inner portion of the endoplasm, form the central mass of the amoeba, it is in a fluid state
Plasmalemma→ectoplasm → plasmagel → plasmasol
Nucleus: disc shaped and densely packed with chromatin
Contractile vacuole: Clear, pulsating organelle that slowly contracts and expands (like a slow beating heart) Take water and dissolved metabolic wastes from the cytoplasm and release them outside the cell.

Food vacuole: contains digestive enzymes, digest food using them.
Phagocytosis: a form of endocytosis, describe the method that the food is taken up inside the cell by the plasma membrane.
Amoeba locomotion: Locomotion caused by transformations of the cytoplasm between states of solid and fluid. A portion of the plasmagel weakens, other parts of the plasmagel slightly contracts, this forces plasmasol in and forming a pesudopod. The posterior portion (the one opposite the forming pseudopods) also transforms from plasmagel to plasmasol to allow a forward flow. Distant parts (distal) of the pseudopod convert from plasmasol to plasmagel to give shape and form to the newly formed extension.

Ciliates: 1) Body has a definite shape (due to pellicle) and locomotion is achieved by cilia.
Pellicle: Clear, elastic, and thin layer under the membrane that give rigidity to the owner. Formed from closely packed sacs called alveoli. Gas exchange takes place here
Cilia: Fine hair like extensions from the cytoplasm, used for locomotion.
Trichocysts: Hair enclosed in small capsules under the pellicle. Used for anchorage, defense and immobilizing their prey
Oral Groove: Groove on the side of the organism used for ingesting food
Gullet: tube after the oral groove where food is packaged in vacuoles for journey in the cytoplasm. The inner membrane of the gullet is haired to facilitate movement.
Cytostome: base of the gullet
Food vacuole and pH: Red yeasts will change to blue at pH of 3. As the hydrochloric acid and other enzymes are dumped into the food surrounded in the food vacuole, the red yeast turns blue (indicate low pH) and turns back to red when it is finished been digested.
Cytoproct: Pore in the pellicle used for excretion of wastes, located at the posterior end of the paramecium.
Anterior vs Posterior: anterior is more rounded in shape and oral groove face this direction. Posterior is more sharp.
Contracile vacuoles: Two in the paramercium, one at each side of the organism. Looks like large, clear bubbles with radiating canals inside. They eliminate excess water and dissolved metabolic waste by temporarily fusing with the pellicle and the plasma membrane.
Macronucleus: Large of the two nucleus in a paramecium, used to control cellular activities.
Micronucleus: Smaller of the two, used for conjugation (sex without reproduction immediately after)
Key characteristic of fungi: No chlorophyll, which means it cannot photosynthesis to provide its own food
How fungi eat: either saporphytically, or parasitically
Saprophytically: Feeding on dead organisms.
Parasitically: Living and feeding on living organism.
Coenocytic: Many nuclei within a common cytoplasm

Fungi structure: could be unicellular, coenocytic, or multicellular structures made of masses of filaments
Hypha: a single filament
Septa: Cross walls that divides the filament incompletely. Exception is when septa divides the gametangia.
Mycelium: All the hyphae of a single organism, mycelium looks the same but the reproductive structures are different enough to allow us to distinguish between different species. (i.e. mushrooms)
Rhizopus: Common black bread mold, part of zygomycota
Vegetative structure:

- **Stolons** horizontally oriented hyphae that cover the substrate.
- **Rhizoids:** root like hyphae that penetrate the substrate and act in anchorage and absorption.

Asexual reproduction:

- Reproduce asexually by the means of **non-motile spores**
- No fruiting structure
- Spores are born on **sporangia** (structure that produce spores) that are borne on stalk like **sporangiophores** that grow from the stolon.
- Walls of the sporangium breaks down, the spores are released and dispersed by air currents to new places

Sexual Reproduction:

- Requires two heterothallic strains (two different mating types, the hypha looks like but the hypha could tell it apart during sexual reproduction) but some species could do it with a homothallic strain
- Started with the forming of lateral hyphal outgrowths that enlarge to form **progametangia**
- Septa divides the progametangia from the rest of the hypha, resulting in a **gametangia,** these gametangia contains many nuclei (multinucleate)
- Gametangias fuse, resulting in a multinucleate **zygosporangium**
- Haploid nuclei fuses, producing a single zygospore inside the zygosporangium that has multiple diploid nuclei. This zygospore is different from other spores by having a multiple nuclei within it
- Zygospore geminates after a period of dormancy
- Nuclei undergoes meiosis and zygosporangium opens to allow haploid sporangiophore to emerge carrying haploid spores.

Lichens:

- **Symbiotic (**Fungus provides water and mineral in exchange for carbohydrates) organism composed of a fungus and a photosynthetic partner such as green alga and/or cyanobacteria.
- Usually four layers, 1) surface layer made up of heavily gelatinized fungal hyphae 2) Photosynthetic layer made up of hyphae filaments interwoven with photosyntheric partner 3) Loose hyphae 4) bottom layer of more fungal hyphae that have projections (i.e. rhizoids) that attach the entire lichen structure to the substrate
- Extremely sensitive to air pollution, this in cities, there are less lichens. In this way, they can be considered as bioindicators of air quality.

Soredia: asexual reproductive structures made from cyanbacteria/algae clustered with fungal hyphae

Slides to look at:
Paramecium
Amoeba
Rhizopus sexual reproduction