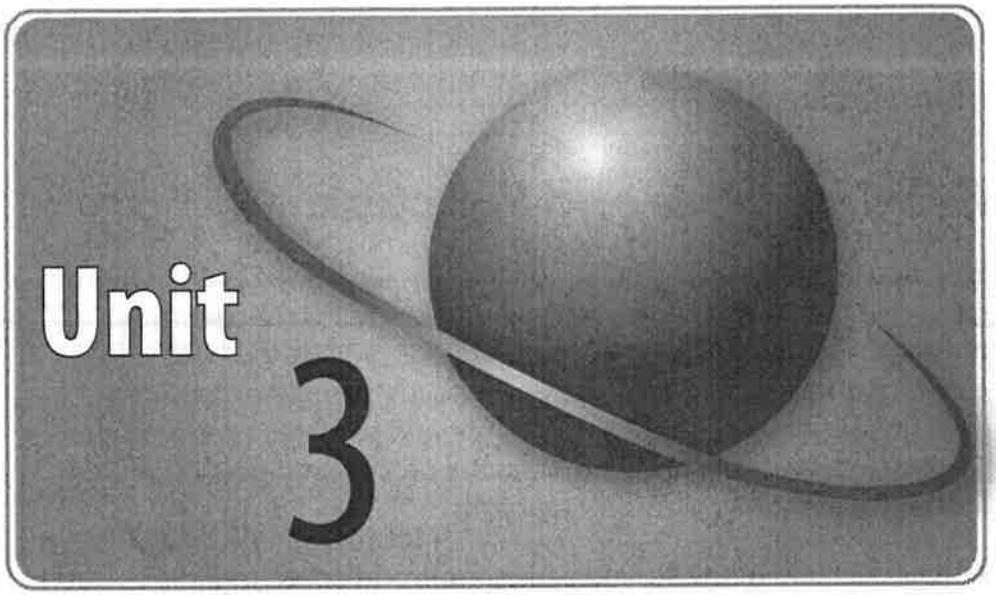


Life Sciences

Review 7: Cell Structure and Function

Review 8: Human Health

Review 9: Reproduction and Heredity

Review 10: Adaptations for Survival

Review 11: Life Cycles of Plants and Animals

Review 7

Flint - Grade 7

Cell Structure and Function

Your body is composed of trillions of cells. The many different types of cells in your body have many different functions. Nerve cells carry messages all throughout the body. Skin cells provide the body's outer covering. Some of the cells in your eyes focus the light entering the eyes. Other cells are sensitive to the light and pass this information to the brain. Cells in your liver complete the process of digesting your food and break down harmful chemicals.

At the other end of the scale are the simple one-celled organisms. Yet, even these cells are remarkably similar to the complex cells in your body. Let's not forget the plant world. There are single-celled plants as well as redwood trees that soar hundreds of feet into the air.

Since all of these living things are made up of cells, it is important to know how cells live and function. This review will cover some of the basic facts about cells.

Above: Life on Earth ranges from diatoms, which are single cells of algae, to the mighty California redwood trees.

Words to Know

- aerobic respiration
- anaerobic respiration
- anaphase
- cell
- cell cycle
- cell membrane
- cell wall
- chloroplast
- chromosomes
- cytokinesis
- cytoplasm
- daughter cell
- diffusion
- diploid cell
- endoplasmic reticulum
- eukaryotic cell
- haploid cell
- interphase
- meiosis
- metaphase
- mitochondria
- mitosis
- nuclear membrane
- nucleus
- organelle
- osmosis
- parent cell
- photosynthesis
- prokaryotic cell
- prophase
- pyruvic acid
- respiration
- ribosome
- semipermeable membrane
- telophase
- vacuole

Benchmarks/GLEs: LS-M-A1/2; LS-M-A2/4

Word Links

Look at the "Words to Know" list on the previous page. Circle two words that you don't know or that you want to learn more about. Then, on a separate piece of paper, write each word and what you think each word means.

Cells

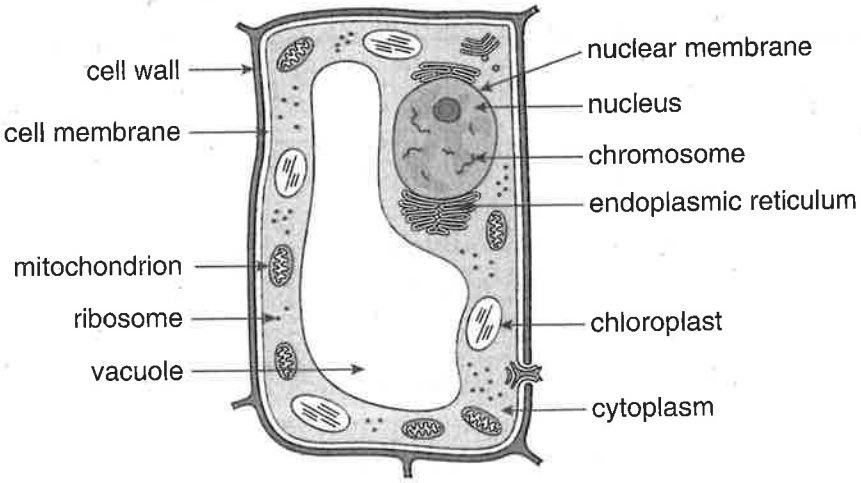
Cells got their name from the scientist Robert Hooke. In 1665, he was using a microscope to look at a very thin section of cork. He saw little boxlike structures next to one another. They reminded him of the little chambers called cells that monks lived in, so he named these things cells. Today, we know that **cells** are the basic unit of life. All living things, from the simplest one-celled organism to the blue whale (the largest organism ever to live on Earth), are made up of cells.

Even though cells are very small, they are incredibly complex. Scientists classify cells on the basis of their complexity. Every cell is classified as either a eukaryote or a prokaryote.

