7th Grade Life Science

Unit: Cells and Body Systems

Performance Expectations: MS-LS1-2. MS-LS1-3.

Learning Outcomes:

By the end of the lesson, students should be able to:

- Describe the three tenets of the cell theory.
- Describe evidence supporting the cell theory.
- Use scientific tools to gather evidence in support of the cell theory.
- Explain how both simple and complex organisms are composed of cells that perform essential functions.
- Recognize the importance of microscopy in the discovery of cells.

Day 1 Activity

A. Quick Write (2 to 4 Mins)

What Do You Already Know about Cells? What are all living things made of?

B. Reading

Do you know what all living things are made of? For most of human history, we did not know the answer to this question. It was not until 1665 that people realized that all living things are made up of tiny cells, and that cells perform all of the functions that keep organisms alive. Below is a picture of one such cell that constitutes most of your blood. What do you know about cells? How big do you think they are? How many do you think are in the human body? If you looked inside a cell, what do you think you would find?

The discovery of cells was made when Robert Hooke looked through his microscope at the bark of a cork tree. He saw the spaces created by the cells of the cork tree's bark and began to form a theory. Without this amazing discovery, many scientific breakthroughs would not have been possible. For example, we would not be able to treat most diseases such as cancer effectively. People would not understand heredity and genetics. The discovery of cells has been the basis for much of what we know about life science today.

By building upon the work of Robert Hooke, German scientists Theodor Schwann, Matthias Schleiden, and Rudolf Virchow developed the cell theory. This theory is one of the fundamental principles of biology. But what exactly is the cell theory and why is it important to understand the structure and function of organisms? In this concept, you will learn about the importance of cells and the cell theory.

C. Reflection Questions

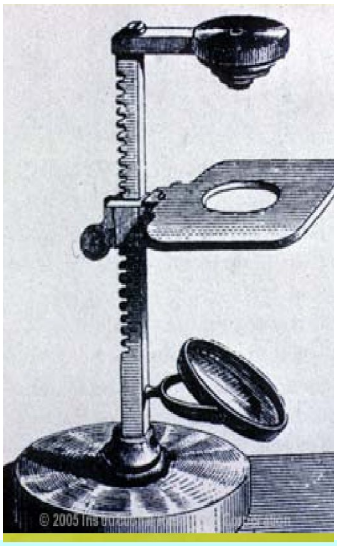
1. As time progressed and technology improved, microscopes were able to give clearer images of extremely tiny objects. How did this development advance the cell theory?
2. Comparing Cell Sizes: An elephant and a mouse both are made of cells.


Compare the sizes of the cells found in an elephant to those found in a mouse. Why is an elephant so much larger than a mouse? Use scientific reasoning to support your claims.

3. Two Different Cell Types: Living cells are classed as either prokaryotic or eukaryotic. Identify the following as characteristics of prokaryotic cells, eukaryotic cells, or both. Label each characteristic with either P for prokaryotic , E for eukaryotic or B for both.

Have a nucleus	
contain cytoplasm	
Are the smallest unit of living matter	
Have membrane bound organelles	
Contain DNA	
Are produced by division of another cell	
Mostly single-celled organisms	
Comprise most multi-celled organisms	

The Microscope: The Tool of Modern Biology



The development of the microscope changed our understanding of biology.

Today, most people accept the idea that our bodies are made of **cells.** Scientists agree these tiny structures work together to keep us alive. People have not always understood how cells work, however. Ancient Greek thinkers such as Plato pondered the construction of living things. These early scientists knew that living things must be made of smaller parts. Exactly what these parts might be, however, remained a mystery for centuries.

In the 17th century, an important innovation helped solve this mystery. In 1655, Robert Hooke used an early microscope to study a thin slice of wood from a cork tree. Hooke observed that tiny structures acted together to form the entire tree; he called these structures "cells." In 1676, Antonie van Leeuwenhoek used a refined microscope to examine water. He saw tiny organisms made of single cells floating in the water. With his microscope, van Leeuwenhoek made the first reported observations of bacteria! Biologists now had a tool they could use to study the tiniest bits of nature.

Almost 200 years after van Leeuwenhoek, Matthias Jacob Schleiden and Theodor Schwann reported their findings that all living things are made of cells. Since then, microscopes have become even more powerful. Biologists have used them to study many different kinds of organisms. Although these organisms may look and act very differently, biologists using microscopes have confirmed the cells of these organisms are quite similar.

We can see through a microscope that all cells are surrounded by a **membrane,** which holds the cell and its contents together. This membrane is thin and porous, allowing water and other substances to move into and out of the cell. Cells obtain nutrients and dispose of waste through their porous membranes.

