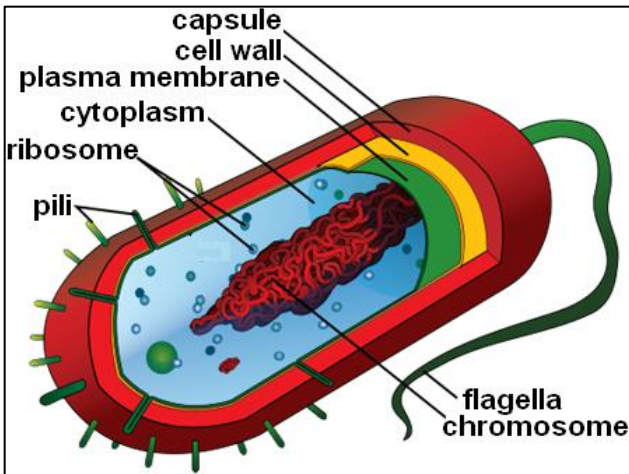


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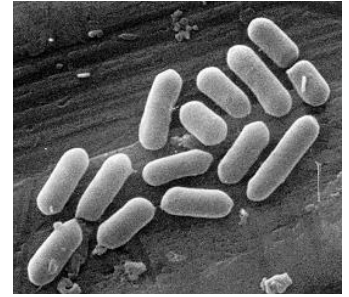
Characteristics of Bacteria Worksheet

Bacteria are classified into two very different kingdoms—Archaeobacteria and Eubacteria. All bacteria have the same basic structure. Look at the two pictures below as you continue your reading.

Like all cells, bacteria have a **plasma membrane** that controls what can enter and leave the cell. The plasma membrane is surrounded by a **cell wall**. The cell wall gives



the bacteria shape and support. Certain kinds of bacteria have yet another coat around the cell wall; called a **capsule**. The capsule is a thick and sticky overcoat that some bacteria have. Bacteria that have a capsule usually cause disease. Therefore, scientists think the capsule helps them stick to its host.



Some bacteria have one or more **flagella** sticking out of the plasma membrane. Flagella are used to move the cell around. Bacteria also have a circular piece of DNA called a **plasmid** instead of a proper nucleus. They also have many **ribosomes** which make proteins for the bacteria. The

bacteria also have one or more **pili** (singular = pilus) sticking through the cell membrane. Bacteria use the pilus to trade pieces of its DNA with other bacteria during a process called **conjugation**.

Archaeobacteria and Eubacteria probably split from each other several billion years ago, but nobody knows exactly when. There are many differences between the Archaeobacteria and the Eubacteria.

Some of those differences are:

1. Their cell walls have different structures
2. The lipids in their plasma membranes are different.
3. Their tRNA and rRNA bases are different.
4. They react differently to antibiotics.

Archaeobacteria – the extreme bacteria

Archaeobacteria include 3 sub-types that are found mainly in extreme habitats where little else can live.

- One group lives in oxygen-free environments and produces methane. These Archaeobacteria are called Methanogens. They can live in the digestive tract of many animals, where they produce methane gas.
- A second group can live only in bodies of concentrated salt water such as the Great Salt Lake in Utah and the Dead Sea in the Middle East. These are the extreme halophiles.
- The third group, Thermoacidophiles, is found in the hot acidic waters of sulfur springs and near deep-sea ocean vents.