- **Eukaryotic cells**, such as plant and animal cells, contain tiny structures called **organelles**. Each organelle has a purpose in the function, maintenance, repair, and reproduction of the cell.
- **Prokaryotic cells**, such as bacteria, are different from eukaryotes because they do *not* contain membrane-bound organelles. They do, however, contain ribosomes.

This review will focus on the more complex eukaryotic cell. The basic parts of a plant cell are shown in the following diagram.

Plant Cell



The following list briefly explains the function of each labeled component.

Endoplasmic reticulum: transports materials within the cell

Nuclear membrane: encloses and protects the nucleus

Nucleus: control center for all cell activity; contains **chromosomes**, which carry the genes for an organism's traits and control cell processes

Cytoplasm: clear, thick fluid that holds all the components of a cell

Cell wall: the outer, nonliving cellulose structure that helps the plant cell keep its shape

Mitochondria: organelles that release energy to support all cell activity

Chloroplasts: organelles that contain chlorophyll used by plants in photosynthesis

Vacuoles: cavities inside the cytoplasm that contain fluid and pigment (coloring)

Cell membrane: semipermeable membrane that controls the movement of molecules into and out of the cell

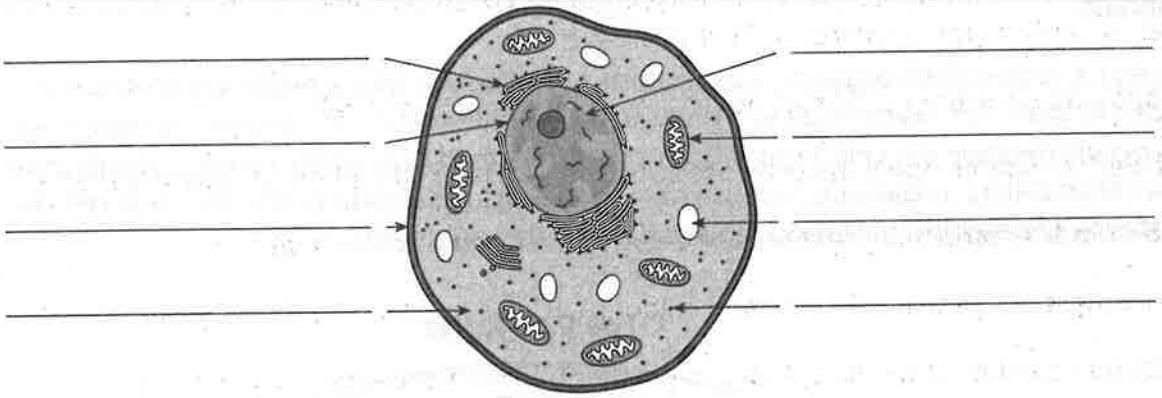
Ribosomes: organelles that contain the enzymes that help produce proteins

Suzanne is looking at two different cells under a microscope. One is a prokaryotic cell, and one is a eukaryotic cell. How can Suzanne tell the difference between the cells?

Benchmarks/GLEs: LS-M-A1/2; LS-M-A2/4

Animal cells are very similar to plant cells. Label the organelles in the animal cell below. (There are two components in the list of cell organelles on the previous page that you will not need, because they are not found in animal cells.)

Animal Cell



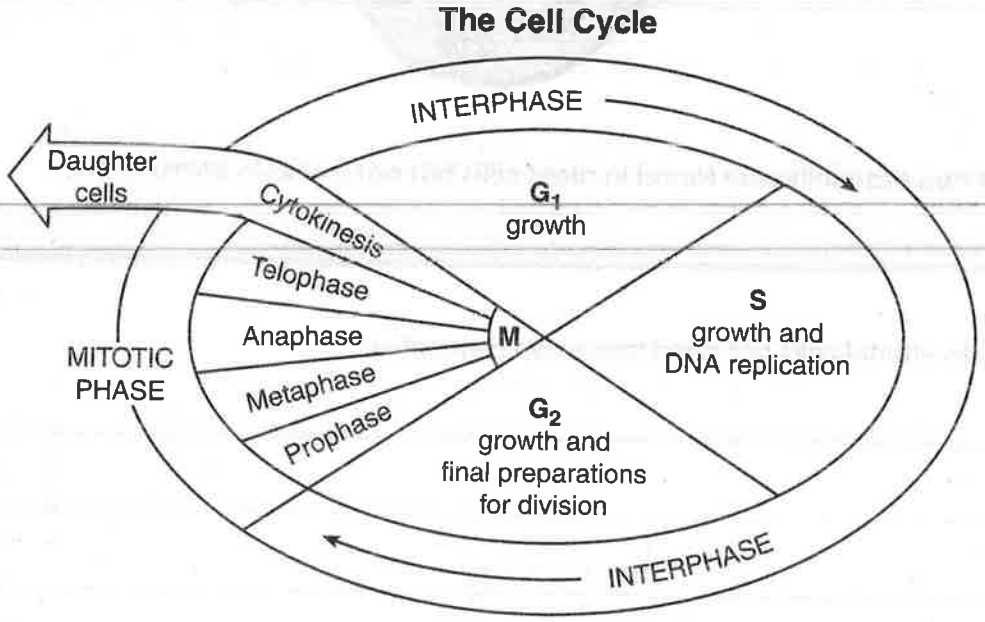
What two organelles are found in plant cells but not found in animal cells?

Why do animal cells not need these two organelles?

Mitosis

Mitosis is a process of cell division. It is part of the **cell cycle**, when a cell divides into two cells that are identical to each other. The original cell is called the **parent cell**; the new cells are called **daughter cells**. The cell cycle has two main phases: interphase and the mitotic phase (mitosis). Within mitosis, there are also four subphases: prophase, metaphase, anaphase, and telophase.

