

The Cell

Objectives:

The student should be able to:

1. Describe a typical plant cell.
2. Describe a typical animal cell and be able to differentiate it from a plant cell.
3. Describe the three main shapes of bacterial cells.
4. Differentiate a prokaryotic cell from a eukaryotic cell.

Key terms:

- a. animal cell
- b. bacteria
- c. bacillus
- d. cell membrane
- e. cell wall
- f. chloroplast
- g. cilia
- h. coccus
- i. colony
- j. cyanobacteria
- k. diatom
- l. eukaryote
- m. flagellum
- n. green algae
- o. hyphae
- p. mycelium
- q. nucleus
- r. nucleolus
- s. prokaryote
- t. pseudopodia
- u. protozoa
- v. spirilla
- w. sporangium
- x. vacuole
- y. zygospor

Cells are the smallest, most basic unit of life in the same way that an atom is the smallest unit of an element. In today's laboratory we will examine cells of each of five main groups: bacteria, single-celled eukaryotic organisms (generally referred to as protists), fungi (mushrooms and molds), plants (represented by Elodea) and animals (represented by your cheek cells). It should be noted that these are general groups of organisms rather than taxonomically correct classifications.

Most cells are microscopic and the cells that we will examine today will be studied with the use of the microscope but all cells are not microscopic. The yolk of the egg is an individual cell and it can certainly be studied without the microscope. During your work today, you will learn to distinguish each type of cell from other related types. Most cells share many organelles but in each cell type there are major differences of form and function. In this laboratory we will begin to examine the structure of cells and to compare and contrast cell types.

You will be doing drawings of the cells you observe today. **You must correctly identify each cell type, record the total magnification used and calculate the approximate size of the cell. This data must be recorded next to each drawing you do.**

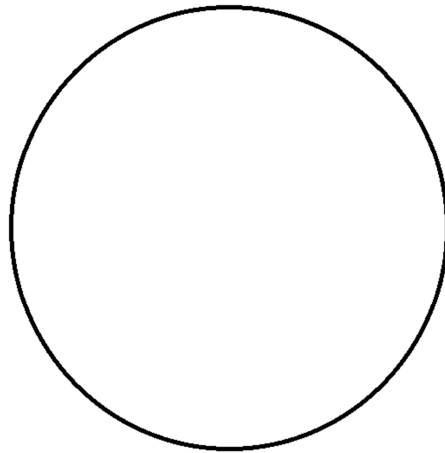
Prokaryotic Cells

Two large groups of organisms are composed of prokaryotic cells - Bacteria and Archaea. Prokaryotic cells are very small (.5-5 um) and are much less complex than eukaryotic cells. They are found as unicellular organisms, although they may appear in colonies, in bunches or strings of cells. The bacteria that we will look at today include various forms: cocci, bacilli and spirilla. Some of these may be presented on prepared slides. Note that observed cell structure is not discernible with the techniques that you will be using today. Cell walls and capsules will be seen with stains. Remember that bacteria are very simple life forms but are ubiquitous and extremely important. Bacteria play a major role in decomposition of organic material, in disease as well as antibiotic production.

The bacteria that you will examine is found in yogurt with live cultures of bacteria. The bacteria commonly used are *Streptococcus thermophilus*, which ferments the sugar lactose and *Lactobacillus bulgaricus* which produces the flavors and aroma of yogurt.

Prepare a slide of yogurt culture:

