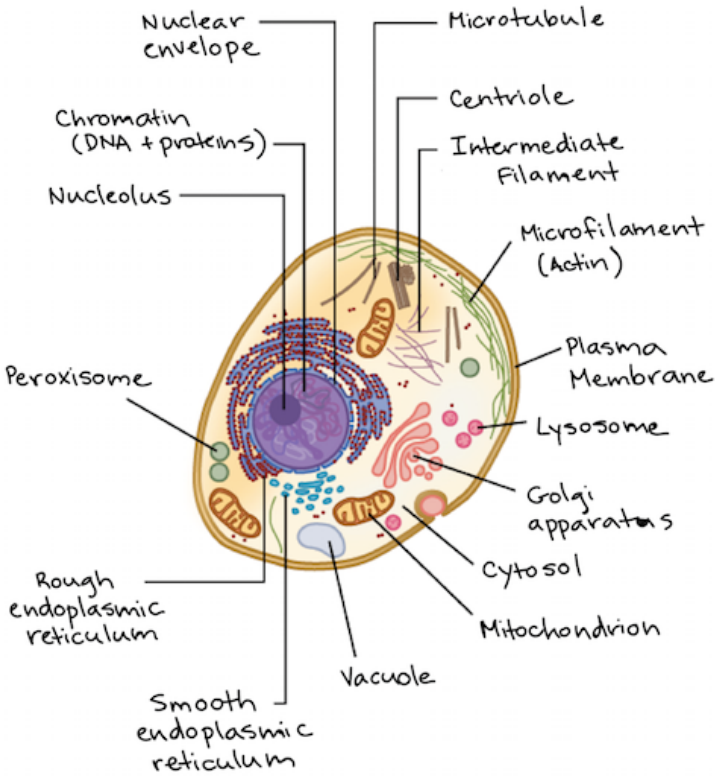
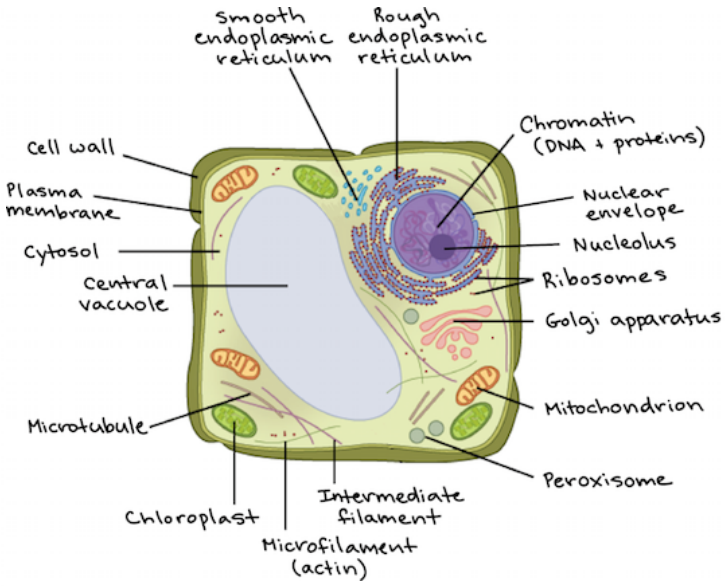
Part 1: Cells and Kingdoms

How do plant and animal cells differ?

Both plant and animal cells are eukaryotic, so they contain membrane-bound organelles like the nucleus and mitochondria. The nucleus of eukaryotic cells is similar to the brain of the cell. It contains the genetic information (DNA) and directs the cell how to function.

However, plant cells and animal cells do not look exactly the same or have all of the same organelles, since they each have different needs. For example, plant cells contain chloroplasts since they need to perform photosynthesis, but animal cells do not. Plants and animals are very different on the outside as well as on the cellular level.