Unicellular (one-celled) organisms use mitosis to reproduce. Multicellular organisms use mitosis to grow. For example, as you grow, your bones, muscles, and organs increase in size. This occurs because the cells in your body divide over and over again, causing you to grow larger. Multicellular organisms also use mitosis to replace damaged cells. Your skin cells are constantly undergoing mitosis to replace dead or damaged cells.



Look at the diagram above. Identify the three stages that are part of the interphase.

_____

Identify the four subphases within the mitotic phase.

_____

_____

During which phase of the cell cycle is a cell's DNA replicated?

_____

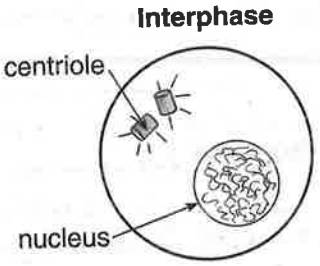
Benchmark/GLE: LS-M-B1/15

Before a parent cell can divide into two identical daughter cells, the DNA in the nucleus must be copied. The DNA must also organize itself into tight coils called chromosomes.

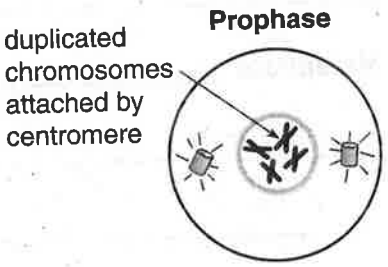
The following list describes the different phases of the cell cycle.

Interphase: Interphase is the part of the cell cycle when the cell is not dividing. *Inter-* means "between"; interphase occurs in between cell divisions.

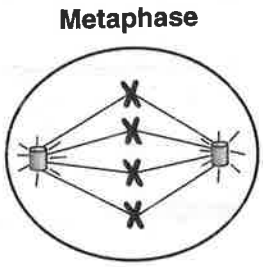
- The G_1 stage is the first stage, and it is the growth stage. During this stage, cells increase in size.
- The next stage is the S stage, or the synthesis stage. During this stage, the DNA in the nucleus is duplicated, or synthesized.
- During the G_2 stage, the cell continues to grow and prepares to undergo mitosis.



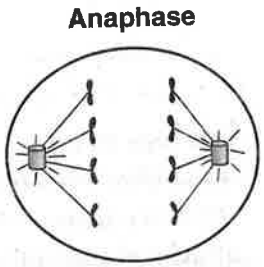
Prophase: This is the first phase of mitosis. During this phase, both copies of the cell's DNA condense to form chromosomes. The nuclear membrane breaks down, and the centrioles move to opposite sides of the nucleus.



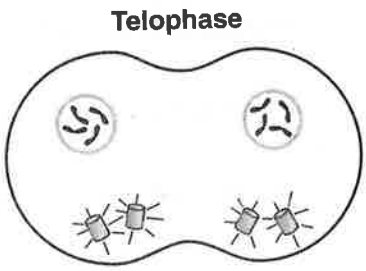
Metaphase: During this phase of mitosis, the chromosomes line up along the middle of the cell and attach to the centrioles. This arrangement ensures that each new daughter cell will receive a copy of each chromosome.



Anaphase: During anaphase, the duplicated chromosomes separate, and the centrioles pull them to the opposite ends of the cell. Each daughter cell will get one complete copy of DNA.



Telophase: Telophase is the last phase of mitosis. *Telo-* means "end." During this phase, a new nucleus begins to form around each copy of DNA in the new daughter cells. At the end of this phase, the process called **cytokinesis** finally splits the cell into two daughter cells.



Describe what happens to a cell during each of the following phases.

Interphase: _____

_____

_____

Prophase: _____

_____

_____

Metaphase: _____

_____

_____

Anaphase: _____

_____

_____

Telophase: _____

_____

_____

One way to help you remember the different phases of the cell cycle, or I-P-M-A-T, is to remember the sentence, "**I**ntelligent **P**eople **M**arvel **A**t **T**echnology." Write your own sentence using "I-P-M-A-T" that can help you and other students remember the different phases of the cell cycle.

_____

_____

Benchmark/GLE: LS-M-B1/15

After mitosis, both daughter cells have a complete copy of the DNA from the original cell. A cell with a complete copy of DNA is called a **diploid cell**. Sometimes, however, the daughter cells each receive half of the DNA in the original cell. These cells are called **haploid cells** and are formed by a process called **meiosis**.

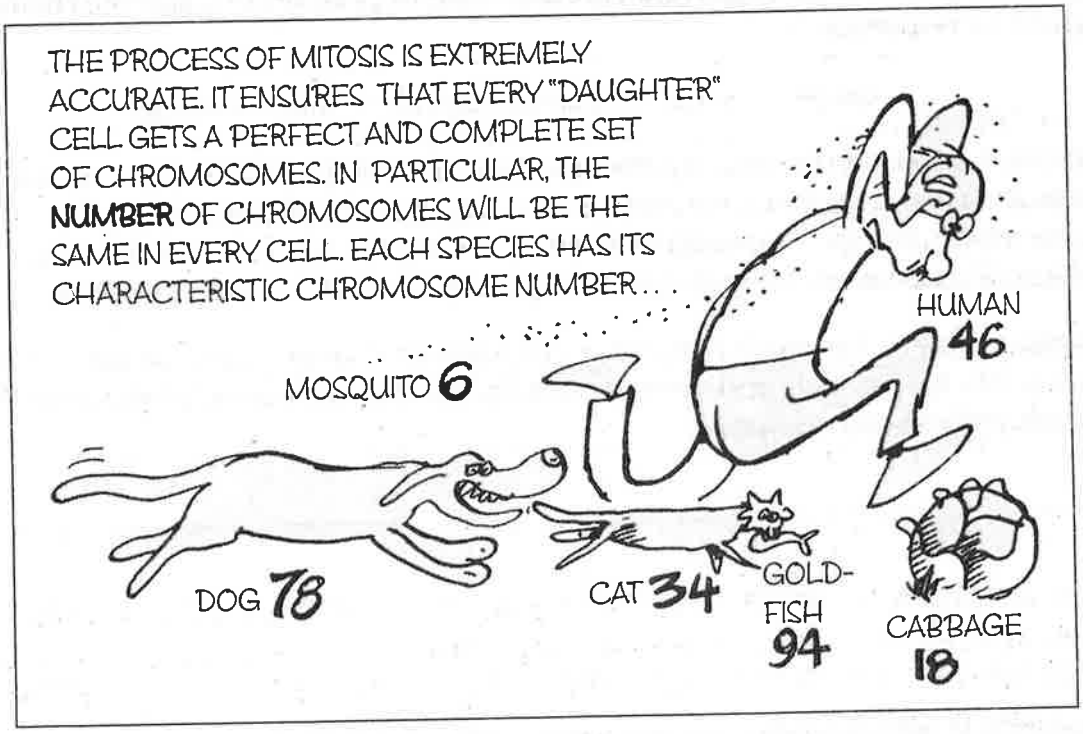
An easy way to remember the difference between diploid and haploid cells is that *diploid* cells have *double* the amount of DNA of a haploid cell. *Haploid* cells only have *half* the DNA of a diploid cell.