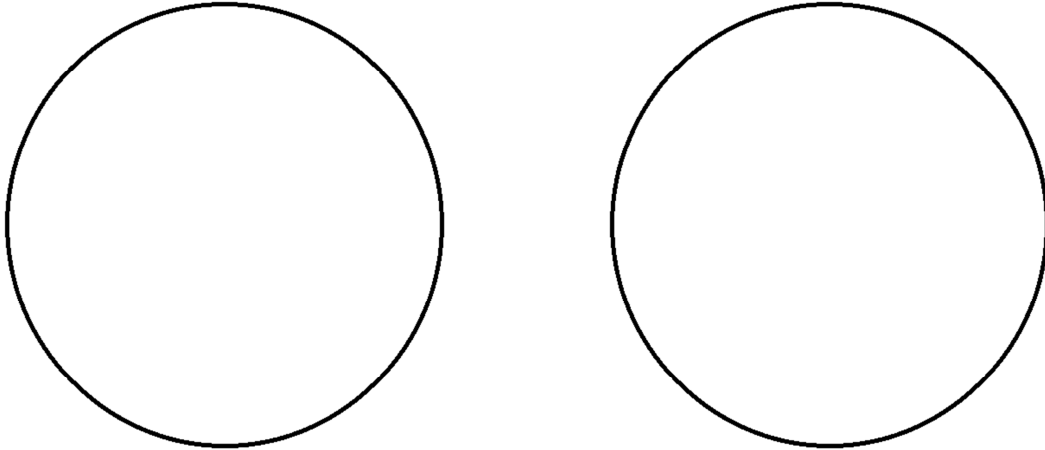
1. Obtain a slide and cover slip. With a bacterial loop or a toothpick transfer a small amount of yogurt to the center of the slide.
2. Smear the yogurt in an area slightly smaller than the cover slip. Allow it to dry.
3. Place two drops of crystal violet or carbol-fuchsin stain on the air-dried yogurt smear.
4. Place a coverslip on the stained smear and examine under the microscope.
5. Draw the observed bacterial types.



Cyanobacteria are photosynthetic bacteria. Cyanobacteria are found in aquatic environments as well as in damp, terrestrial environments. They exist largely as colonies and filaments and produce spores that resist desiccation. They generally have gelatinous capsules that are often toxic and are not a normal food source for heterotrophs.

You may be using prepared slides or using fresh cultures of these organisms. A few cyanobacteria are *Anabaena*, *Gloeocapsa*, *Oscillatoria* and *Merismopedia*. Your instructor may provide a survey culture of various organisms to key out and to examine.

Draw and label several representatives of cyanobacteria.

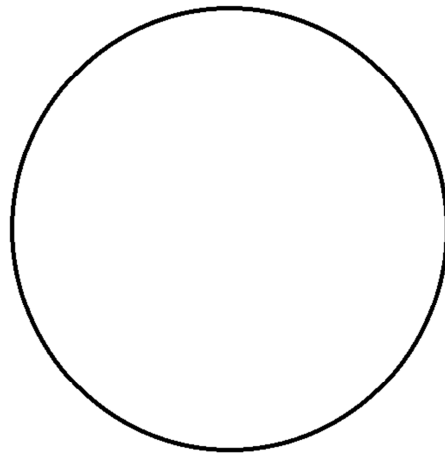
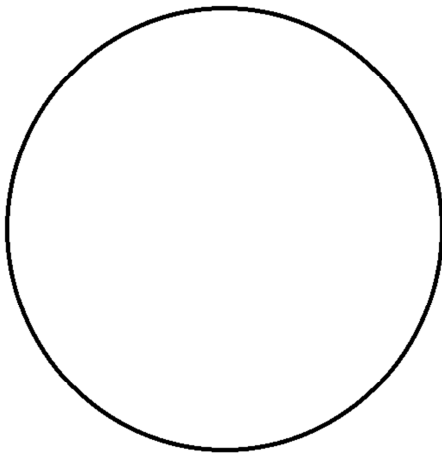
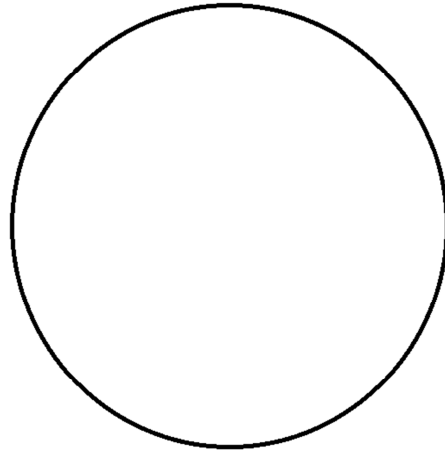
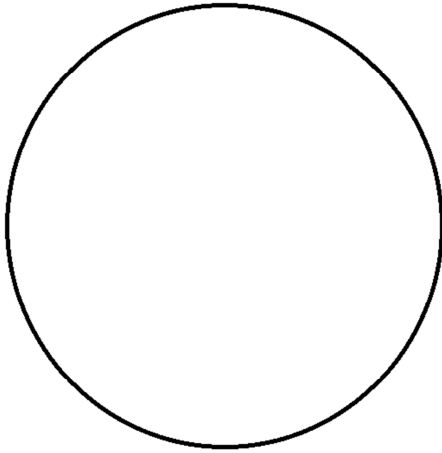