Biologists have discovered all cells contain genetic material called DNA. This material helps the cell reproduce. Cells also contain structures that process nutrients and build proteins, which cells need to survive. These structures are surrounded by a substance called **cytoplasm.** Cytoplasm fills up the gaps in the cell and separates the cell's different parts. In addition, the

cells in plants are surrounded by an extra layer called a **cell wall.** Cell walls are thicker than cell membranes. The thick walls help the cells maintain their shape.

More advanced microscopes have allowed biologists to see that more complex cells contain **organelles.** These tiny structures complete various functions to help the cell survive. There are many types of organelles:

- The **nucleus** is the part of the cell that contains most of the DNA. The plural form of *nucleus* is *nuclei.* Nuclei are the control centers of cells.
- **Mitochondria** convert energy into a form the cell can use.
- **Chloroplasts** use sunlight to produce energy for plant cells.
- **Vacuoles** fill the center of plant cells. They contain water that makes the cells rigid and enables plants to stand upright.

Red blood cells viewed through a microscope look like round flower petals.

As people discovered different kinds of cells, scientists began to use this information to classify organisms. Organisms made of the simplest cells are called **prokaryotes.** Most prokaryotic cells are encased in cell walls. These cells do not contain nuclei. Bacteria and some other single-celled organisms are prokaryotes.

Organisms made of more complex cells are **eukaryotes.** All eukaryotic cells contain nuclei, but these cells can otherwise differ greatly. Plants and animals are both eukaryotes, for example. Plant cells have a cell wall, chloroplasts, and vacuoles, but animal cells do not.

Despite these differences, all living things rely on the healthy functioning of their cells. Biologists will continue to use the microscope and other tools to study ways to cure disease, prevent illness, and keep cells functioning in a healthy way.

Day 2 Activity

A. Quick Write (2 to 4 Mins)

What is cell theory? Describe.

B. Reading Discovering the Basic Unit of Life

What Evidence Supports the Cell Theory?

Our modern understanding of life's processes and diversity relies partly on a body of knowledge called cell theory. There are three tenets—or principles—of the cell theory. First, cells are the most basic unit of biological structure. Cells are the building blocks of all organisms. Second, all organisms are made of one or more cells. For example, adult humans are made up of many trillions of cells, while a bacterium is just one cell. Third, all cells come from pre-existing cells. These tenets may seem obvious now, but they were hypotheses at the time. Over time, scientists provided plenty of evidence to support their hypotheses. Evidence came from an instrument that is now the workhorse of biology—the microscope.

In the 1600s, many scientists were experimenting with glass lenses and mirrors to create microscopes and telescopes. With these inventions, scientists could visualize previously unseen parts of nature, including tiny cells. Scientists first observed cells in the 1600s, but didn't realize their biological significance until the 1800s. Matthias Schleiden had observed plants under the microscope and realized that all the different parts of plants were made of cells, each cell having a nucleus. Meanwhile, Theodor Schwann had been studying animals and realized that all the different parts of animals were made of cells. These cells also had a nucleus! The two combined their ideas and developed the first two tenets of the cell theory. However, they were unable to agree on where cells came from.

A scientist named Robert Remak developed a method enabling him to watch cells divide. Remak proposed that cells arose from other cells. However, he was a lesser-known scientist trying to promote an idea that went against the ideas of Schleiden and Schwann, who were better known. A few years later, German scientist Rudolf Virchow presented Remak's work as his own, and the scientific community accepted Remak's idea. In the late 1850s, over 200 years since the discovery of the cell, modern cell theory finally emerged.

Once it was understood that all living things were made of cells, scientists looked at cells more closely. What were they made of? What did they do? These questions sparked discoveries that supported the cell theory and improved our lives. For example, medical research today is based on a cellular approach. This advance helped to combat the many diseases that are caused by single-celled organisms. The study of cells has helped scientists' understanding of genetics. That in turn has helped doctors to treat disease using a genetic approach. Forensic scientists use cells collected from crime scenes to learn about what happened and who was involved. These are some examples of how a better understanding of cells has improved our lives and advanced science.

C. Reflection Question

1. Evidence, or Just Fact? The passage below presents several facts about cells. However, only some of these facts provide evidence for the cell theory. Select the sentences that specifically confirm one or more of the three tenets of the cell theory.

Although scientists developed each principle of cell theory independently, each one has been confirmed by extensive research on cells. For example, when researchers remove a cell's nucleus, they find that the cell is unable to survive. Removal of other organelles such as mitochondria also results in cell death, showing that nothing can live outside of a cell. Many things show attributes of life. Like cells, crystals can reproduce. Fire can reproduce and is responsive. Cells respond and reproduce, but they also respire. Cells comprise all animal and plant tissues, but they vary greatly in size and complexity. In fact, some fungi, algae, and muscle cells are so big that they have multiple nuclei! Researchers could not have made these kinds of discoveries without the microscope. Most cells are too small to be seen with the naked eye. Robert Hooke was the first to observe cells in tissue of cork wood. He coined the word "cells" to describe the tiny compartments he saw in the cork tissue.