Both animal and plant cells have mitochondria, but only plant cells have chloroplasts. Plants don't get their sugar from eating food, so they need to make sugar from sunlight. This process (photosynthesis) takes place in the chloroplast. In order to do photosynthesis, a plant needs sunlight, carbon dioxide (CO_2) and water. Once the sugar is made through photosynthesis, it is then broken down by the mitochondria to make

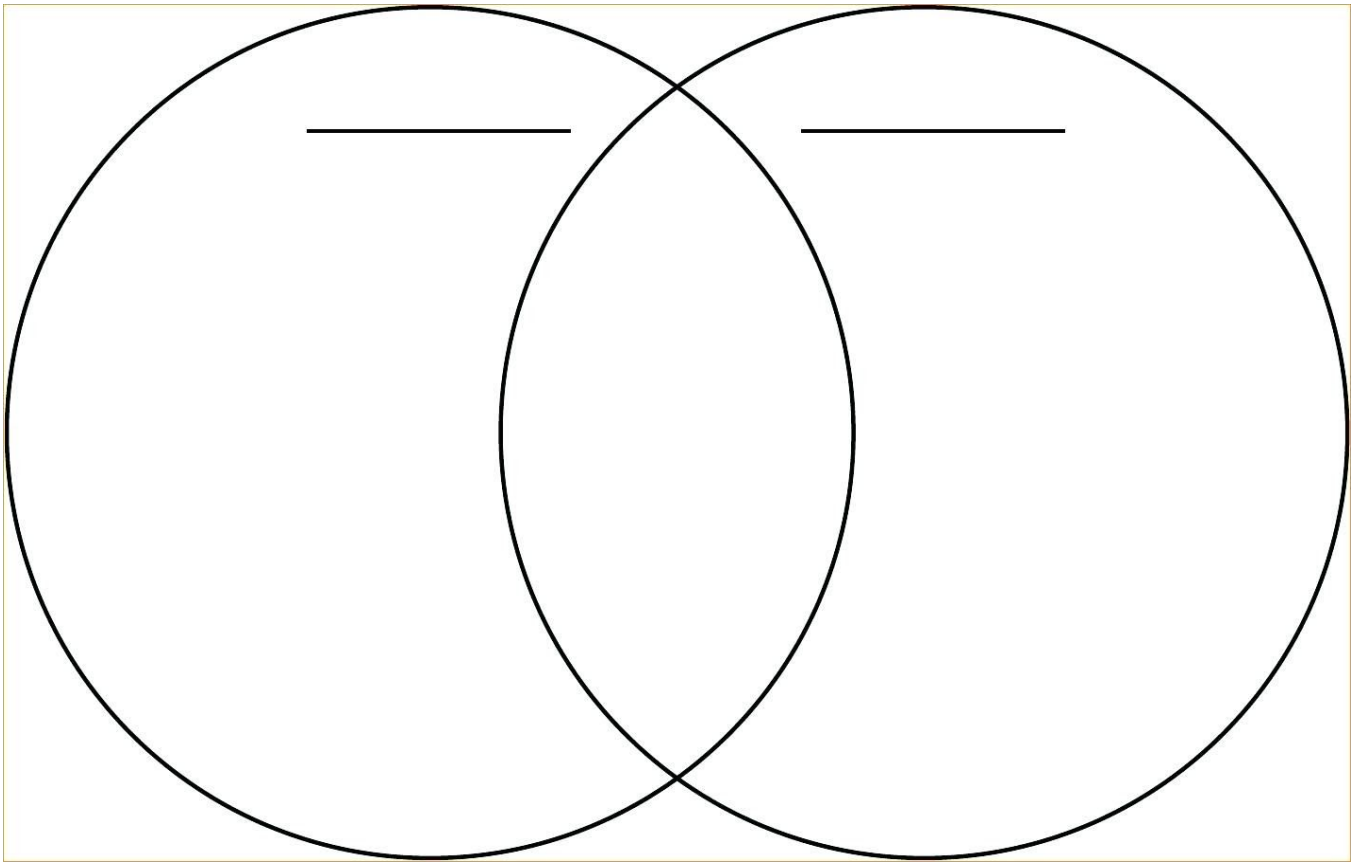
energy for the cell. Because animals get sugar from the food they eat, they do not need chloroplasts: just mitochondria.

Both plant and animal cells have vacuoles. A plant cell contains a large, singular vacuole that is used for storage of water and nutrients. It also helps maintain the shape of the cell. In contrast, animal cells have many, smaller vacuoles, which also are used for storage of water and nutrients.

Plant cells have a cell wall, as well as a cell membrane. In plants, the cell wall surrounds the cell membrane. This gives the plant cell its unique, typically rectangular shape. The function of the cell membrane is to regulate the flow of water and other material in and out of the cell. It also acts as a protective barrier. Animal cells simply have a cell membrane, but no cell wall.

