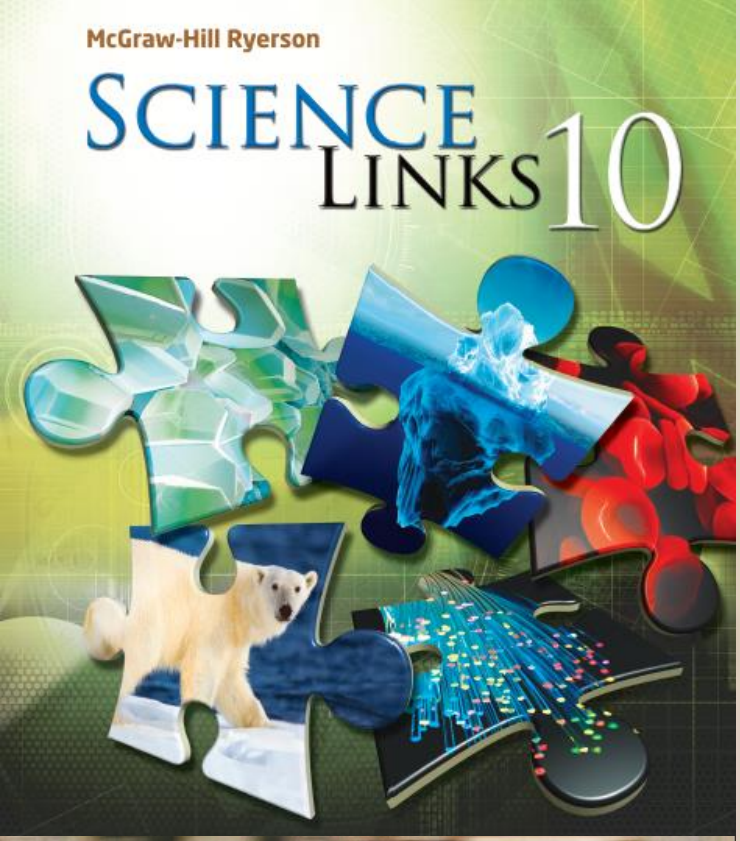


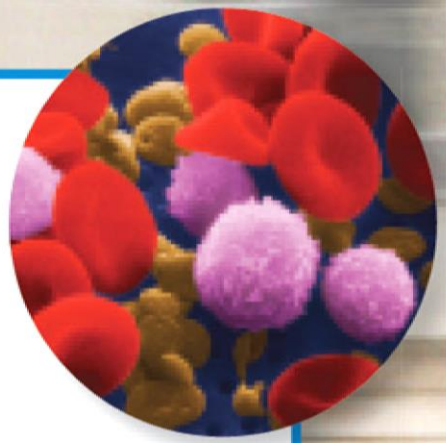
UNIT 1

Tissues, Organs, and Systems

- ***Topic 1.1***: *Why are cells important?*
- ***Topic 1.2*** : *Why do animal cells divide and what happens when they do?*
- ***Topic 1.3***: *How do cells work together in the human body?*
- ***Topic 1.4***: *How do systems work together in the human body?*
- ***Topic 1.5***: *How do technology, substances, and environmental factors affect human health?*

Topic 1.1 Why are cells important?

(Pages 8-19)