Microscopes have helped scientists make other significant strides in cell biology. For example, microscopy has advanced scientists' models of cell division. By studying cells using microscopes, scientists realized that both prokaryotes and eukaryotes give rise to other cells by fission. Although many cell types make up living things, the eukaryote cell cycle is very well conserved, comprising four distinct cycles. Recent studies have discovered surprising similarities between the eukaryote cell cycle and the process of binary fission in prokaryotes. However, unlike eukaryotes, prokaryote cells often exchange or combine genetic information with other cells. But how did cell division arise in the first place? Fat molecules form globular hollow structures called micelles. When something disturbs a micelle, it will divide in two. Micelles can enclose molecules such as nucleic acids. Perhaps a self-reproducing nucleic acid formed inside a micelle. This structure could have been the first simple cell and the earliest form of life on Earth.

Discovery of Cells and Cell Theory

In 1665, Robert Hooke first introduced the world to cells. When he examined thin slices of a cork tree under a microscope, Hooke observed that the cork was divided into tiny compartments. These compartments reminded Hooke of the rooms where monks reside. The monks' rooms were called cells, and so Hooke gave the same name to the cork compartments. After Hooke's discovery, many scientists became interested in cells. Through thousands of observations and experiments, much about the structure and functions of living cells was uncovered.

Robert Hooke drew his observations of cork cells.

In the mid-19th century, German scientists Theodor Schwann, Matthias Schleiden, and Rudolph Virchow developed the cell theory. The cell theory is one of the fundamental principles of biology. The original version of the cell theory states:

- Cells are the basic unit of life.
- All living organisms, both unicellular and multicellular, are composed of cells.
- Cells arise from pre-existing cells.

Like many scientific theories, the cell theory has been revised as new information has been discovered. Today the cell theory also includes:

- Cells contain hereditary information (DNA) that is passed from one cell to another during cell division.
- The flow of energy in living organisms occurs in cells.
- All cells have the same basic chemical composition and structure.

The six parts of the cell theory have continued to develop. Scientists from around the world have collected data about cellular structure and function. Interestingly, all cells, from single-celled bacteria to complex humans, are very similar.

There are two basic types of cells: prokaryotic and eukaryotic. Prokaryotic cells, such as bacteria, do not have nuclei or other membrane-bound structures. Prokaryotes are mostly unicellular organisms. Eukaryotic cells, which include plant, animal, and

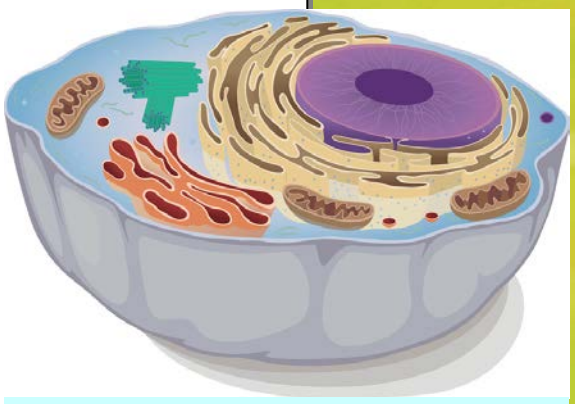
Discovery of Cells and Cell Theory

fungi cells, are more advanced and contain at least one nucleus and many membrane-bound structures. Eukaryotic cells generally make up multicellular beings.

The cell's main job is to organize the functions of the living organism. Many cells working together for a common function form tissue. There are many different kinds of tissue. Muscle tissue helps with movement. Cardiac tissue controls the heart. Nerve tissue carries messages from the brain to locations throughout the body.

Tissues form such organs as the heart, stomach, and skin. Organs coordinate to keep an organism alive. Muscles move the body, but they cannot function without input from the brain or blood pumped from the heart. Each organ is part of a larger organ system. The digestive system absorbs nutrients from food. The immune system fights off disease and infection. Collectively the organ systems make up an entire organism.

It should be remembered that life starts with the cell. The parts of a cell have specific functions that support tissues, organs, and organ systems. These cell parts are called "organelles."



In a eukaryotic animal cell, each organelle performs a unique function for the cell.

The cell membrane is a double layer of fatty acids that forms the cell's boundary and contains its parts. Both prokaryotes and eukaryotes are contained within a cell membrane.

