Domain Bacteria: Characteristics and Life Functions

I. Shape and Body Structure of Bacteria
   A. Bacteria exist in 3 basic shapes:
      1. **bacilli** (singular—bacillus) = rod-shaped bacteria
         a. Ex. *Lactobacillus acidophilus* is one of the bacteria that is used in making yogurt.
      2. **coci** (singular—coccus) = sphere-shaped bacteria
         a. Ex. *Streptococcus pneumoniae* is the bacterium that causes strep throat.
      3. **spirilla** (singular—spirillum) = spiral-shaped bacteria
   B. A bacterium consists of the following structures:
      1. **cell wall**—provides shape and support.
         a. On the outside of the cell wall, the bacterium is covered with a thick, sticky **gel-like capsule** that provides the bacterium with protection and a way to stick to surfaces.
      2. **cell membrane**—holds cytoplasm in; controls what gets in and out of the bacterium.
      3. **cytoplasm**
      4. **ribosomes**—to make protein
      5. **nuclear material**—a circular strand of DNA that floats freely in the cytoplasm; it is **not** surrounded by a nuclear membrane (bacteria are **prokaryotic**).
   C. Specialty Structures
      1. Many bacteria that live in moist or water environments have a whiplike tail called a **flagellum** (plural—flagella) that it moves back and forth to swim.
      2. Some species of bacteria are able to make their own food (see “Cyanobacteria” below). To do this, they contain **chlorophyll** and another bluish pigment.
         a. The chlorophyll floats freely in the cytoplasm and is **not** contained in a membrane because bacteria are prokaryotic.

II. Types of Bacteria and Where They Are Found
   A. Bacteria are classified based on whether or not they can make their own food.
      1. **Heterotrophic bacteria**—these bacteria are not able to make their own food (they are **heterotrophs** and rely on other organism for their food source.
         a. These bacteria are **consumers** or **decomposers**.
         b. Heterotrophic bacteria can live almost everywhere—in the air, water, soil, in and on other living things.
      2. **Cyanobacteria**—these bacteria contain chlorophyll and another pigment that is either blue or red; these pigments allow them to do photosynthesis.
         a. They are able to make their own food (they are **autotrophs**), so they are **producers**.
         b. The cyanobacteria that contain both green chlorophyll and the blue pigment are commonly called **blue-green bacteria** (formally known as blue-green algae).
         c. Photosynthesis requires carbon dioxide, the sun’s energy, and water. Therefore, cyanobacteria are most often found in water environments such as lakes and pond.
            1. They are a very important part of the food chain in these environments.
            d. While still single-celled organisms, cyanobacteria often live in chain-like colonies called **filaments**. This sometimes gives ponds a greenish appearance.
            e. Scientists believe that these may have been the first organisms on Earth. The waste product of their photosynthesis—oxygen—began to collect in the Earth’s first atmosphere. Cyanobacteria (and later plants) have played an important role in creating an environment in which other organisms that require oxygen can live.
      B. Bacteria are among the most numerous organisms on Earth.
         1. Scientist estimate that there are 2.5 billion bacteria in one gram of soil.
         2. The total number of bacteria in your mouth is greater than the number of people who have ever lived!

(OVER)
III. Life Functions of Bacteria

A. Metabolism—Obtaining and Breaking Down Food

1. Cyanobacteria make their own food.

2. Heterotrophic bacteria feed on other living things or dead things.
   a. parasite = an organism that feeds on another living thing, causing harm to its host (ex. cause infection and disease in the host).
   b. host = an organism in which (or on which) another organism lives.

3. To break down food, most bacteria require oxygen.
   a. aerobes (or aerobic bacteria) = organisms that require oxygen for cell respiration.

4. Some bacteria are able to live without oxygen—they are called anaerobes (or anaerobic bacteria).
   a. These may be found in such places as swamps, hot springs, and the intestines of animals.

B. Reproduction

1. Bacteria reproduce by simple binary fission.
   a. In binary fission, the bacterium grows larger and the DNA makes a copy of itself.
   b. The bacterium splits in two with each new bacterium getting a copy of the DNA (the process is very similar to mitosis).

2. Most bacteria can reproduce quickly (some in as little as 20 minutes).
   a. This is why food goes “bad” quickly if left out in warm conditions.

C. Bacteria during “Hard Times”

1. When living conditions become so poor that the bacteria may not be able to survive (for example, their food, water, and/or oxygen is used up), some bacteria can form endospores inside and become inactive.
   a. endospore = a round, compact spore that contains the bacterium’s DNA and some protein and is surrounded by a thick wall that protects the DNA.
   b. When conditions improve, endospores break open and the bacteria become active again.