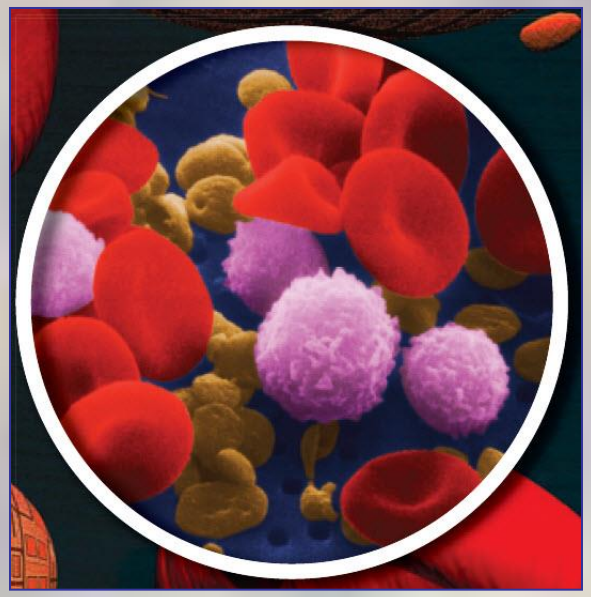


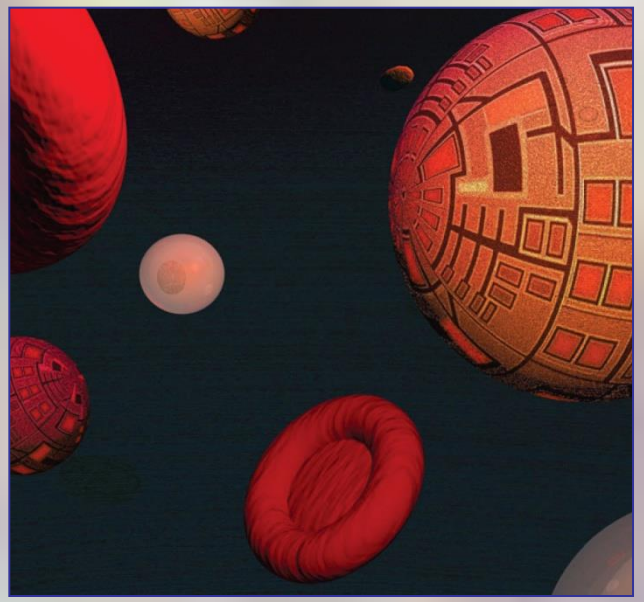
Key Concepts

- Studying cells helps us understand how organisms function.
- Cellular organelles work together to carry out life functions.
- Cellular processes enable organisms to meet their basic needs.

Why are cells important?

Scientists working in **nanotechnology** (the science and the technology of the very, very small) are working to create the first artificial cell.





Only by studying real cells will they be able to create the perfect fake.

Studying cells helps us understand how organisms function.

Why should we learn about cells?

By learning about cells, we come to understand how we can:

- protect cells to prevent infection and other harmful effects
- observe cells to diagnose disease
- treat cells to heal illnesses
- stop harming cells through our lifestyle choices and actions

The next 4 slides describe medical advances that have been achieved through a better understanding of how cells work.

Medical Advances

Malaria is a deadly disease. It is transmitted by mosquitoes in tropical parts of the world. Scientists have recently developed a vaccine that can protect human cells from malaria infection. To develop this vaccine, scientists needed to learn about cells in both humans and mosquitoes. They also needed to understand the single-celled organism that causes malaria.

Medical Advances

A person with severe burns is often treated with skin grafts taken from another region of their body. However, sometimes there is little healthy skin left on the body. In such cases, doctors place an artificial skin substitute over the burns. This nylon-based material contains a substance that works with the blood to heal the wound. Knowledge of how both skin and blood cells function has made this technology possible.

Medical Advances

Medical doctors have discovered that reducing body temperature can help a person survive a heart attack. Cold temperatures reduce the harm to heart and brain cells after a heart attack. By studying cells, doctors have been able to develop this new life-saving treatment.

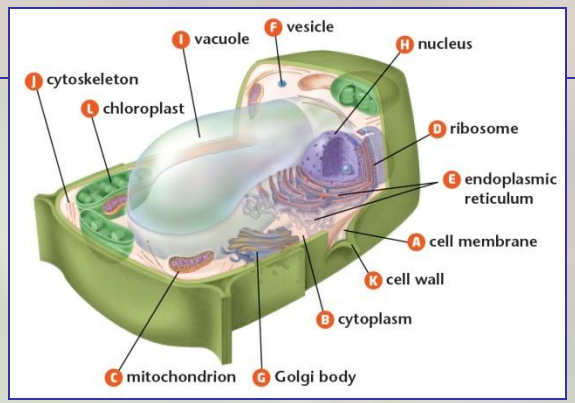
Medical Advances

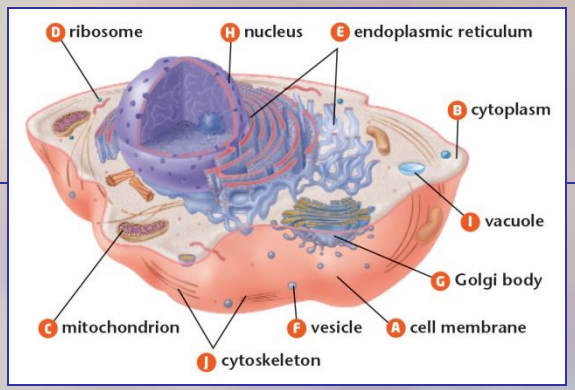
Did you know that artificial sweeteners can make us gain weight? Scientists have discovered that consuming artificially sweetened foods and beverages "disappoints" brain cells that were expecting sugar, based on the taste. As a result, our brain tells us to keep eating, hoping to get the sugar it was promised. Such knowledge about cells can help us make healthier choices in the foods and beverages we consume.