Eukaryotes

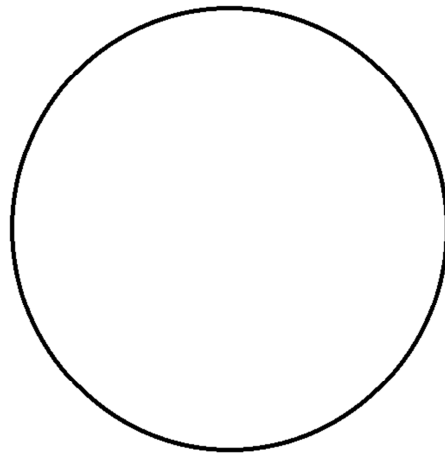
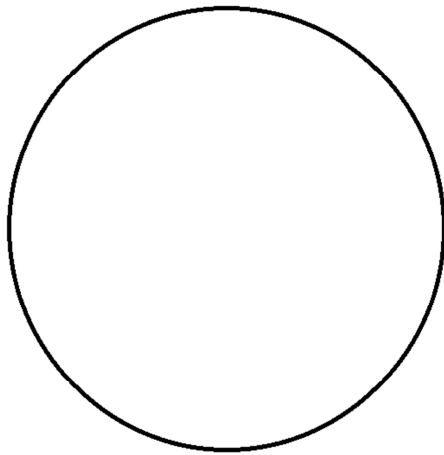
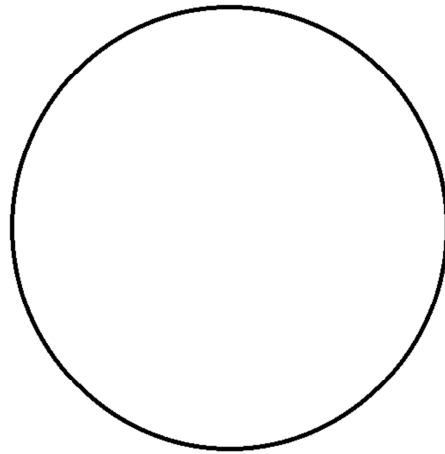
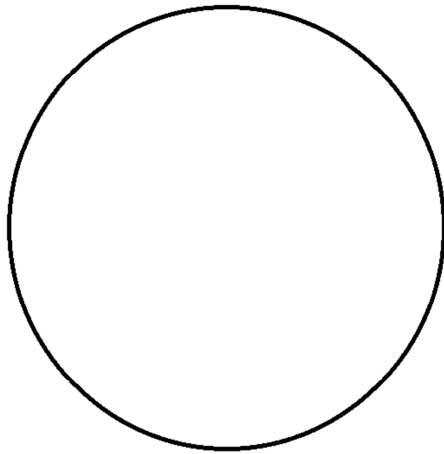
Eukaryotes include many single-celled organisms, fungi, plants and animals. The characteristic that sets them apart from prokaryotes is the presence of a nucleus. Many other organelles are often present such as mitochondria (cell respiration) and chloroplasts (photosynthesis in plant cells.) The cells tend to be larger by at least a factor of 10 when compared to bacteria. Compartmentalization of various cellular processes characterizes eukaryotes.