A cell has 10 chromosomes. How many chromosomes would its diploid cell have?

_____

How many chromosomes would its haploid cell have?

_____



The cartoon above states the number of chromosomes in the diploid cells of several organisms.

Does anything about those numbers surprise you? If so, describe what it is.

_____

_____

Photosynthesis and Respiration

Photosynthesis and respiration are two chemical reactions that are vital to life on Earth. **Photosynthesis** is the process plants use to capture the Sun's energy and convert it to a form that can be stored and used later. The energy from the Sun drives a chemical reaction. The products of the reaction have energy stored in their chemical bonds—energy that can be released and used later. The chemical reaction is:

$$\text{carbon dioxide} + \text{water} + \text{energy (sunlight)} \longrightarrow \text{oxygen} + \text{sugar}$$

Photosynthesis occurs in the chloroplasts of plants. Animals do not have chloroplasts, which explains why they must eat plants or other animals to get the energy they need to live.

One of the by-products of photosynthesis is oxygen. That is a good thing, because animals also cannot produce their own oxygen. Plants use oxygen, but they produce enough extra oxygen so there is enough oxygen for animal life on Earth.

When a living organism, either plant or animal, needs to use some of the energy it has stored, a chemical reaction called **respiration** releases the energy stored in sugar. The chemical equation for respiration is:

$$\text{oxygen} + \text{sugar} \longrightarrow \text{carbon dioxide} + \text{water} + \text{energy}$$

Note that the equation for photosynthesis is the reverse of the equation for respiration, and the equation for respiration is the reverse of the equation for photosynthesis. In photosynthesis, energy is captured by the plant chloroplasts and stored in the sugar produced. In respiration, energy from the sugar is released for the organism's use.

Maria puts some rechargeable batteries into the battery charger. Later, she puts the charged batteries into her flashlight and turns the flashlight on. Explain how what Maria did is similar to photosynthesis and respiration.

Photosynthesis and respiration are much more complicated chemical processes than is shown by the two equations. Photosynthesis and respiration are both a series of complex chemical reactions. Respiration, for example, can be divided into two different processes: anaerobic respiration and aerobic respiration.

In **anaerobic respiration**, a sugar molecule is broken down in the absence of oxygen. Some energy is released and stored, but not much. Most of the energy is still stored in one of the chemical products of anaerobic respiration, a chemical called **pyruvic acid**. Pyruvic acid still contains a lot of the energy that was present in the original sugar molecule. If enough oxygen is present, aerobic respiration takes place. In **aerobic respiration**, oxygen is used to break down the pyruvic acid molecules to release more energy.

Aerobic respiration releases much more energy than anaerobic respiration. Animals use both types of respiration, but they could not survive without aerobic respiration.

Diffusion and Osmosis

Chemicals are always moving around inside cells and living tissues. Two of the most important processes of this transfer of chemicals are diffusion and osmosis.

Diffusion is the passive movement of chemicals from an area of higher concentration to an area of lower concentration. If you drop some food coloring into a glass of water, after a while the food coloring will be distributed throughout the water. Diffusion has taken place. If you open a can of paint, after a while people on the other side of the room can smell the paint. Some of the paint molecules have been diffused through the air in the room. Because diffusion is a passive process, it does not require energy.

Give another example of diffusion.

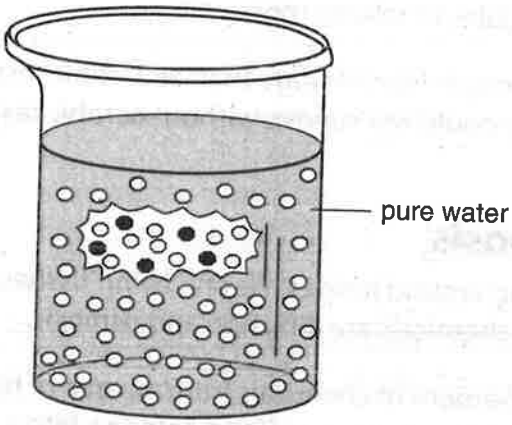
_____

_____

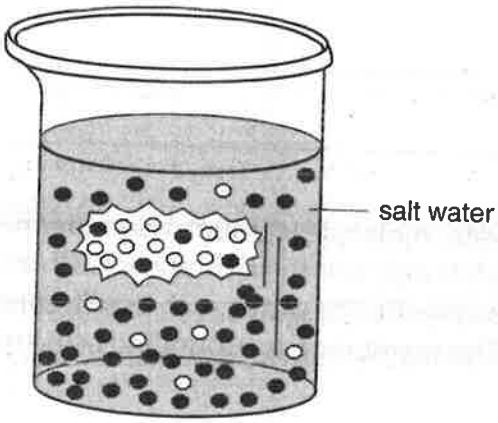
Osmosis is the diffusion of water molecules through a semipermeable membrane. A **semipermeable membrane** lets only certain substances, such as water, pass through it. Other substances that are dissolved in the water, such as salt, cannot pass through the semipermeable membrane. The membranes surrounding cells are semipermeable membranes.