Organelle	**Function (what it does)**
Cell Membrane	
Cell Wall	
Chloroplast	
Vacuole	
Nucleus	
Mitochondria	

Create a Venn Diagram to show the similarities and differences between plant cells and animal cells. Be sure to include information about their structures (organelles) and functions (what they do or how they work).



1. Directions: Match each vocabulary word with its definition.

_____ Cell	a. Any living thing
_____ Organism	b. The science of classifying organisms
_____ Organelle	c. One of the 5 classifications of living things
_____ Kingdom	d. All living things are made of these
_____ Taxonomy	e. Parts of a cell

2. What are the 7 characteristics of living things? (you can look this up if you forget!)

a. _____
b. _____
c. _____
d. _____
e. _____
f. _____
g. _____

3. What is the organelle in a cell that **protects** and **keeps things out**?

a. Cell membrane
b. Chloroplast
c. Vacuole
D. Mitochondria

4. What is the organelle in a cell that **powers** the cell making **energy**?

a. Cell membrane
b. Chloroplast
c. Vacuole
D. Mitochondria

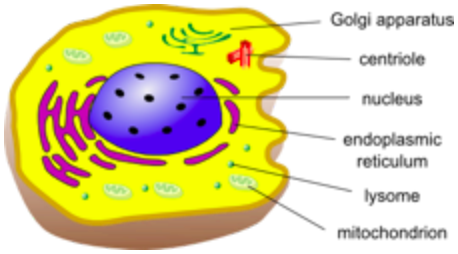
5. What is the organelle in a plant cell that **stores nutrients**? This is larger in plants than in animals.

a. Cell membrane
b. Chloroplast
c. Vacuole
D. Mitochondria

6. Plants get their energy through the process of photosynthesis. Which organelle is necessary for **photosynthesis**?

a. Cell membrane
b. Chloroplast
c. Vacuole
D. Mitochondria

7. Label each as a plant cell or an animal cell. **Explain** how you know.



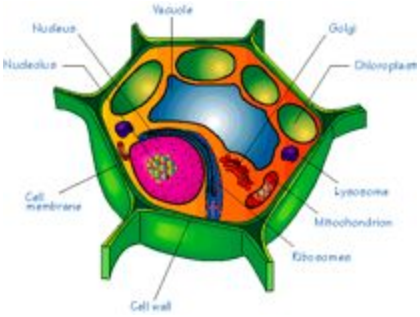
This is a _____ cell because

_____

_____

_____

_____



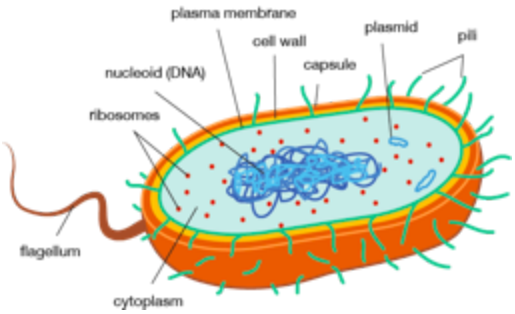
This is a _____ cell because

_____

_____

_____

_____



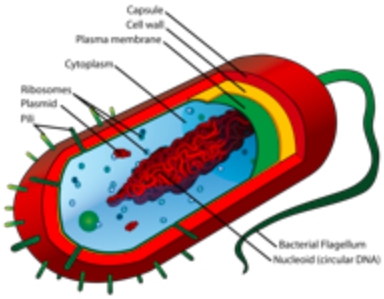
This is a _____ cell because

_____

_____

_____

_____



This is a _____ cell because

_____

_____

_____

_____

8. How did you decide which cells were plants or animals? Explain your thinking.

_____

_____

_____

9.

The table below lists some of the cell structures present in four different cells.

Cell Structure	Cell 1	Cell 2	Cell 3	Cell 4
cell membrane	✓	✓	✓	✓
nucleus		✓	✓	✓
chloroplasts		✓		
cell wall	✓	✓	✓	
mitochondria		✓	✓	✓

Based on the information in the table, which cell is **most likely** an animal cell?