Protists (single-celled eukaryotes): includes photosynthetic members - algae - and heterotrophic single-celled organisms called protozoans as well as some fungi-like protists. Protists are a food source for many organisms and comprise the base of the food chain. To examine algae we will use the green survey mixture in which a number of algae will be included. Note that algae cells have a cell wall made of cellulose. The plasma membrane is contiguous with the wall and will not be observed. These cells will also probably have visible chloroplasts, some of which will be oval, round or spiral shaped. Much of the algae are either filamentous or colonial. While diagrams of a number of cell types with organelles are included in this lab, often the organelles will not be readily observed. Also note that the algae survey mixtures often contain cyanobacteria which are classified as Bacteria.

Identify and draw at least four algae representatives. Calculate cell size of each alga.



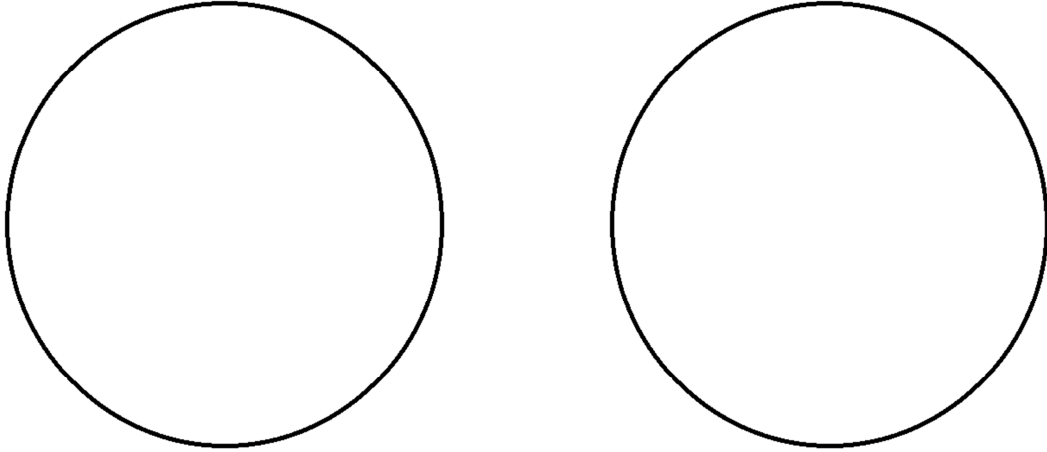
Protozoans differ in morphology considerably. We have chosen several representative species for you to examine: amoeba, paramecium, and euglena. Note that each of these move differently. Amoebas extend cytoplasmic extensions in response to environmental stimuli. They use these pseudopodia (false-feet), extensions of cytoplasm, to move and to engulf prey. Paramecium use small oar-like structures called cilia and euglena use flagella (longer cilia-like structures) to move through water. All of these microorganisms have a cell membrane. Make drawings of these three and then record your own observations of the organism, calculating cell size as you do so.



Kingdom Fungi: Fungi are heterotrophic multicellular organisms. Fungi include mushrooms, mildews, yeasts and molds. Fungi are characterized by a vegetative structure called hyphae which occur in mats called mycelia. Hyphae are filaments of cells. Fungi are ubiquitous and often grow in damp, dark places. A typical fungus is *Rhizopus*, which is a black terrestrial mold often found on old bread. There are sexual and asexual stages which we will be examining today.

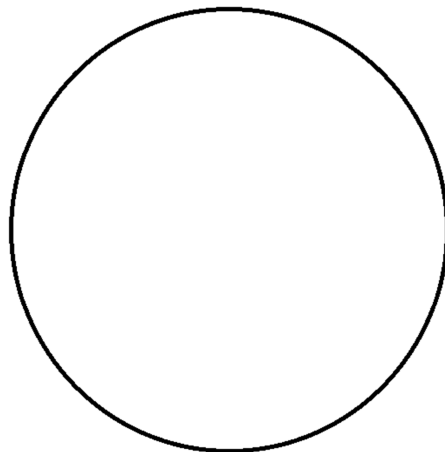
Using a prepared slide of *Rhizopus*, examine both the asexual and sexual stages. In asexual reproduction, sporangiospores are produced inside a spherical structure, the sporangium. When hyphae of opposite mating types meet and fuse a dark zygospore will be produced. Upon germination, a zygospore produces colonies that are genetically different from either parent.