Because osmosis is a form of diffusion, osmosis is a passive process (requires no energy). We also know that the water molecules are moving from an area of higher concentration to an area of lower concentration. Osmosis takes place when there is a difference in the amount of dissolved substances on either side of a semipermeable membrane.

All cells have chemicals dissolved in the water enclosed by the cell membranes. In the illustration below, a cell has been placed into a beaker of pure water. In the drawing, the open circles are water molecules and the shaded circles are molecules of dissolved chemicals. The dissolved chemicals cannot pass through the cell membrane.



The drawing above shows that the concentration of water molecules inside the cell is lower than the concentration of water molecules outside the cell. The water would move from the area of higher concentration (water in the beaker) to the area of lower concentration (inside the cell). If the cell could not get rid of the extra water, the cell membrane would burst.

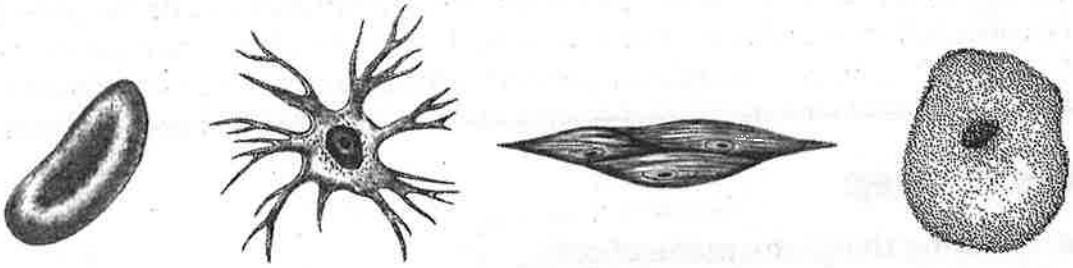


In the second illustration, a cell has been placed into a beaker of salt water. So much salt has been dissolved in the water that the concentration of water molecules in the cell is higher than the concentration of water molecules in the beaker. Water would pass through the cell membrane and out into the water in the beaker. The cell would shrink.

James is on the swim team. After a long practice, he notices that the skin on the ends of his fingers looks puffy and a little bit swollen. What has happened? Explain your answer using the concept of osmosis.

Different Types of Cells

Because the human body is so complex, it contains a great variety of cells. Four of the most common cells in the human body are shown below. The shapes of the cells are so different because what the cells do in the body is so different.



Red Blood Cell | Nerve Cell | Muscle Cell | Skin Cell

Red blood cells pick up oxygen from the lungs. They travel through the bloodstream and deliver the oxygen to the tissues. At the tissues, they pick up carbon dioxide and bring it back to the lungs, where the carbon dioxide is exhaled.

Red blood cells look like thick discs with depressions on both sides of the disc. The reason for the depressions is that they give the cell more surface area to absorb oxygen and carbon dioxide.

Nerve cells form a vast network throughout the body, carrying messages and delivering commands. The many projections on the nerve cell shown above allow it to form connections with many other nerve cells.

Muscle cells come in a variety of shapes. All muscle cells have the ability to contract. When a muscle cell contracts, it gets shorter and thicker. That is what happens every time you use a muscle.

Skin cells are flat and thin, like shingles on a roof. Their shape allows them to form a protective layer covering almost all of the body.

Why would skin cells need to able to divide rapidly and often?

_____

_____

Word Links

Now that you've read through this review, go back to the words you circled in the "Words to Know" list. Write each word in the "Word Links" table at the back of this workbook. Fill out one row for each word.

Keys to Keep

- All living things are made of cells.
- All cells have small structures called organelles that perform different functions.
- Mitosis is the process of cell division and reproduction.
- Plants use photosynthesis to convert the energy in sunlight into stored energy in sugar.
- Plants and animals use respiration to release the stored energy from sugar.
- Diffusion is the passive movement of molecules from a region of higher concentration to a region of lower concentration.
- Osmosis is diffusion across a semipermeable membrane.
- The human body has many different types of cells that perform many different functions.

Benchmark/GLE: LS-M-A1/3

Explore It Yourself

In this exercise, you will see the effects of osmosis across a semipermeable membrane.

Note: Constructing the apparatus below will require two people.

Materials Needed

- flat tube (to represent a semipermeable membrane)
- molasses
- water
- dental floss or fine string
- beaker
- small glass tube
- eyedropper or similar device

Step 1: The strip of semipermeable membrane is actually a tube itself, squashed flat. To separate the two sides of the semipermeable membrane, put it under some warm water and then roll it back and forth between your thumb and first finger to separate the two sides.

Step 2: After the sides of the membrane have been separated, carefully push the glass tube down the length of the membrane to open it further.

Step 3: Pull the glass tube back up the membrane so about 2 cm of the membrane does not have the glass tube in it. Tightly tie off this end of the membrane with some fine string or dental floss.

Step 4: Now you can use the eyedropper to fill up the semipermeable membrane with molasses. The glass tube will help keep the membrane tube open as you do this.

Step 5: When the semipermeable membrane tube is filled with molasses, tie off the other end of the semipermeable membrane tube. Do this by leaving the glass tube in the membrane and tying the string or dental floss tightly around both the semipermeable membrane tubing and the glass tube. Seal the membrane tube tightly around the glass tube, tying the string about 2 cm down from the top of the membrane tubing.

Step 6: Carefully lower the semipermeable membrane sack and glass tube into a beaker of hot water. Submerge the semipermeable membrane sack so most of it is under water but the top part tied off by the string is not. Keep holding on to the apparatus—do not let the semipermeable membrane sack rest on the bottom of the beaker.