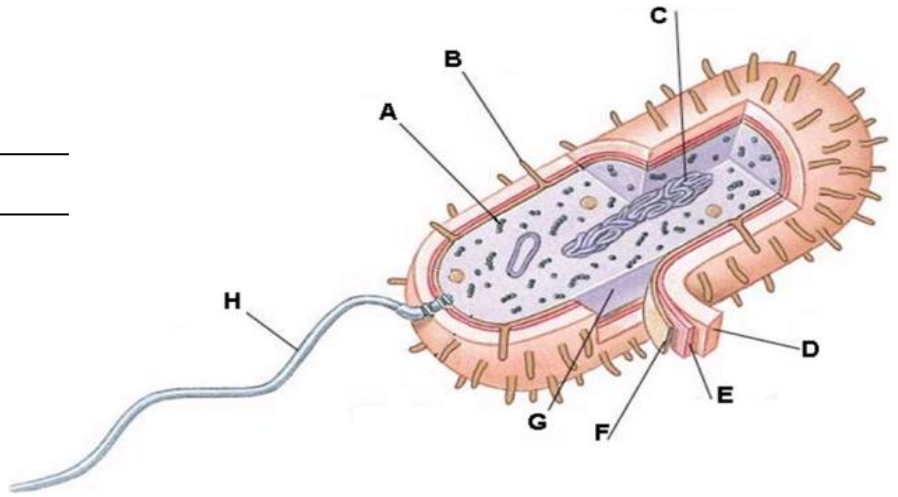
Eubacteria - all the other bacteria

Eubacteria, the second main group of bacteria, live in many different habitats and have different types of metabolism. Some examples of eubacteria are *Streptococcus* which causes strep throat, *E. coli* which helps us digest our food, and *Streptomyces erythraeus* which produces the antibiotic streptomycin. Some characteristics of eubacteria are:

- Bacteria are the smallest and simplest of living things.
- Bacteria are also prokaryotes, which means they have no membrane-bound organelles like a nucleus, mitochondria, or chloroplasts.
- Their ribosomes are smaller than those of eukaryotes.
- Their genetic information is held in a single circular chromosome, rather than in paired chromosomes.

- 1) What are the **two** kingdoms of bacteria?
- a. _____
- b. _____

2) Label the parts of the bacterium in the picture to the right.



3) Name three differences between Archaeobacteria and Eubacteria.

- a. _____
- b. _____
- c. _____

4) Fill in the missing information in the table below about the parts of a bacteria and what they do.

Parts of a Bacteria	What it does
A.	Controls what enters and leaves the bacteria
Cell Wall	B.
C.	Sticky covering outside the cell wall that helps disease causing bacteria stick to its host
Pili	D.
E.	Circular piece of genetic information that keeps the information needed to run the cell
Ribosome	F.
G.	Movement

- 5) Name the three groups of Archaeobacteria.
- a. _____
- b. _____
- c. _____

6) Name three characteristics of all eubacteria.

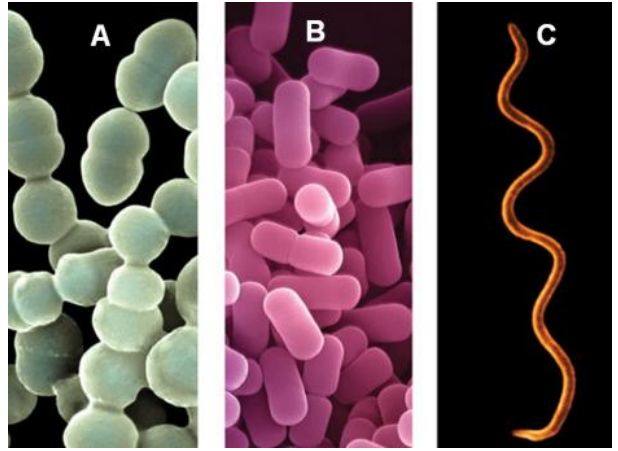
- a. _____
- b. _____
- c. _____

7) Where do each Archaeobacteria live?

- a. Thermoacidophiles: _____
- b. Methanogens: _____
- c. Extreme halophiles: _____

Classification of Bacteria By Shape

The three most common shapes are spheres, rods and spirals. Sphere shaped bacteria such as those shown in the A section of the photo to the right are called **coccus** (pl. is cocci) bacteria. They usually have coccus in their name like streptococcus. Another group in the shape classification system is the **bacillus** (bacilli =plural). These bacteria are rod shaped. These bacteria are pictured above in B. The third group is the **spirillum** (spirilla plural). These are the corkscrew shaped bacteria. These bacteria are pictured above in C.



Because scientist wished to give as much information as they can when naming bacteria, scientist use their shape as well as if they are found in pairs, chains, or clusters.

If they are found in pairs, adding the prefix diplo- to their shape forms the name. An example is diplococci (a sphere shaped bacteria that is found in pairs).

If the bacteria are found in chains, the prefix strepto- is added to their shape (ex. streptococci = long chains of sphere shaped bacteria).

