NAME _____

DATE _____

Introduction to Prokaryotes: Cyanobacteria

Algae are generally aquatic photoautrophs that do not develop the distinct roots, stems, and leaves characteristic of most terrestrial plants. Because they carry out photosynthesis and live in water, cyanobacteria are often referred to as algae, or specifically, as blue-green algae. However, cyanobacteria are prokaryotes, and all other algae are eukaryotes. In this activity, you will examine two types of cyanobacteria and compare them with *Zygnema*, a eukaryotic green alga.

Proceed to a workstation and pick up a microscope slide. Observe the alga culture. Use a dropping pipet to remove a sample from the culture. To sample, squeeze the bulb of the pipet and lower the tip into the water to the area being sampled. Release pressure on the bulb to draw in the sample. Place 1–2 drops of the sample on a slide and gently cover it with a coverslip. Examine under the low-power objective of your microscope to locate algal cells. Once you have located cells, center them in the microscopic field and swing the high-power objective in place. Make all your observations on high power.

Prokaryotes

Anabaena

Look for heterocysts. These are enlarged thick-walled cells. *Anabaena*, like many cyanobacteria, can convert free nitrogen (N_2) into ammonia (NH_3) and other nitrogen-containing compounds. This process, called nitrogen fixation, occurs in the heterocysts. In the space below, draw a segment of *Anabaena*. Include about eight cells, one of which should be a heterocyst.

Adjust the slide on the stage until you have a filament of *Anabaena* that spans the diameter of the field of view on high power. Count the number of cells visible in this filament and record it. _____ cells of *Anabaena* equal the diameter of the field of view.

Gloeocapsa

Observe your slide of *Gloeocapsa* and make a drawing in the space below.

Remove the coverslip. Go to the staining station and add a drop of methylene blue. (Be cautious—methylene blue will stain skin and clothing. Avoid skin and eye contact.) Replace the coverslip and reexamine the slide under high power. Cells of cyanobacteria are typically surrounded by a gelatinous sheath. In some, such as *Anabaena*, the sheath is thin and difficult to see. The sheath is relatively thick around cells of *Gloeocapsa* and stains with methylene blue. Revise your drawing of *Gloeocapsa* to show the gelatinous sheath surrounding the cells.

Eukaryote

Zygnema

Look for the chloroplasts. How many chloroplasts are in most cells? The chloroplasts of *Zygnema* are often described as stellate. What does this mean?

Draw a segment of *Zygnema* below and label a chloroplast.

Adjust the slide on the stage until you have a filament of *Zygnema* that spans the diameter of the field of view on high power. Count the number of cells visible in this filament and record it here. _____ cells of *Zygnema* equal the diameter of the field of view.

Assuming that the diameter of the field of view of your microscope at high power is 300 micrometers (1000 μm = 1 mm), estimate the length of the algal cells.

$$\text{Cell length} = \frac{300\ \mu m}{\#\ \text{cells across the diameter of the field of view}}$$

Cell length for *Anabaena* = _____ μm

Cell length for *Zygnema* = _____ μm

On the basis of your observations and the assumption that the organisms you have observed are typical representatives, list at least two ways that that cyanobacteria differ from eukaryotic algae.

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