Draw and label both asexual and sexual stages of *Rhizopus*.

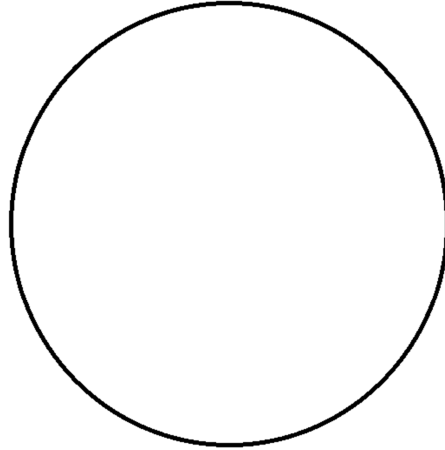


Kingdom Plantae: This kingdom includes mosses, ferns, horsetails, club mosses, conifers, angiosperms (flowering plants). To examine cell structure of a typical plant we will use *Elodea*, an aquatic plant. Place a leaf of *Elodea* on a slide. Use one drop of water and place the cover slip on the drop. Examine the visible structures and draw in the space provided. Locate the cell wall, which consists of cellulose, the chloroplasts and the nucleus. Other organelles may not be visible.

Draw and label the visible structures of *Elodea*.



With a razor blade, slice a very thin section of potato and stain with two drops of Lugol's Solution. Look for leucoplasts, starch-rich structures called plastids. Draw a cell.

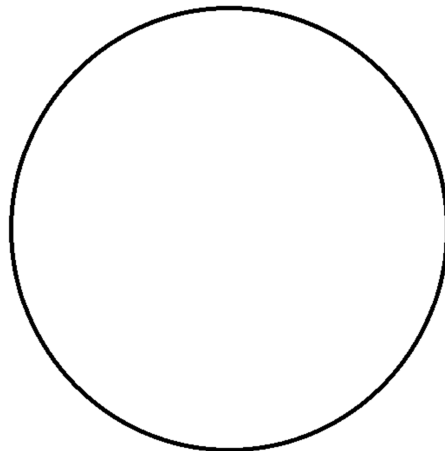


Kingdom Animalia: The kingdom Animalia includes a variety of organisms such as nematodes, mollusks (clams), insects, fish, birds, and mammals. These are heterotrophic, multicellular organisms with wide ranges of form and function. We will examine cells from the inside of your cheek as representative animal cells.

To prepare a slide of your cheek cells carry out the following steps:

1. Gently rub a wooden toothpick on the inside of your cheek.
2. Smear the cells on to a clean microscope slide. Don't worry if you cannot see anything at this stage.
3. Add 1 drop of bromophenol blue stain and 1 drop of H₂O and carefully place a coverslip on the stained material.
4. Observe the cells in the microscope.

The cells that you are examining will be pale with a nucleus that is darker. After examining the slide under low power, move to high power. Locate the plasma membrane, the nucleus and the nucleolus, characterized by a darkened area in the nucleus. Calculate cell size and draw a few representative cells.

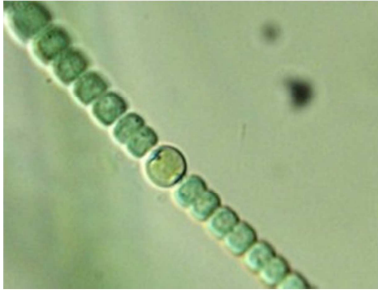


Questions:

1. Differentiate between prokaryotic and eukaryotic cells.
2. Compare and contrast plant and animal cells.
3. Discuss methods of locomotion in Protozoans.
4. Describe the different types of bacterial cells.
5. Differentiate between sporangiophore and zygospore in *Rhizopus*.

