Protist Diversity

**PPE is not required for this lab, but you may want to bring a pair of gloves. You will require your text book Biological Science during this lab**

Learning Objectives
Building on the learning objectives from your lab syllabus, you will be expected to:
1. Recognize and identify (to genus) the organisms covered in lab; make sure to pay careful attention to form and function.
2. Describe the characteristics of each organism by recognizing the anatomical diversity of the model organisms in this lab.
3. Correctly classify the organisms.

Pre-lab Activity
Using the information in your textbook Biological Science 6th edition by Freeman, answer the following questions BEFORE coming to lab.

1. Review the taxonomy and classification of life from Chapter 1 (pg 8) and Chapter 25. In the space below, write the classification scheme, starting with domain, which is commonly recognized today. In this explanation, make sure to define the terms monophyletic, paraphyletic, and polyphyletic.

2. The protists are an extremely diverse eukaryotic group, varying greatly in their morphology, motility, feeding strategy, and life cycle. Protists, as called, are a paraphyletic grouping, with various members being more closely related to plants, animals or fungi than they are to other protists. However, thanks to our emerging techniques and technology, phyla and other classification has been recognized.

How did this diversity arise? Biologists agree, based on morphological and rRNA sequences, that events such as primary and secondary endosymbiosis, were critical. Using your text (pgs. 546-548 may help), diagram primary and secondary endosymbiosis events in the space below.
Introduction
Many of the organisms you will see in today’s lab will be viewed as living cultures. As you observe these specimens, make careful notes about their morphology (structure, shape, color, etc.) and motility (or lack of motility).

Activity 1: Lineage Plantae: Phylum Chlorophyta: “Green Algae”
The "green algae" is the most diverse group of algae, with more than 7000 species growing in a variety of habitats. The "green algae" is a paraphyletic group because it does not include any individuals from Kingdom Plantae. However, the do share some similarities with green plants: 2 forms of chlorophyll, which they use to photosynthesize, but unlike plants, they are primarily aquatic.

- Make a wet mount of *Chlamydomonas*. (You may need to add Protoslo to your slide) Are these organisms single-celled, colonial, or multicellular? ________________________________

  Are the cells moving? If so, can you determine the source of the movement? ________________________________

Diagram/Draw what *Chlamydomonas* looks like in the space below:

10x 40x

- Make a wet mount of *Volvox* using a depression slide (you also have a prepared slide of this genus). Organisms in this genus are colonial, composed of a loose association of many individual cells. *Volvox* is capable of both sexual and asexual reproduction. Make note of the daughter colonies that may be contained within the parent colonies. These daughter colonies are a product of asexual reproduction.

  What color are the cells in the living culture? ________________________________ Why? ________________________________

  Are the colonies moving? ________________________________ How? ________________________________

Diagram/Draw the *Volvox* in your field of view:

4x 10x

How does the living specimen compare with the prepared slide? ________________________________
• Make a wet mount of Spirogyra. Organisms in this genus are filamentous, with individual cells joined together in long strands. Note the arrangement of the chloroplasts within the cells. How do you think this genus got its name?  

• Observe the prepared slide of Spirogyra. This slide displays a sexual reproductive process known as conjugation. This process involves the joining of two haploid filaments by a conjugation tube, followed by movement of the one cell’s contents to the other cell. The nuclei then fuse to form a diploid zygote, which will eventually undergo meiosis to produce new daughter cells.

• Draw/Diagram Spirogyra in your field of view.

• Observe the preserved specimens of Ulva, commonly known as sea lettuce. Is this organism single-celled, colonial, or multicellular?  

• Diagram/Draw what you observe from the preserved specimen.

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**Activity 2: Lineage Plantae: Phylum Rhodophyta: Red Algae**

Most red algae are photosynthetic marine species. The name of this group comes from the presence of an accessory pigment called phycoerythrin.

• Observe the preserved specimen of Chondrus, or Irish Moss. Note the coloration. Is this organism single-celled, colonial, or multicellular?  

• Diagram/Draw what you observe from the preserved specimen.
Activity 3: Lineage Stramenopila: Phylum Ochrophyta
Brown Algae (Class Phaeophyta)
The brown algae are a photosynthetic group that includes the ecologically important kelp species. Common pigments are chlorophyll a and c as well as fucoxanthin.