Step 7: What happens to the column of molasses in the glass tube?

What Does It Mean?

1. Explain what you observed during the exercise. Use the concepts of passive diffusion across a semipermeable membrane (osmosis) in your answer.

2. Suppose the molasses had been diluted before the experiment by adding one cup of water to one cup of molasses. How do you think this would have affected the results of the experiment?

3. In plants that live in water, the concentration of dissolved substances inside their cells must be similar to the concentration of dissolved substances in the water they live in. Why do you think this is?

4. A plant that lives in seawater is placed into a beaker of pure water. What do you think will happen to the cells of the plant?

5. A plant that lives in freshwater is placed into a beaker of seawater. What do you think will happen to the cells of the plant?

Louisiana *i*LEAP Science Practice begins on the following page.

*i*LEAP Science Practice

1. Which statement describes one function of the nucleus in cells?

   A. releases energy and keeps the cell functioning
   B. holds all the components of a cell
   C. protects the chromosomes
   D. transports material within the cell

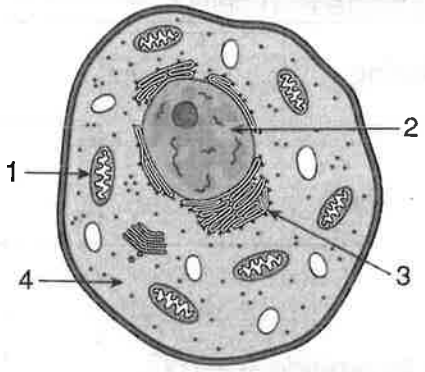
2. In which process is pyruvic acid broken down to provide energy?

   A. osmosis
   B. aerobic respiration
   C. photosynthesis
   D. anaerobic respiration

3. What is the function of the cell membrane of a cell?

   A. It controls what enters and leaves the cell.
   B. It provides stability to the cell's shape.
   C. It moves the cell from place to place.
   D. It produces energy to power the cell.

4. Which organelle provides the cell with energy?



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

5. Which of the cells listed below does **not** contain membrane-bound organelles?

A. skin cells
B. plant cells
C. eukaryotic cells
D. prokaryotic cells

6. In which stage of mitosis do the chromosomes line up along the center of the cell?

A. telophase
B. metaphase
C. prophase
D. anaphase

7. Humans and animals use anaerobic respiration when they need energy but not enough oxygen is available for aerobic respiration. On a track team, which runner is more likely to start using anaerobic respiration sooner—a runner who sprints for a quarter mile or a long-distance runner who is running for two miles? Explain your answer.

8. Anaerobic respiration produces a waste product that must be broken down. This breakdown requires lots of oxygen. Explain why a sprinter breathes more heavily after a race than a long-distance runner.

Review 8

Human Health

Your body is complex; it is made up of many different parts and systems. Some of these systems you can control. For example, you can choose whether to eat a piece of bread or a candy bar. However, many of your body's systems are self-controlled. Whatever you choose to eat, once the food gets into your mouth, your body starts taking over, as though it were on autopilot. Your tongue makes saliva to break down some of the food. Muscles in your throat push the food down to your stomach. Your brain tells your stomach to make acid that turns the food to slush. Your intestines soak up nutrients from that slush, the nutrients your body needs to keep working. Your blood, pushed and pulled along by your heart, carries these nutrients all around your body. Any wastes from the body and anything left over is handled by your kidneys, your liver, and your colon.

Above: Your body is complex and made up of many different parts and systems.

You cannot control most of these processes. They are automatic. It's a good thing your body does all these things by itself. If you had to think about doing all this stuff, you'd be making thousands of little choices every minute of every day just to stay alive. You wouldn't have time to talk to friends, listen to music, read a book, or go have fun on a Friday night. You couldn't even sleep, because your mind would have to stay awake to tell your body how!

This review is all about the systems that keep your body running without you even thinking about them—all the systems that leave you free to think about things like school.

Words to Know

- alveoli
- antibiotics
- antimicrobial agents
- artery
- blood
- bone
- capillary
- cartilage
- diaphragm
- esophagus
- excretory system
- heart
- homeostasis
- infectious diseases
- intestine
- joint
- lungs
- noninfectious diseases
- organ
- organ systems
- parasite
- pathogen
- plasma
- puberty
- red blood cells
- stomach
- tissues
- trachea
- vein
- vertebrates
- villi
- white blood cells

Word Links

Look at the "Words to Know" list on the previous page. Circle two words that you don't know or that you want to learn more about. Then, on a separate piece of paper, write each word and what you think each word means.

Tissues, Organs, and Organ Systems

The descriptions in this review focus on the human body. However, much of this description also applies to many **vertebrates**—animals with backbones. Vertebrates include fish, amphibians, reptiles, birds, and mammals.

The most basic complete structures in the body are cells. Cells that do the same job work together to form body **tissues**. Each tissue is made of a specific type of cell that has a particular function. For example, muscles are tissues. Muscles are made of muscle cells. Their job is to contract and relax, making the body move. Groups of tissues, sometimes with specialized functions, make up **organs**. Organs have specific functions in the body that are usually unique, like the liver. Sometimes organs come in pairs, like the lungs and kidneys. Organs, in turn, work together in **organ systems**. These are groups of organs that accomplish some goal. For instance, the heart, the blood, and the blood vessels work together to form the circulatory system, the body's transit system. Each function that humans and most other animals must do to stay alive (breathing, eating, thinking, etc.) is made possible by groups of specialized cells arranged into tissues, organs, and organ systems.

Place the following in order from least complex to most complex: organ, organ system, organelle, tissue, cell, vertebrate.

_____

_____

What is the difference between an organelle and an organ?

_____

_____

Now let's look at some of the organ systems at work within the human body.