The nucleus contains DNA and directs the cell's activity. It is surrounded by a separate membrane called the "nuclear envelope." Since prokaryotes do not have a contained nucleus, their DNA is free-floating in the cytoplasm.

Cytoplasm is a jelly-like substance that fills the cell and contains all of the organelles.

The endoplasmic reticulum is a folded mass of tubes that stores proteins and produces fats that are sent to other cell

Discovery of Cells and Cell Theory

parts. Endoplasmic reticulum can be smooth or rough. Rough endoplasmic reticulum is studded with ribosomes that are used in protein synthesis.

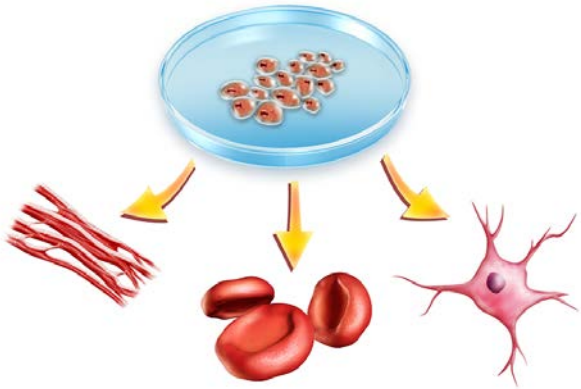
Mitochondria are a bean-shaped mass of membranes. The mitochondria serve as centers for cellular respiration and provide energy for the cell.

The Golgi apparatus, shaped like a stack of pancakes, packages proteins and other materials for movement around the cell.

Vacuoles are sacs that store water, food, and/or waste products. Plant cells have a large central vacuole for storing water.

Lysosomes are acid-containing sacs that break down wastes for removal from the cell.

Plant and animal cells are very similar; however, there are a few differences. Such organelles as the cell wall and chloroplasts are found only in plant cells and can be used to differentiate between plant and animal cells. The cell wall is a rigid membrane surrounding the cell. It gives structure and support to plants. Chloroplasts are green, disk-shaped organelles containing the pigment chlorophyll. Photosynthesis takes place in chloroplasts.



The stem cells in the Petri dish differentiate to form muscle cells (left), blood cells (center), and neurons (right).

Eukaryotic cells have the same basic structures, but not all eukaryotic cells are alike. Early in an organism's life cycle, all of its cells are identical. These base cells are called stem cells. As the organism grows, the cells differentiate, or specialize. Cells change depending on the function they will perform. The genetic material in a cell directs its differentiation.

Compare a muscle cell with a nerve cell, called a neuron. The size, shape, and structure of neurons differ to suit their

functions. Muscle cells are long and thin and contain many mitochondria. The muscle cell's shape allows it to stretch and contract to produce movement. The many mitochondria provide energy for quick response. Neurons are long, thin cells with appendages on both ends. The long appendages help send electric signals to and from the brain and through the body.

Since Robert Hooke's cell discovery, the scientific community has carefully explored these microscopic units of life. Knowing how cells function is the first step to understanding life itself. Today, experiments with stem cells, somatic cell nuclear transfer, gene therapy, and other technologies open up a wealth of new cellular possibilities.

Activity 3

A. Quick Write (2 to 4 Mins)
B. Reading Plant or Animal

How Are Cells' Structures Related to Their Functions?

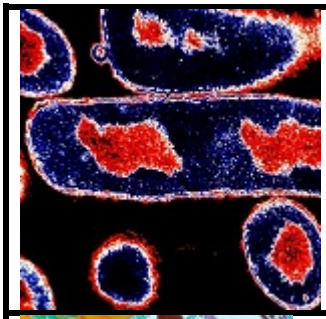
All living things are made of cells, but not all cells are the same. While a specific cell's structure depends on the type of cell, some structures are common to all eukaryotic cells. For example, all eukaryotic cells have a nucleus, membrane-bound organelles, a plasma membrane, and cytoplasm. The nucleus of a cell surrounds the genetic material with a membrane. Other structures called organelles are also surrounded by membranes. The membranes around the organelles both protect and isolate, helping the organelles work more efficiently. Organelles perform various vital tasks, and each organelle has a specific structure related to its function. Organelles provide the cell with energy, excrete waste products, and make proteins. All eukaryotic cells also have a plasma membrane that envelopes the entire cell. The membrane has many passages through it. These passages chemically control what can enter or leave the cell. All eukaryotic cells also have cytoplasm. This jelly-like fluid fills the cell's interior and contains thread-like proteins that help the cell keep its shape.