A. cell 1
B. cell 2
C. cell 3
D. cell 4

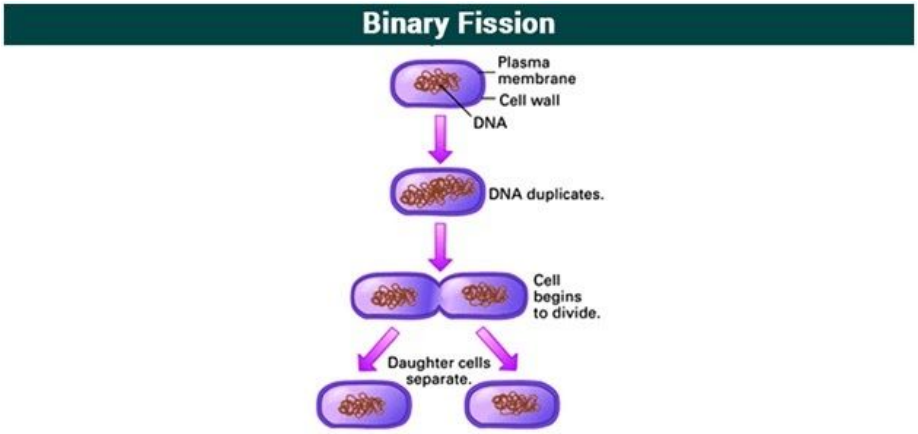
Part 2: Sexual vs. Asexual Reproduction

Reproduction: Asexual vs. Sexual

One parent or two?

That is the main difference between sexual and asexual reproduction. Sexual reproduction just means combining genetic material from two parents. **Asexual reproduction** produces offspring genetically identical to the one parent.

Cell division is how organisms grow and repair themselves. It is also how many organisms produce offspring. For many single-celled organisms, reproduction is a similar process. The parent cell simply divides to form two daughter cells that are identical to the parent.

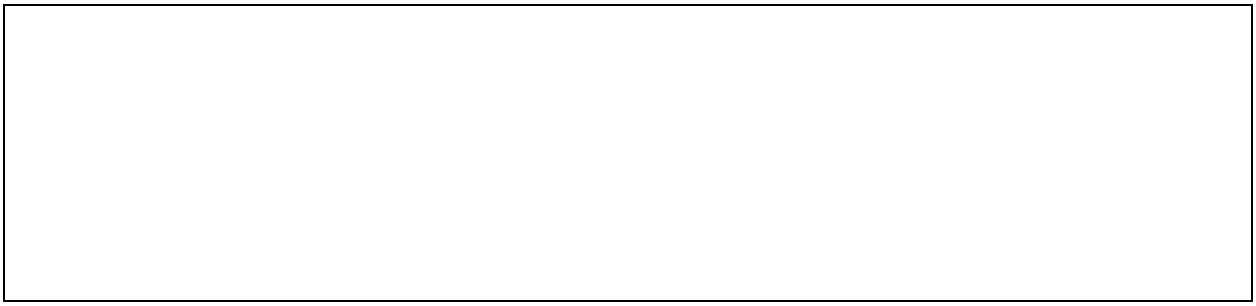


In many other organisms, two parents are involved, and the offspring are not identical to the parents. In fact, each offspring is unique.

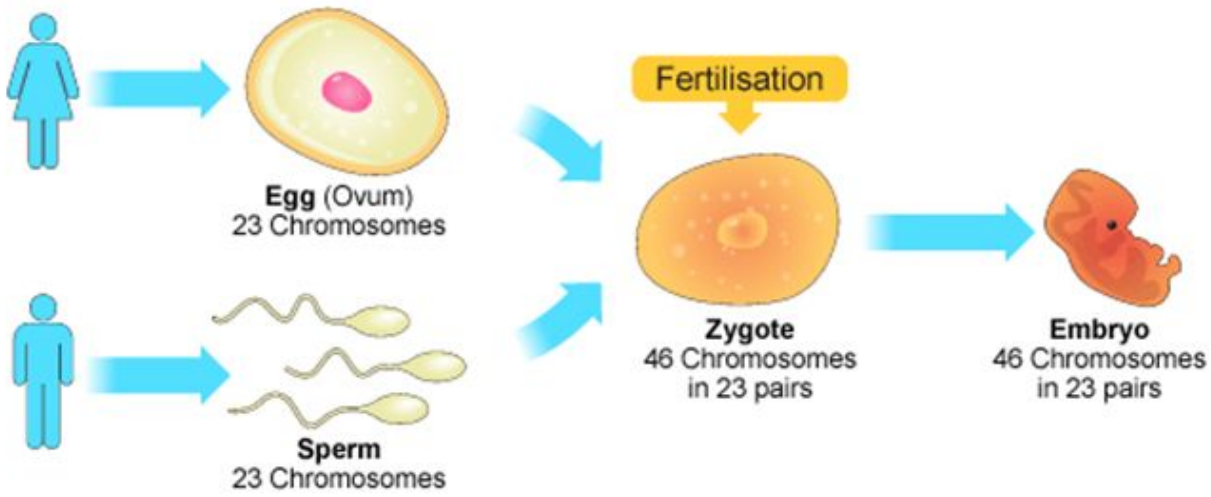
Asexual reproduction involves a single parent. It results in offspring that are genetically identical to each other and to the parent. All prokaryotes and some eukaryotes reproduce this way.