Benchmarks/GLEs: LS-M-A5/9, 10; LS-M-A6/11, 12; LS-M-A7/13

The Skeletal System

The skeletal system is made up of the different **bones** of the body. Bones vary tremendously in their size and shape, depending on their function. For example, the bones in your legs are long, straight, and circular. Your ribs, on the other hand, are curved and flat. The skeletal system has many functions. For example, some bones protect organs. The bones in your skull protect your brain; the bones of your rib cage protect your heart and lungs.

The skeletal system is also important because it provides support for the body. Explain what this means.

_____

_____

The skeletal system helps your body move. To see how this is, bend your arm at the elbow. This movement is possible because the bones of your arm, like all bones in your body, are connected by **joints**. Many joints in the skeletal system are lined with **cartilage**. Cartilage is a soft, flexible, smooth tissue. It lets the joints slide past each other easily. It also cushions and protects the ends of bones during movement.

The skeletal system contains many joints. Identify two joints other than your knee joint.

Joint 1: _____

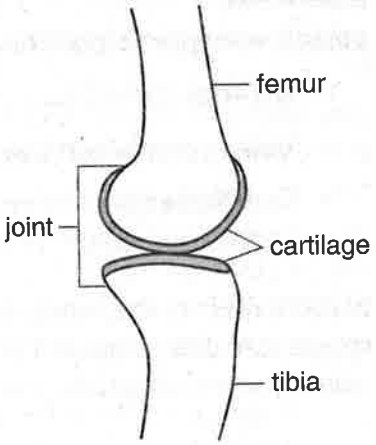
Joint 2: _____

What kinds of movements do the joints you identified produce?

_____

_____

Knee Joint



Above: Cartilage allows the joints to slide past each other and cushions and protects the ends of bones during movement.

Arthritis is a condition in which the cartilage in a joint has worn away. What happens to a joint that is no longer cushioned and covered by cartilage?

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The Circulatory System

The circulatory system consists of the **heart**, blood, and blood vessels. This system is the body's delivery service. It provides all tissues in the body with oxygen and nutrients. It is also the trash collection system because it removes waste products, such as carbon dioxide.

Blood

The heart acts as a pump that keeps blood moving through blood vessels. **Blood** is a thick liquid that transports nutrients and wastes. Blood is made of three main components.

- **Plasma:** Over half of your blood is made of plasma, which is mostly water.
- **Red blood cells:** These blood cells transport oxygen throughout the body.
- **White blood cells:** These blood cells help fight infections.

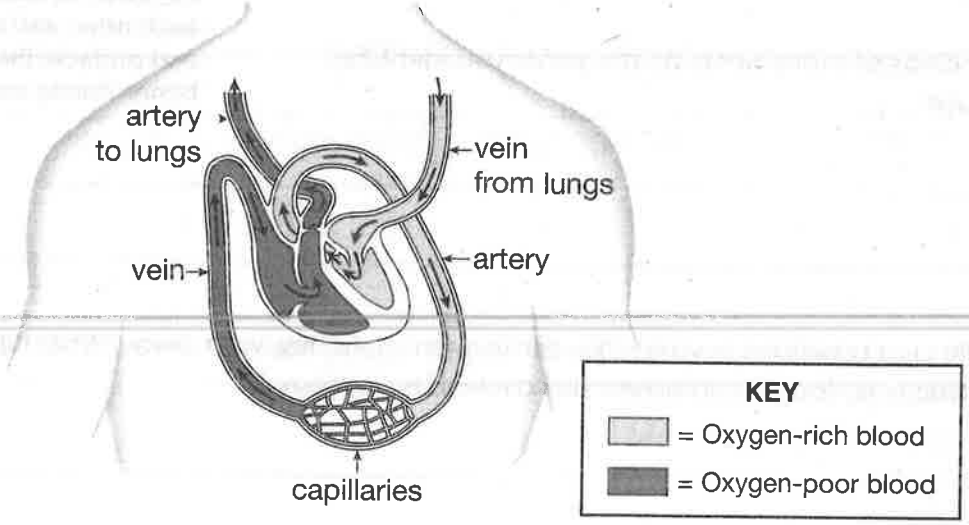
Vessels

Vessels transport blood throughout the body. There are three types of blood vessels.

- **Arteries** carry blood away from the heart.
- **Veins** carry blood toward the heart.
- **Capillaries** are tiny vessels that join arteries and veins and reach all cells of the body. Capillaries can be thinner than a single strand of hair.

Blood travels to the lungs, where red blood cells pick up oxygen. The red blood cells carry this oxygen to other parts of the body. Blood also travels to the digestive system, where nutrients from food are absorbed into the bloodstream and distributed to other tissues.

Human Circulatory System



Willy claims that arteries carry oxygenated blood and veins carry blood with carbon dioxide. Is this correct? Explain your answer.

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When you exercise, your heart beats much faster than when you sit still. Explain why physical activity causes this to happen.

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Which blood vessels, arteries, veins, or capillaries, contain blood at the highest pressure? Explain your answer.

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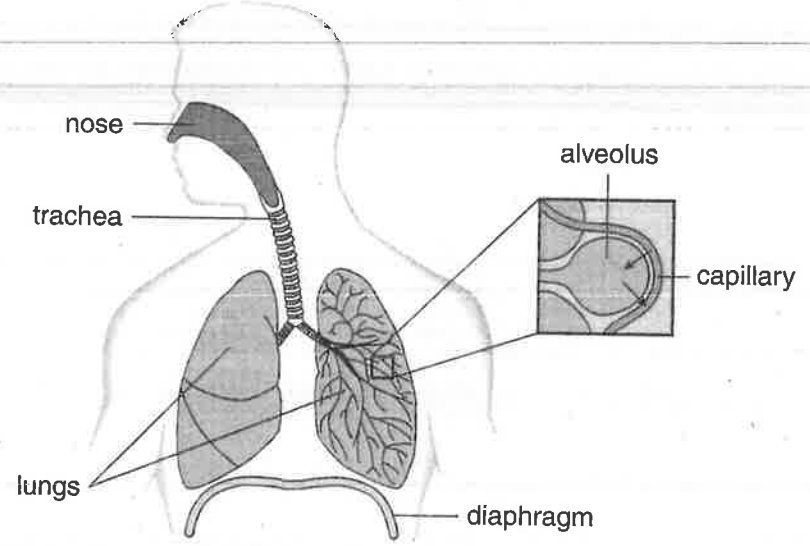
The Respiratory System