Given the variety of eukaryotic cells, it's not surprising they differ in many ways. Plants and animals have eukaryotic cells. However, plants and animals have different needs, so their cell structures differ. Plant cells have a thick cell wall. Together, these rigid cells help the plant keep its form. Many animal cells have coatings of molecules that allow the cells to stick together and to recognize each other. Most eukaryotic cells have mitochondria. This is an organelle that converts glucose (food) into energy for the cell. Plant cells make their own glucose through photosynthesis in organelles called chloroplasts. Some eukaryotic cells are single-celled organisms. Single-celled eukaryotes often have some type of structure to help them move, such as the cilia on a paramecium or the flagella on a protozoan. Cilia are tiny hair-like structures that wave back and forth, propelling the organism along. Flagella are larger, whip-like exterior hairs used to help the cell move about.

The other type of cell is a prokaryotic cell. All prokaryotic cells found so far are single-celled organisms such as bacteria. Most prokaryotic cells are much smaller than eukaryotic cells. They are also simpler. For example, prokaryotic cells lack membrane-bound organelles. Instead, prokaryotes carry out various functions throughout the cytoplasm. All prokaryotic cells have cell walls for protection and shape, but the thickness of the cell wall is not the same for all types of prokaryote. Many prokaryotes have flagella that allow them to move. With their small size and simpler structure, prokaryotic cells multiply faster than eukaryotic cells. Their high rate of reproduction is one reason why these single-celled organisms are so successful.

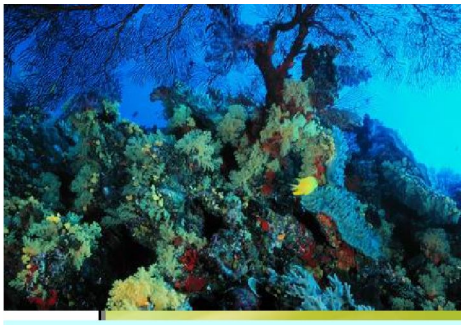
C. Reflection Questions

Review the characteristics of each type of cell. Then classify each of the following microscopic images as a eukaryotic or prokaryotic cell.

Are They Plants or Animals?

Some scientists believe about 2 million different species of plants, animals, and other organisms live on Earth. Other scientists believe the number of species on Earth may be greater than 5 million! New species are constantly being discovered. When a new organism is discovered, biologists try to identify it. Is it a plant, an animal, or some other type of creature? What kind of environment does the organism live in? What kind of conditions help it survive?

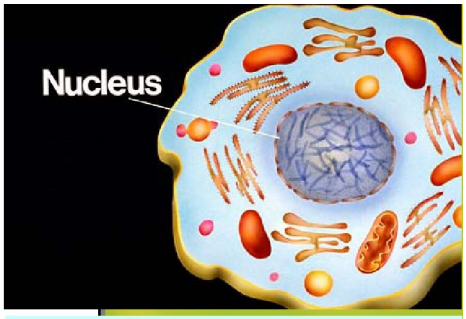


Coral live in warm, shallow waters of the ocean.

Telling the difference between plants and animals may seem simple. Some organisms are more difficult to categorize than others, however. For example, coral do not move. Their bodies are shaped like some plants, and most types of coral must live in sunlight. But coral are animals! Scientists determined this fact by examining coral very closely. They studied the bodies of different species of coral and learned that coral function more like animals than like plants.

Scientists determined that coral are animals by studying coral cells. **Cells** are the tiny building blocks that make up all living things. Some cells are very simple. Bacteria cells, for example, have only a few parts. We call organisms with these simple types of cells **prokaryotic organisms.**

Most cells are more complicated. They contain a nucleus and other parts that help the cells obtain energy, reproduce, and carry out other functions. We call organisms made of these complex cells **eukaryotic organisms.** All plants, animals, algae, and fungi are eukaryotic organisms.

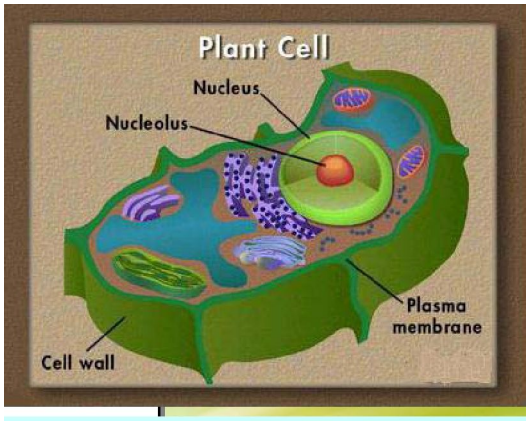


Most eukaryotic cells contain a **nucleus** that directs their growth and reproduction.

Even though both contain a nucleus, plant cells are very different than animal cells. Animal cells are surrounded by a membrane that allows water and nutrients to pass in and out of the cell. This membrane is similar to a net. The membrane is not stiff or solid, but it can still hold all the cell parts together.