Appendix

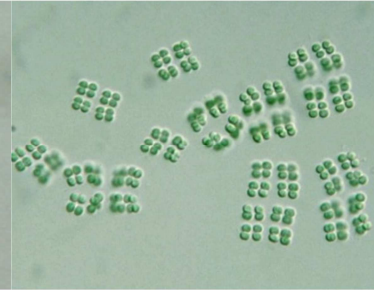
Cyanobacteria:



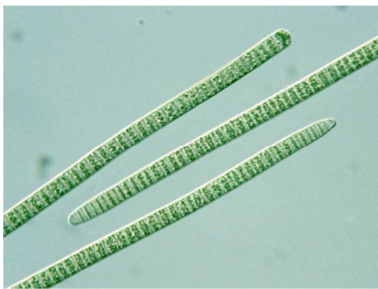
Anabaena



Gloeocapsa



Merismopedia

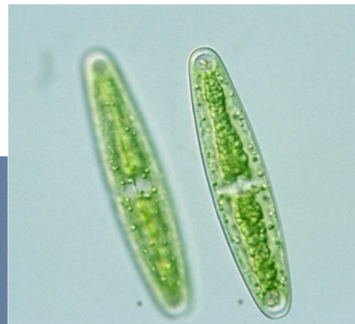


Oscillatoria

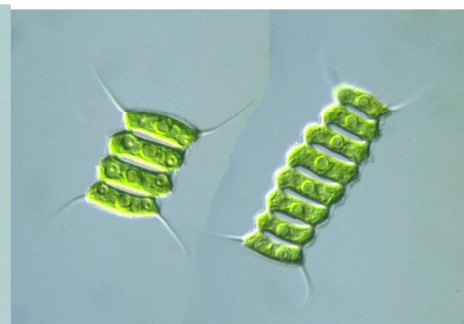
Protists:



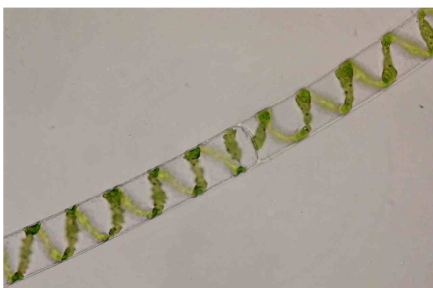
Euglena



Closterium



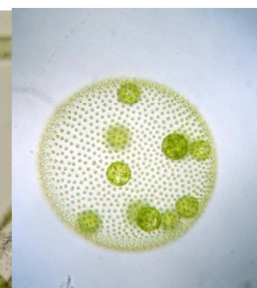
Scenedesmus



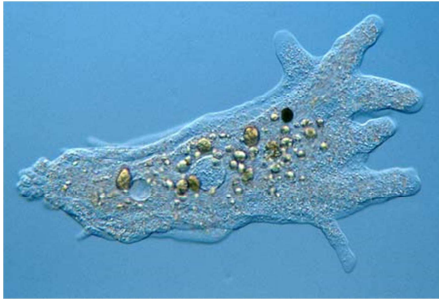
Spirogyra



Oedogonium



Volvox



Amoeba



Paramecium

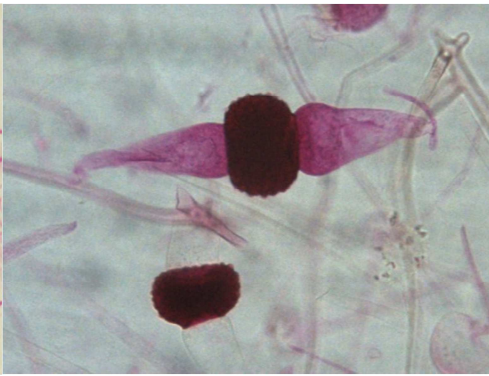


Vorticella

Rhizopus:



Sporangiospores



Zygosporangia