Bacteria that are found in grapelike clusters have the prefix staphylo- added to their shape (ex. staphylobacilli = grapelike clusters of rod shaped bacteria).

Classification of Bacteria By How They Get Their Energy

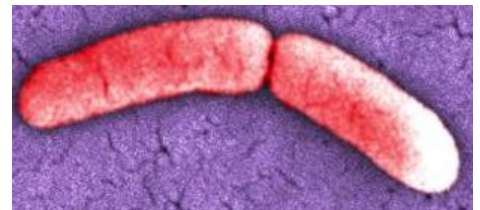
Another way bacteria are classified is by how they get their energy. They are broken up into three groups.

1. The first group is the **heterotrophs**. These bacteria get their energy by decomposing other organisms. These bacteria have a huge roll in recycling materials in an ecosystem.
2. The second group is the **photosynthetic autotrophs**. These bacteria are able to change sunlight into food (that's the photosynthetic part) all by themselves (that's the autotroph part). These bacteria are important because they are the producers in almost all aquatic ecosystems. They capture the sunlight and change it into energy the consumers in the ecosystem can use.
3. The third group is the **chemosynthetic autotrophs**. This group can make their own energy but instead of using sunlight to do it they use chemicals around them. These bacteria are important in changing the nitrogen in the atmosphere that we can't use into a form that we can use to make proteins.

Reproduction

Bacteria cannot reproduce by mitosis or meiosis because they have no nucleus. Instead, they have evolved different methods of reproduction, binary fission and conjugation. Bacteria reproduce asexually by a process known as **binary fission**. The steps in this process are:

1. The bacterium first copies its single chromosome.
2. The copies attach to the cell's plasma membrane.
3. As the cell grows in size, the two copies of the chromosome separate.
4. The cell then divides in two as a partition forms between the two new cells as shown in the picture to the right.



Each new cell receives one copy of the chromosome. Therefore, the daughter cells have the same information as each other. Under ideal conditions, bacteria can reproduce every 20 minutes. Such a rate of reproduction yields enormous numbers of bacteria in a short time.

When you have an infection, billions of bacteria grow in your body. If you are given an **antibiotic** for the infection, you should take the antibiotic for the full prescribed period—even though you feel better after just one or two days. Shortly after you begin to take the antibiotic, most of the bacteria are killed. However, if you stop taking the antibiotic and even a single bacterium is left, it will start reproducing. A day later, you will



have millions of bacteria in your body and you will be sick again. Completing the antibiotic ensures that all of the bacteria will be killed so you will not get sick again.

In addition to reproducing by binary fission, some bacteria have a simple form of sexual reproduction called **conjugation**. You will remember that conjugation is not sexual reproduction in the strict sense of the word since there are no specialized sex cells involved. In conjugation, one bacterium transfers all or part of its chromosome to another cell through a bridge like structure called a pilus (pl. pili) that connects the two cells. This transfer of genetic material can be seen in the picture to the left.

8) How do heterotrophic bacteria get their energy? _____

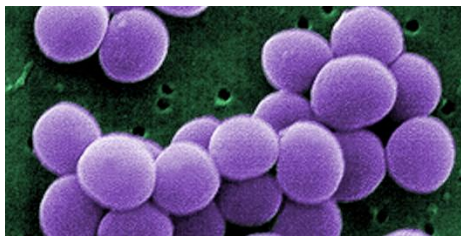
9) How do chemotrophic bacteria get their energy? _____

10) Aside from making oxygen, why are photosynthetic autotrophs important to an ecosystem?

11) Name the three basic shapes of the bacteria in the picture to the right.



a. _____ b. _____ c. _____



12) These bacteria in the picture to the left are called *Staphylococcus aureus*. Give two reasons why is it called *Staphylococcus*.

a. _____

b. _____

13) Place the four steps of binary fission in order from start to finish. _____

A – The cell splits into two cells

C – Copy of chromosome is produced

B – The cell enlarges & chromosomes separate

D – Chromosomes connect to the cell membrane

14) Which special structure is used to transfer DNA from one bacterium to another? _____

15) Which process is described in the previous question? _____

16) Which medicines are prescribed to treat bacterial infections and why it's important to finish them?