Are They Plants or Animals?

A membrane also surrounds plants cells. However, plant cells also have a sturdy wall around their exterior. This wall around plant cells contains many gaps that allow water and nutrients to pass into and out of the cell. But even with these gaps, cell walls are very strong. Remember that plants do not have skeletons to hold them upright. Instead, plants are held upright by their cell walls.



Plant cells contain a cell wall.

Can you guess what kind of cells scientists discovered in coral? Scientists found cells without walls! This discovery meant that coral were not plants.

Like plants, however, most coral grow best where they receive lots of sunlight. Plants are **autotrophic,** which means they make their own food. Special parts of a plant's cells use energy from the sun to make food for the plant. Coral cells, however, do not contain these special parts. Coral are **heterotrophic;** they cannot make their own food.

So why do most coral need sunlight? The reason is algae. For most coral, algae are the main source of food. Algae are autotrophic, so they depend on sunlight to survive. Because the coral depend on the algae, most coral grow in shallow water penetrated by sunlight.

Scientists have determined that coral behave like animals in other ways as well. Like most sea animals, coral reproduce by producing egg and sperm cells that join and begin growing. New coral larvae swim to a sunny, shallow area where they can find food. Then the larvae attach to a hard surface and begin forming their skeletons around the surface. Usually at night, the coral reach their tentacles out to pull food into their mouths.

Scientists continue to study coral to learn what factors in their environments help these animals thrive. In the same way, scientists study newly discovered organisms, hoping to learn more about Earth and the creatures that inhabit it.

Activity 4

A. Quick Write (2 to 4 Mins) What is the cell theory and how does it help to understand the structure and function of organisms?
B. Reading

How Do Cells Relate to the Structures of Simple and Complex Organisms?

Prokaryotes and single-celled eukaryotes are made of just one cell—the entire structure of the organism. The structures of that cell help the organism gain energy, move, expel waste, respond to the environment, and reproduce. All cells reproduce by cell division. Most single-celled organisms reproduce by mitosis, a simple form of cell division. In multicellular organisms, mitosis enables growth and repair. Cell division is the start and end-point of the cell cycle. As with other life processes, cell division relies on internal structures inside the cell.

All complex organisms—including humans—start off as a single cell. Through cells dividing over and over, complex organisms grow in size. As more cells are formed, the cells begin to diversify into different cell types with specific functions. For example, a muscle cell is different from a bone cell, a nerve cell, and a blood cell. Although these cells begin with the same genetic information, their final structure varies greatly. This variety of cell types explains the amazing complexity of multicellular organisms.

In complex organisms, specialized cells group together to form tissues. A tissue's cells are similar and work together to perform the same function. Examples of animal tissues are muscles, skin, and nerves. Examples of plant tissues are xylem (transports water) and phloem (transports nutrients). Tissues that work together and perform the same function are organized into organs like the heart and brain in animals or the stem and leaves in plants. Organs work with other organs to form organ systems, like the nervous system in animals or the vascular system in plants. All the organ systems inside of an organism work together to help it gain energy, move, expel waste, respond to the environment, and reproduce.

C. Reflection Questions

Cell City

Imagine a city so small that the only way to view it is through a microscope. Not only is this city full of life, but its existence is what allows us to have life too. Here is a booming metropolis, a city filled with workers, factories, and even a mayor. Welcome to Cell City!

Cell City is surrounded by a wall called the cell membrane. The job of the cell membrane is to act as a perimeter, protecting and guarding the inside of the cell from outside intruders.

Inside Cell City, we see the framework of the cell. The cytoskeleton makes each cell different and creates a system of organization. The paths created by the cytoskeleton allow parts of the cell to move around. This movement is part of mitosis or cell division. As we wander along, we notice workers busily coming and going. These are called ribosomes and it is their job to carry out the manual labor of the cell.

They take the raw ingredients of amino acids, combined with DNA, to make proteins. Cell City has some special places that act as parks or open spaces. This is cytoplasm and it is a semi-fluid substance like jelly. This material fills and cushions the interior of the cell. Factories, power plants, and communication stations are important parts of any city. The rough reticulum serves as a factory where the ribosomes work to manufacture their goods. The smooth reticulum is a place where they make hormones and steroids. The Golgi Apparatus is the post office, packaging and shipping goods to other parts of the cell.

The mitochondria are the power plant, where the cell creates and stores its energy. The lysomes act like a wrecking ball, knocking down and destroying damaged or older parts of the cell. They also serve as a garbage disposal by breaking down and removing waste.