The respiratory system works closely with the circulatory system to provide the body's tissues with oxygen and to remove carbon dioxide from the body. The respiratory system controls respiration, or breathing. You may remember respiration from a previous review. The same word is used for breathing and for the process of breaking down sugars, because animals breathe in order to exchange the gases used in cellular respiration.

When you inhale, a thin muscle called the **diaphragm** contracts. When this happens, your **lungs**, which are like big sacks or sponges, expand to hold air. When the diaphragm relaxes, it helps squeeze the air back out of your lungs. Air enters mostly through the nose. The nose is full of tiny hairs that filter dust from the air. Air then travels to the **trachea**, a hollow tube that carries air to the lungs. Once in the lungs, the air travels to tiny air sacs called **alveoli**. Oxygen diffuses over membranes in the alveoli, entering the blood. Red blood cells grab on to the oxygen and take it away in the bloodstream. At the same time, carbon dioxide diffuses into the lungs. When you exhale, the carbon dioxide–rich air travels back up the trachea and out through the nose or mouth.

Human Respiratory System



Look at the diagram above. What do the arrows going between the alveolus and the capillary represent?

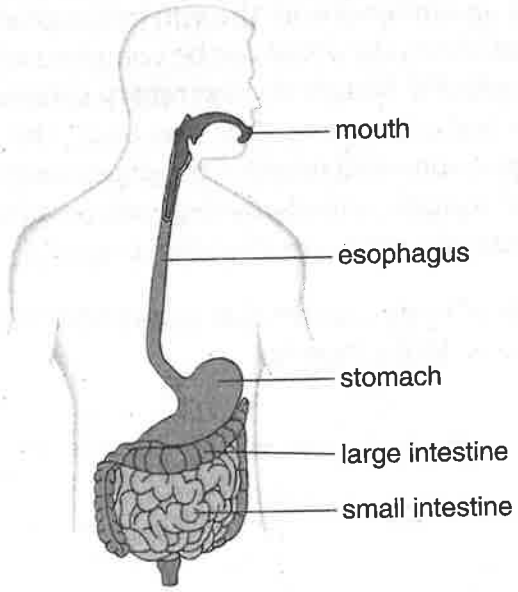
At high elevations, like in the mountains, less oxygen is in the air than at sea level. If you traveled to the mountains, what effect would it have on your respiration? Explain how this relates to diffusion.

Benchmarks/GLEs: LS-M-A5/9, 10; LS-M-A6/11, 12; LS-M-A7/13

The Digestive System

The digestive system provides your body with the nutrients you need to survive. These nutrients come from the food you eat. The process of breaking down food begins in the mouth. When you chew, your teeth break down food physically. Your saliva begins breaking it down chemically. The food is then swallowed and travels through the **esophagus**, a long tube that connects the mouth to the stomach. Once in the **stomach**, food is broken down even more by stomach acid. The food then travels from the stomach to the intestine. The **intestine** is a long, snakelike tube coiled just below your stomach. In fact, when stretched end-to-end, an adult intestine is over 7 meters long! The intestine is divided into two parts, the small intestine and the large intestine. Nutrients from food are absorbed into the blood in the small intestine. Anything that is not absorbed is carried to the large intestine. The large intestine removes water from leftover food and stores the waste until it is expelled from the body.

Human Digestive System



In what ways are the digestive system and the respiratory system similar to each other?

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Why do you think the small intestine needs to be so long?

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Organ Systems Working Together

Organ systems do not function alone. All the systems are needed to make a functioning human body. Several groups of systems work closely together to maintain balance within the body.

The heart, blood, and blood vessels make the circulatory system. The nose, mouth, trachea, and lungs make the respiratory system. What is the relationship between the two systems? To get energy from food nutrients, all cells need a constant supply of oxygen. The process that releases this energy also makes carbon dioxide, which is toxic to humans. Our bodies must constantly breathe in new oxygen and breathe out carbon dioxide. (This relationship with breathing is why the process of breaking down food energy is known as respiration.) The circulatory and respiratory systems work together to exchange gases with the outside environment and distribute them throughout the body.

Organ systems often work in larger groups. The circulatory system, as the conveyor belt of the body, is responsible for moving nutrients to cells, too. In order to do this, it works closely with the digestive system to pick up nutrients from the **villi** in the small intestine and bring them to the cells. At the same time, this cycle would not be complete without the oxygen from the respiratory system and also a fourth system, the **excretory system**. This system is responsible for removing cellular wastes and excess water from the body. This system, too, relies on the circulatory system for transportation and relies on the digestive system for the nutrients to power itself. Ultimately, every system in the body depends on all the others. They must all function together, or the body as a whole will not work properly.

List two more examples of body systems that work together. Explain how they need each other to do their own jobs properly.

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Growth and Development of Humans

People do not go through metamorphosis, like insects. However, we still experience tremendous change as we grow and develop.

Infancy and Childhood

Humans' most distinctive feature is our intelligence. Our brains are so large that we are born before they finish developing. As a result, human newborns are completely helpless. They cannot walk, crawl, or communicate. However, over the first few months and years, humans develop dramatically. By six to ten months, they are usually crawling. They say their first words at around one year old and speak in complete sentences by age three. Throughout childhood, children's brains have one major task: learning.

Above: Over the first few months and years, humans grow and develop dramatically.