Prokaryotes, which includes bacteria are the simplest of all the cells. All prokaryotes have a single, circular chromosome and lack a nucleus and membrane-bound organelles. There are two major groups of prokaryotic organisms --- the Kingdom Eubacteria and the Kingdom Archaeabacteria. Eubacteria are known as true bacteria. They are the most common type of prokaryotes. They are found everywhere, on surfaces and in the soil. Archaeabacteria or the ancient bacteria are extremophiles, meaning that these bacteria are found in extreme environments such as hot sulfur springs and thermal vents in the ocean floor. They belong to the domain Archaea. Archaeabacteria are thought to be some of the oldest life forms on earth.

1. What characteristics do all prokaryotes have in common?

2. Name the 2 prokaryotic domains.

3. Where are the bacterial members of the domain Archaea found? Give an example.
Most bacteria are heterotrophic, meaning that they have to rely on other organisms to provide them with food since they cannot synthesize their own food. Some bacteria such as the cyanobacteria contain chlorophyll and can make their own food. These bacteria have to break down, or decompose, other living things to obtain energy. Very few bacteria cause illnesses. Some bacteria are used to make food, such as cheese and yogurt. Scientists have genetically engineered bacteria for bioremediation (for example, breaking down oil from oil spills). Some bacteria such as \textit{E. coli}, live inside the guts of animals and help them to digest food.

4. Are all bacteria heterotrophic? Explain your answer.

5. What bacteria lives in our gut to help digest food?

6. Name several food products made with the help of bacteria.

7. Give an example of a photosynthetic bacterium.

\textbf{Cyanobacteria}

Most bacterial species are either spherical, called cocci (sing. coccus, from Greek kókkos, grain, and seed) or rod-shaped, called bacilli (sing. bacillus, from Latin baculus, stick). Elongation is associated with swimming. Some rod-shaped bacteria, called vibrio, are slightly curved or comma-shaped; others, can be spiral-shaped, called spirilla, or tightly coiled, called spirochaetes. A small number of species even have tetrahedral or cuboidal shapes. The large surface area to volume ratio of this morphology may give these bacteria an advantage in nutrient-poor environments. This wide variety of shapes is determined by the bacterial cell wall and cytoskeleton, and is important because it can influence the ability of bacteria to acquire nutrients, attach to surfaces, swim through liquids and escape predators.
8. List and describe the 3 basic shapes for bacteria.

A.

B.

C.

Bacteria are unicellular and covered with a thick outer cell wall. Color and label the cell wall PURPLE. Just within the cell wall is the cell membrane. Color and label the cell membrane PINK. Along the surface of some bacteria are structures called pili (pilus-singular) that help bacteria adhere to surfaces. Color and label all the pili LIGHT GREEN. Some bacteria are motile (can move). Many of these bacteria have long, whip like structures called flagella (flagellum-singular). Color and label the flagella DARK GREEN. Since bacteria are prokaryotes, they do NOT have a nucleus. They do have a single strand of DNA (double helix), their chromosome, in the nucleoid region (center of the cell). This single strand of DNA contains all the instructions for making more bacterial cells. Locate the DNA and color and label it YELLOW. Bacterial cells reproduce by a process called binary fission. The inside of the bacterial cell is filled with cytoplasm. Color and label the cytoplasm LIGHT BLUE. Sprinkled throughout the cytoplasm of the cell are small, round structures called ribosomes. Ribosomes make proteins for the cell. Label and Color all of the ribosomes RED.
10. Explain how cyanobacteria are similar to plants. How are they different from plants?

11. How are cyanobacteria beneficial? How can they be detrimental?

12. In the disk diffusion method, did you obtain similar or different results for the two types of bacteria tested? What could explain these results?