As we pass through Town Hall, called the nuclear envelope, we find ourselves at the center of all the activity. This is where the nucleus acts as the brain, controlling all of the activity within the cell. This fascinating tour ends as we step back from the microscope. Each day, billions of cell cities just like this one go about their business, keeping us energized and alive.

1. If someone asked you how a cell is like a city, what would you say?

2. How does comparing a cell to a city make it easier to understand?

3. List all the functions of a cell, then discuss how each function helps the cell survive.

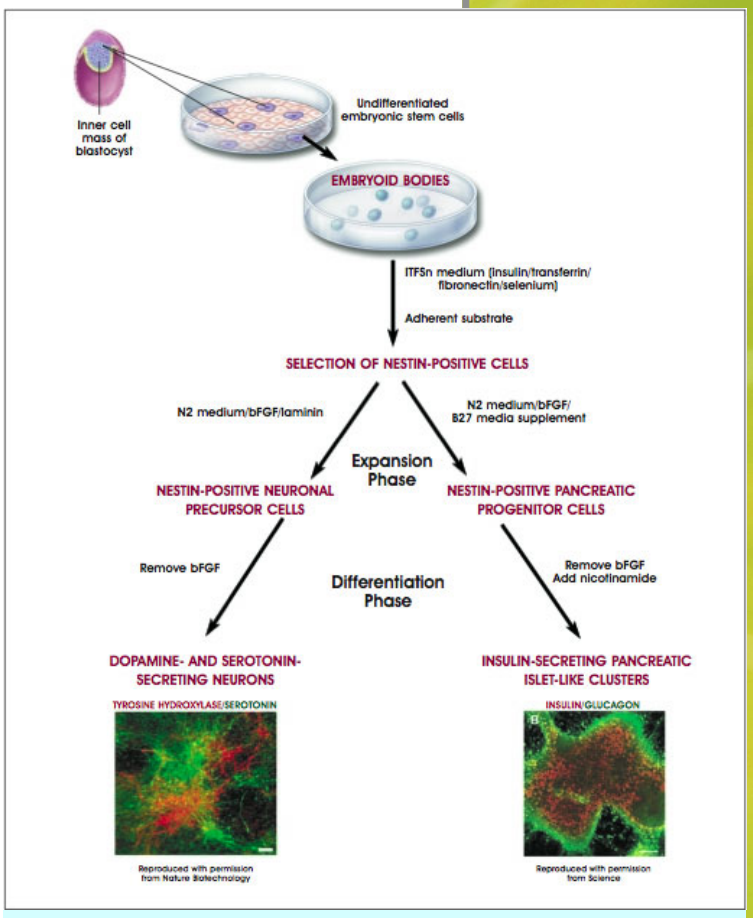
Stem Cell Research

Stem cell research is a common issue debated in the media. Scientists believe that stem cells may one day provide effective treatments to many serious diseases and injuries, but some people feel that there are ethical issues associated with this research.

What are stem cells?

Stem cells are incredibly important cells in the body. These cells are responsible for making many other types of cells. Stem cells are responsible for the creation of heart, bone, brain, and muscle cells. Stem cells are unique, as they are the only cells in the body that can create more than one type of cell.

Adults have limited stem cells in their bodies. Adult stem cells are found in small amounts in bone marrow, and also the placenta and umbilical cord of pregnant women. Embryos have many stem cells. The stem cells that are the most vital to research are found in 4-5 day-old embryos. These embryos have as many as 150 stem cells, which create cells of different human tissues. The stem cells from these embryos can be used to create new and healthy cells to potentially treat many different diseases.



Stem cells provide a wide variety of uses and can be adapted to meet different needs.

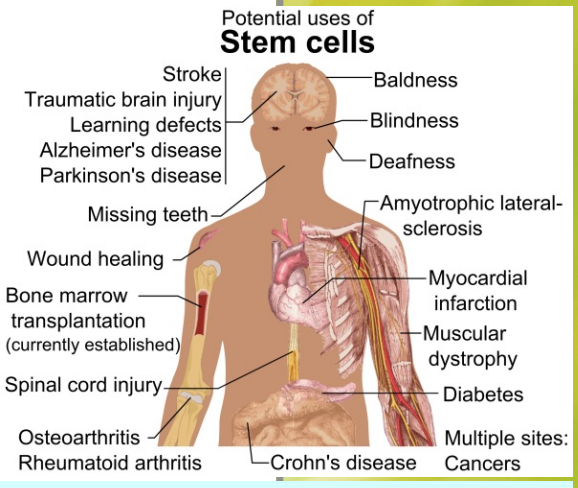
What are the benefits of stem cell research?

Stem cell research can benefit science in countless ways. Studying these early cells may help scientists understand how cells grow and how certain health problems begin. Many diseases are caused by damage to cells or cell mutation. Stem cell therapies can grow new, healthy cells to replace diseased cells.