Asexual reproduction can be very rapid. This is an advantage for many organisms. It allows them to crowd out other organisms that reproduce more slowly. Bacteria, for example, may divide several times per hour. Under ideal conditions, 100 bacteria can divide to produce millions of bacterial cells in just a few hours! However, most bacteria do not live under ideal conditions. If they did, the entire surface of the planet would soon be covered with them. Instead, their reproduction is kept in check by limited resources, predators, etc. This is true of most other organisms as well.

What are the benefits of asexual reproduction?



Sexual reproduction involves two parents. As you can see from **Figure** below, in sexual reproduction, parents produce reproductive cells—called **gametes**—that unite to form an offspring. Gametes are **haploid** cells. This means they contain only half the number of chromosomes found in other cells of the organism. Gametes are produced by a type of cell division called **meiosis**.The process in which two gametes unite is called **fertilization**. This creates a zygote which becomes an embryo.



When offspring a born from sexual reproduction, they inherit some traits of their biological mother and some traits from their biological father. Sexual reproduction can be beneficial to a species because it allows for more variation (differences) in traits.

How is sexual reproduction similar and different from asexual reproduction?

Similarities	Differences

1. In sexual reproduction, what fraction of an offspring's genes comes from each parent?
    a. ¼
    b. ½
    c. ⅓
    d. ¾

2. How many chromosomes are in a human zygote?
    a. 23
    b. 30
    c. 39
    d. 46

3. _____ is the process in which two gametes come together to form a single cell.

    a. Transformation
    b. Reproduction
    c. Fertilization
    d. Condensation

4. What type of reproduction to mammals (i.e. humans, dogs, cats, elephants, etc) do? Explain how you know using evidence.

_____
_____
_____
_____
_____

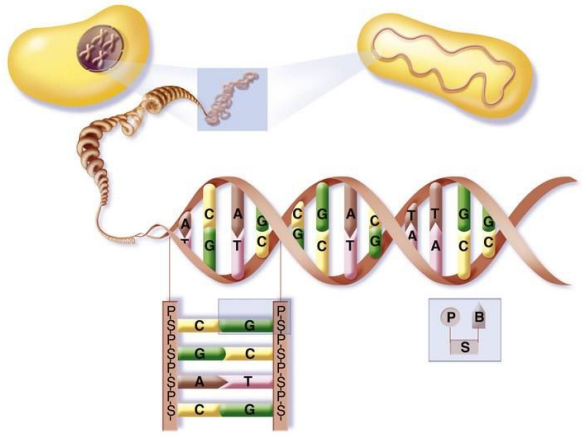
5. How are sexual reproduction and asexual reproduction different?

_____
_____
_____
_____

6. How are sexual reproduction and asexual reproduction similar?

_____
_____
_____
_____

Part 3: Cells Scientific Text



As is often repeated, cells are the basic building blocks of all life. They are responsible for generating the energy that sustains life. They also eliminate waste and quickly replicate themselves to replace damaged tissues.

Cells are fascinatingly complex organisms, able to perform a wide variety of tasks. This is true from single-celled organisms up to multicellular organisms, such as humans.

Bacteria: In Sickness And Health

Some organisms consist of a single cell with only the most basic parts: genetic material (DNA), ribosomes, cytoplasm and a cell membrane. Bacteria, for example, mainly consist of these basic cell parts, and may also have a cell wall.

