

Name _____

Date: _____

Period: _____

Prokaryotes are single celled organisms (living things) that contain no nucleus or other cell parts. Although they are simple, prokaryotes are the most abundant organisms on the planet. There are two types of prokaryotes - archaea and bacteria. Archaea live only in extreme environments (i.e. -volcanic hot springs, deep ocean hydrothermal vents). Bacteria, on the other hand, can live in many different environments. A number of bacteria species are harmful and sometimes deadly, but most bacteria are not harmful (see Figure 1) – and in fact our lives and health depend on them.

The reason there are so many different species of prokaryotes is because they are oldest type of organism on Earth. Fossil evidence suggests that prokaryotes began living over 3.5 billion years ago, while the first multicellular organisms formed only 1 billion years ago. And since prokaryotes were the first organism, they are the organism from which all others evolved – a prokaryotic cell was the origin of life on Earth.

Eukaryotes, on the other hand, can be single or multicellular organisms. For example, plants and animals are multicellular eukaryotes, but protists (like a paramecium) are unicellular eukaryotes. Eukaryotic cells also contain many cell parts, called organelles, which help each cell function – much like the organs of a human. Eukaryotes are much more complex cells than Prokaryotes.

Since eukaryotes can be unicellular or multicellular, single celled eukaryotes are often confused with bacteria, if the observer is not familiar with their differences. (See Figure 2) Although protists look alien to us, they are more closely related to humans than bacteria and have very similar cell structures to that of human cells.

Protozoans are a very diverse group of organisms – meaning there are many different types. Just like bacteria, some protozoans are harmful, but most are not. Humans do not depend on protozoans for their health as they do with bacteria.

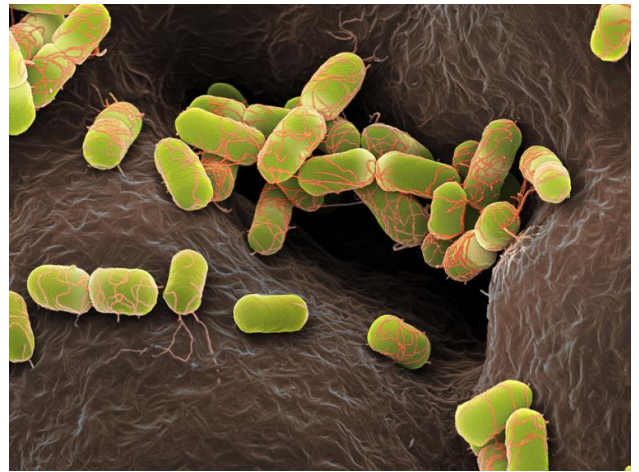


Fig. 1 – SEM image of E. coli

<http://www.adipogen.com/media/E-coli-Inflammation.png>

Escherichia coli (abbreviated as *E. coli*) bacteria normally live in the intestines of people and animals. Most types of *E. coli* are harmless and actually are an important part of a healthy human intestine. However, some *E. coli* are pathogenic, meaning they can cause illness – diarrhea and infections in other parts of the body. The types of *E. coli* that can cause diarrhea can be found in contaminated water or food, or through contact with animals or persons.

<http://www.cdc.gov/ecoli/>



<http://www.visualphotos.com/photo/1x3746017/e-coli-color-enhanced-shadow-cast-transmission-electron-micrograph-tem-of-the-bacteria-escheri-8A2217.jpg>

http://www.photomacrography.net/forum/userpix/925_parameci_2.jpg

Fig. 2 – TEM E. coli bacterium (left) and Light Microscope Paramecia – eukaryotes (right)

Although the bacterium and protists above are both single celled organisms and have similar structure on the outside, their insides are quite different. In the *E. coli*, there are very few parts, while in the paramecia there are many working parts – seen as various colors.

The lesson below will help you complete the following standards:

Massachusetts Science and Technology/Engineering Curriculum Framework (2006) – Life Science 6-8 and High School

2. Recognize that all organisms are composed of cells, and that many organisms are single-celled (unicellular), e.g., bacteria, yeast. In these single-celled organisms, one cell must carry out all of the basic functions of life.

2.2 Compare and contrast, at the cellular level, the general structures and degrees of complexity of prokaryotes and eukaryotes.

Prokaryotes & Eukaryotes Investigation

Now that you have a basic understanding of prokaryotes and eukaryotes, it is time to put your knowledge to good use. The following investigation asks you to research two single celled organisms – one prokaryotic, one eukaryotic. The purpose of this investigation is to discover each organism's story – find out what makes that organism unique from others. Explore, work hard, and share out what you find!

Make sure to complete each of the following:

- a. Cite your sources – Below are some resources that may be useful in your search. Make sure to write down the authors, web addresses and, book titles from wherever you get your answers to give credit to those who deserve it. Lastly, use good resources - .gov and .edu are always trustworthy.

Use these two websites first to pick your bacterium (prokaryote) and protist (eukaryote)

Visual database for protozoa (a type of protist)

<http://www.pirx.com/droplet/gallery.html>

Visual database for bacteria

<http://www.bacteriainphotos.com/bacteria%20photo%20gallery.html#>

1. Biology4Kids

Prokaryotes - http://www.biology4kids.com/files/micro_prokaryote.html

Eukaryotes - http://www.biology4kids.com/files/micro_eukaryote.html

2. Center for Disease Control (CDC)

<http://www.cdc.gov/>

3. Pathogens (Protozoa and bacteria)

<http://www.fda.gov/downloads/food/foodborneillnesscontaminants/ucm297627.pdf>

- b. The Basics – compare the structures of prokaryotes and eukaryotes (similarities & differences)

Prokaryotes

Eukaryotes

c. Answer the following questions for your **prokaryote**:

1. What is its name? _____
2. What does it look like? What features make it unique? _____

3. How does it move? _____

4. What is its story? Does it help or hurt other organisms (or both)? How does it help or hurt other organisms? _____

d. Answer the following questions for your **eukaryote**:

1. What is its name? _____
2. What does it look like? What features make it unique? _____

3. How does it move? _____

4. What is its story? Does it help or hurt other organisms (or both)? How does it help or hurt other organisms? _____