- Observe the preserved specimens of Fucus (rockweed) and Nereocystis (bull kelp). Are these species single-celled, colonial, or multicellular?
- Many brown algae have a morphology that includes leaf-like blades, a stem-like stipe, and root-like holdfasts. Look for these structures on the preserved specimens. Air bladders may also be present. In the space below, diagram/draw what you observe from the preserved specimen. Make sure to label these structures. What do you think the function of these structures would be?

Diatoms (Class Bacillariophyta)
Diatoms are a photosynthetic group of organisms that have “glassy” cell walls composed of silica compounds. As a major component of aquatic phytoplankton, these organisms are an important food source for other organisms. The silica-based cell walls of dead diatoms accumulate in layers that can be mined as diatomaceous earth, which is used in many products including cleaning agents and as a pesticide.

- Observe the prepared slide of diatoms. Note the many different shapes and sizes. Draw/Diagram the cells you observe in your field of view.
Activity 4: Lineage Excavata: Phylum Euglenozoa: Euglenoids

Euglenoids can be either autotrophic or heterotrophic. Some have a flexible outer covering that allows them to change shape as they move.

- Make a wet mount of *Euglena* (you may need to add Protoslo). Are these organisms single-celled, colonial, or multicellular? ________________________________

- Diagram/Draw what your specimen looks like in the field of view:

  ![10x Image](10x.png) ![40x Image](40x.png)

What color are the cells? ________________________________
Do you think this species is autotrophic or heterotrophic? ________________________________
Are the cells moving? If so, can you determine the source of the movement? ________________________________

Activity 5: Lineage Alveolata: Phylum Ciliophora: Ciliates

The ciliates get their name from the many cilia that line their cell surfaces. These structures are used in motility or in feeding (they can create water currents that sweep food particles into a mouth-like oral groove). The ciliates are heterotrophic via ingestion.

Make a wet mount of *Paramecium caudatum* (you may need to add Protoslo). First, observe the organisms under the 10x objective lens and note the pattern of movement. Second, increase the magnification to 40x. Can you see the cilia present along the cell surface? ________________________________

Draw/Diagram the cells you observe.

![10x Image](10x.png) ![40x Image](40x.png)

- Are these organisms single-celled, colonial, or multicellular? ________________________________

Note the lack of pigments in these organisms. Why aren’t pigments present? ________________________________
Describe two advantages why a heterotrophic organism needs to be motile.
1) __________________________________________
2) __________________________________________
Make a wet mount of the second *Paramecium* culture (*Paramecium bursaria*) (you may need to add Protoslo). First, observe the organisms under the 10x objective lens and note the pattern of movement. Second, increase the magnification to 40x.

Can you see the cilia present along the cell surface? _________________________________________

Draw/Diagram the cells you observe.

![10x][40x]

How is this culture different from the first Paramecium? What does this difference suggest? ________
____________________________________________________________________________________
____________________________________________________________________________________

**Activity 6: Lineage Amoebozoa: Phylum Amoebozoa: Amoebozoans**

Like the ciliates, amoebas are heterotrophic via ingestion, but their method of motility is different. Amoebas lack cilia and move via cytoplasmic extensions called **pseudopodia** (“false feet”). This crawling type of movement is called **amoeboid motion**. When an amoeba encounters prey, the pseudopodia surround the prey item and the cell engulfs the prey via endocytosis.

- Observe the demo slide of the amoeba *Chaos*. (Or make your own wet mount if specimens are available). Using the 4x objective lens, observe the crawling motion of the cells. Prey organisms are also present in the culture medium. Watch closely and you may be able to see the amoebas feeding. Diagram/draw what you observe.

![4x][10x]

Are these organisms single-celled, colonial, or multicellular? _________________________________________
Post-Lab Activity

Protist Review. Answer the following questions. You may be asked to submit these for a grade.

1. Observe the prepared slide of mixed protozoa in your slide box. Based on your observations today, what organisms can you identify from this slide? List them here.

2. Of all the protists you have observed today, which organisms are autotrophic? Which are heterotrophic?

3. Which organisms move by flagella? cilia? pseudopodia? Which organism are nonmotile?

4. Which organisms are single-celled? colonial? multicellular?

5. Which organisms represent a primary endosymbiosis event? A secondary endosymbiosis event?