key: ☐ All Cells ☐ Prokaryotes ☐ Eukaryotes

Name: _____ Period ___ Date: _____

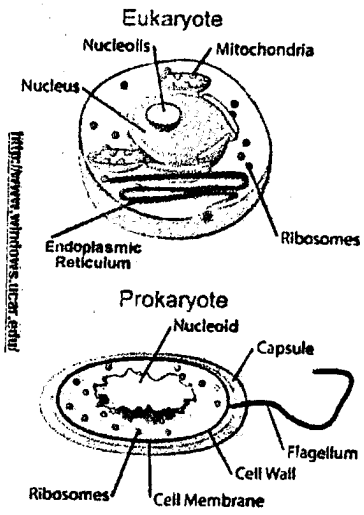
Prokaryotic vs. Eukaryotic Cells

Instructions: Use the following information to make a detailed Venn Diagram comparing and contrasting Prokaryotic and Eurkaryotic cells.

As you have already learned, everything that lives is made up of cells. And the cells themselves are made up of many different parts – right down to their molecules.

In fact, what scientists call "the universal principle of life" is defined as the specific interaction of molecules with one another. Now let's find out a little more about cells and molecules. There are many different cells that do many different things. But all of these cells fall into one of the two main categories: prokaryotic cells and eukaryotic cells.

These cells are more alike than they are different. So first let's talk about what prokaryotic and eukaryotic cells have in common.



What They Have in Common

- Both have DNA as their genetic material (it's DNA that tells cells what kind of cells they should be).
- Both are covered by a cell membrane.
- Both are made from the same basic chemicals: carbohydrates, proteins, nucleic acid, fats, minerals, and vitamins.
- Both regulate the flow of the nutrients and wastes that enter and leave them.
- Both have similar basic metabolism (life processes) like photosynthesis and reproduction.
- Both require a supply of energy.

That's what prokaryotic and eukaryotic cells have in common. But there are significant differences between them too. The two main differences are age and structure.

How They Are Different

Age

Scientists believe that prokaryotic cells (in the form of bacteria) were the first life forms on earth. They are considered "primitive" and originated about 3.5 billion years ago. That's 2 billion years earlier than eukaryotic cells and billions of years before our earliest ancestors, the hominids.

Here is a brief timeline of the development of life on Earth:

- 4.6 billion years ago the Earth was formed
- 3.5 billion years ago the first life arose: prokaryotic bacteria
- 1.5 billion years ago eukaryotic cells arose
- 0.5 billion years ago the Cambrian explosion – multi-celled eukaryotes arose
- 3 million years ago our earliest ancestors, the hominids, appeared

There is strong data to suggest that eukaryotic cells actually evolved from groups of prokaryotic cells that became interdependent on each other. You'll be learning more about this theory later.

Structure

Eukaryotic cells contain two important things that prokaryotic cells do not: a nucleus and organelles (little organs) with membranes around them.

DNA arrangement

Although both eukaryotic and prokaryotic cells contain DNA, the DNA in eukaryotic cells is held within the nucleus. In prokaryotic cells, the DNA floats freely around in an unorganized manner.

Presence of organelles

The organelles in eukaryotic cells allow them to perform more complex functions than prokaryotic cells, which don't have these little organs.

Some of the organelles in eukaryotic cells are:

- **The Nucleus** – The "brain" or control center of the cell. It contains DNA, which makes up genes.
- **Ribosomes** – These are the protein factories. The instructions from DNA tell the ribosomes to make specific proteins. Note, this particular organelle is found in prokaryotes too!
- **Endoplasmic Reticulum** (ER) – Structures that modify proteins produced in the ribosomes. Not all of the proteins made by the ribosomes need changing, but those that do get "altered" here.
- **Golgi Apparatus** – This structure will make even more changes to the proteins that already got changed when they were in the E.R. Remember those proteins were made in the ribosomes, changed once in the E.R. and will be changed again in the Golgi Apparatus. The Golgi also acts as a post office by packaging and shipping proteins to other parts of the cell or out of the cell.
- **Mitochondria** – structures which produce the cell's energy, a.k.a. powerhouses of the cell.
- **Chloroplasts** – structures which allow plants to trap sunlight and carry out photosynthesis.

Size

Eukaryotic cells are, on average, *ten times larger* than prokaryotic cells.