Stem Cell Research

Many health conditions may one day be treated by stem cell therapies, including:

- Birth defects
- Alzheimer's Disease
- Diabetes
- Cancer
- Burns
- Spinal cord injuries
- Parkinson's disease



There are many potential uses for stem cells.

Stem cells may also be used to test drug therapies. Scientists can see how a drug will react in the human body by injecting stem cells with the medication.

What is the controversy with stem cell research?
In the United States, embryos for stem cell research are provided by in vitro fertilization centers. These centers help infertile couples conceive a child by fertilizing eggs in a laboratory and implanting the fertilized eggs into the mother. The embryos used in stem cell research were embryos that, for one reason or another, were not used to make a pregnancy. These eggs cannot survive outside of the mother and will never become a full-grown baby, however some people believe it is unethical to use these embryos for research purposes.

Is stem cell research a new field?
Stem cells may seem like a new topic, however the research began many years ago. In the 1950s, scientists first discovered that adults have stem cells in their bone marrow. This discovery eventually led to bone marrow transplants, which now treat cancers and blood-related health conditions.

In 1973, shortly after the Roe vs. Wade trial legalized abortion, the United States government pulled federal funding of embryonic research. The first experiment on embryonic stem cells was done in 1998 at the University of Wisconsin using embryos from in vitro fertilization. In 2002, the National Institutes of Health funded its first study on embryonic stem

cells. In 2009, President Barack Obama lifted the ban on federal funding for embryonic stem cell research.

Is it possible to perform research on only adult stem cells?

Many scientists research adult stem cells, but the potential of these cells is limited. Adults have very few stem cells in their bodies, and these cells can be difficult to separate. Adult stem cells may also have mutations, which make them less effective than embryonic stem cells.

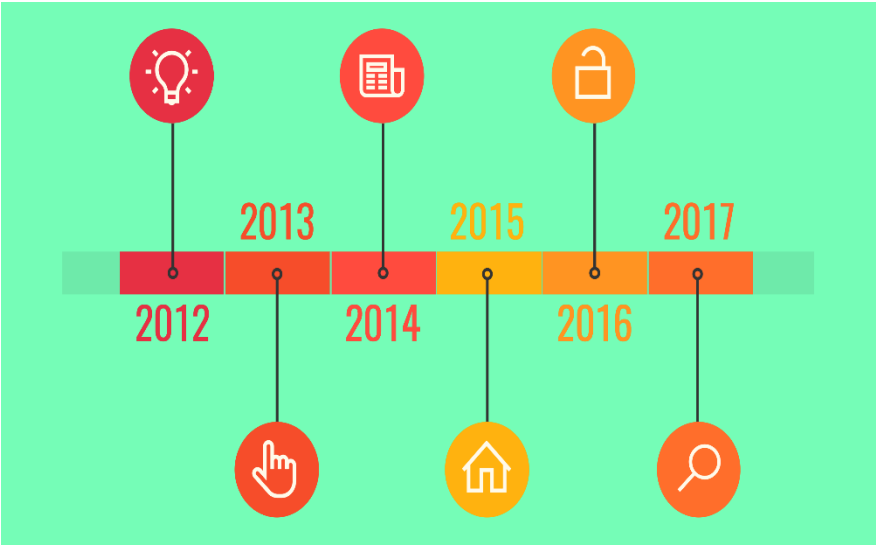
Since embryos grow at a fast rate, stem cells from embryos have the potential to grow into many different types of cells. Adult stem cells may only be able to grow into a few different cell types. Many scientists believe that embryonic cells offer the best potential for treating disease.

This may change in the future. Exciting new research known as nuclear reprogramming has shown that adult stem cells can be genetically altered to regain some of the diverse abilities of embryonic stem cells. This research is still in the early stages, but it may open the door for future treatments to be developed from adult stem cells.

Day 5 Assessment

Project: Cell Theory Timeline

What were the major contributions that led to the development of the cell theory?



Many scientists made observations and discoveries that led to the development of the cell theory. Robert Hooke's compound microscope was just one of these contributions. What are other important milestones that led to the development of the cell theory? Has the cell theory changed since it was first developed? If so, how? How might our knowledge of cells change in the future with even more advancements in technology?

Research the cell theory. **Create a timeline showing at least five of the major discoveries that contributed to the development of the cell theory, beginning with Robert Hooke's contribution.**

Each point on the timeline should include 1. the discovery, 2. the date of the discovery, 3. the name(s) of the discoverer(s), and 4. illustration of the observation that led to the discovery. Be sure to include technological advances that made possible these discoveries.