Bacteria are capable of causing human illnesses, from mild food poisoning to deadly tuberculosis. They are also capable of promoting human health. For example, bacteria living in the human gut aid in digestion and absorbing nutrients, among other things.

Forming Biofilm

Bacteria are able to form biofilm, a layer of microbes held together by certain molecules. The molecules are secreted by the bacterial cell membrane. The cell membrane also has surface structures, such as proteins and flagella, that help bacteria form biofilms.

Some biofilms are harmful and may grow on medical equipment and cause infection. They also form on industrial materials, such as oil and gas pipelines. Corrosion due to biofilm can cost billions of dollars to prevent and fix. This type of corrosion may even result in environmental damage when pipelines leak.

Gene Transfer

Cells have another ability called horizontal gene transfer. Genetic material can exist in mobile segments, or movable sections. Horizontal gene transfer is when bacteria exchange portions of this DNA.

In vertical gene transfer, parents pass on DNA to their offspring. Horizontal gene transfer is different because it involves genetic material moving from one living organism to another, regardless of relatedness. This capability allows many bacteria to quickly resist antibiotics, which is what humans use to fight bacterial infections. Whenever antibiotics are used, some bacteria may have genes that allow them to survive. When these genes are passed on to other bacteria, the whole group becomes more resistant.

Yeast And Fermentation

More complex single-celled organisms, such as yeast, are eukaryotes. Unlike prokaryotic cells, eukaryotic cells contain a nucleus as well as other organelles. These organelles are like the cell's organs, or parts that perform specific tasks.

For example, the organelles in yeast allow it to perform processes like fermentation. Humans have long harnessed fermentation to make bread, wine, beer and even biofuel. Fermentation is possible because of certain enzymes within yeast that allow it to convert sugars into alcohol. Like all proteins, enzymes are produced by ribosomes within a cell.

Cellular Slime Molds

Single-celled organisms can aggregate to form a multicellular structure. One example is the cellular slime molds, a type of amoeba. These social amoebae will function as

individual organisms when soil nutrients are present. In times of low nutrients, however, they band together into a slug-like form. They migrate together in search of food.

The cellular communication between amoebae during aggregation involves many cell parts. These parts include the cytoskeleton and the nuclear membrane. The nuclear membrane controls the entry of key molecules from the cytoplasm into the nucleus. In the nucleus, these key molecules regulate gene transcription, or gene copying — the first stage of gene expression.

Ultimately, the aggregate amoebae typically splits into stalk cells and spore cells. A large vacuole, or space, forms within stalk cells as they undergo cell death and form a column. In this process, spore cells are lifted and then scattered to a new location. Many cell parts play a role in this complex behavior of social amoebae, including functions of the mitochondria. These are critical to cell movement, differentiation and patterning of cells within the multicellular slug.

Specialized Cells In Plants And Animals

In true multicellular organisms, a variety of organelles allow equally incredible feats. Chloroplasts in plant cells allow the organism to capture the sun's energy and produce food. In a growing animal, the cytoskeleton sorts critical parts and molecules within the cell. It defines which end of the cell is which to enable specific functions as the tiny animal embryo grows bigger.

Following development, specialized cells within multicellular organisms perform specific functions to support the body. Meanwhile, organelles help cells accomplish various tasks. For example, mature red blood cells in mammals lack a nucleus. This helps them clear out as much cellular space as possible for a protein called hemoglobin. This protein allows the cell to carry oxygen from the lungs to the rest of the body.

White blood cells are part of the body's immune system. They use lysosomes to engulf and destroy bacteria, preventing infection.

Neurons In The Brain

Neurons in the human brain allow problem solving, memory and emotion. A neuron's cell parts are critical to these functions. Neurons release neurotransmitters in response to environmental signals. The secretion of neurotransmitters is regulated by organelles called Golgi bodies. These are capable of making special vesicles, or sacs, to transport neurotransmitters outside the neuron. Once there, they aid in cell communication to help regulate things like mood. A long axon fiber extending from the cell releases these critical signaling chemicals. Then, a neighboring cell's many fingerlike dendrites receive the signals.

Choose 2 of the types of cells or functions of cells from the article (**the bold headlines**) and explain what they are or what they do.