Cellular organelles work together to carry out life functions.

An **organelle** is a structure within a cell that carries out specific functions to support the life of the cell. Organelle functions include:

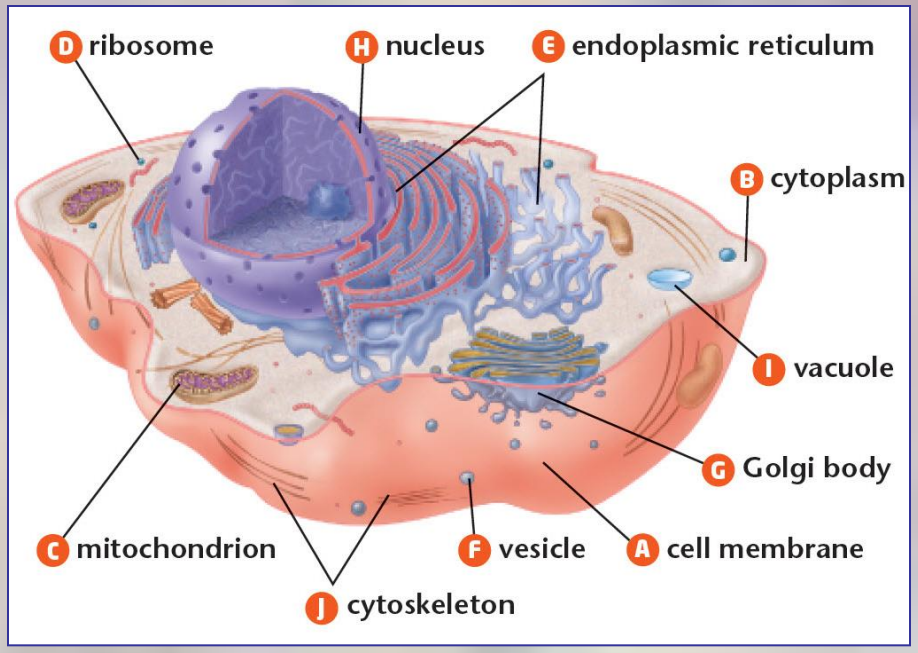
- bringing in nutrients
- removing wastes
- generating and releasing energy for the cell to use
- making substances the cell needs
- reproducing



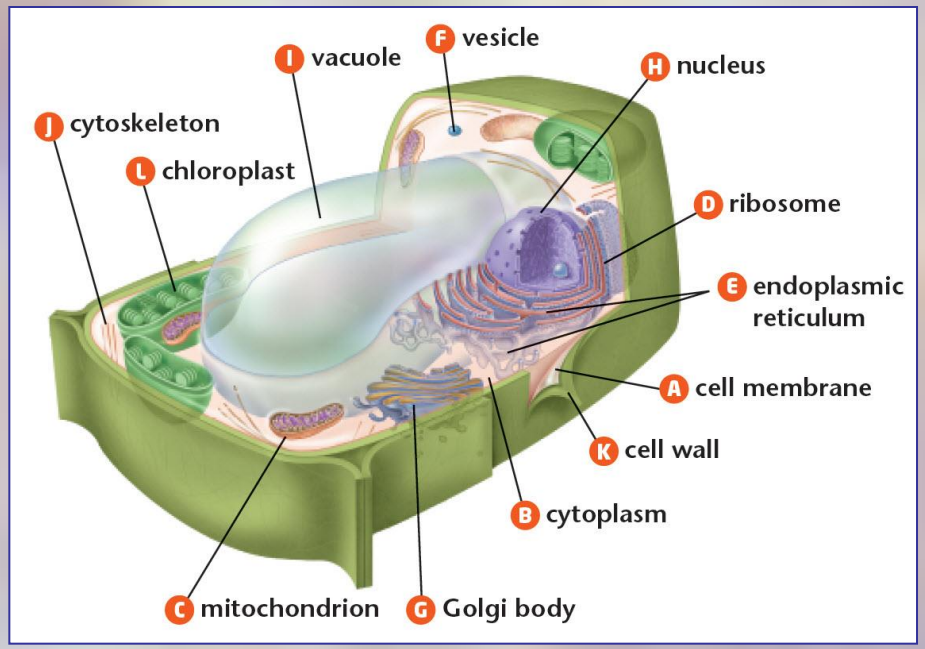


Organelles and other structures in cells have different tasks.

Each organelle has a specific role within a cell. Some cells have more of one type of organelle and fewer of others.

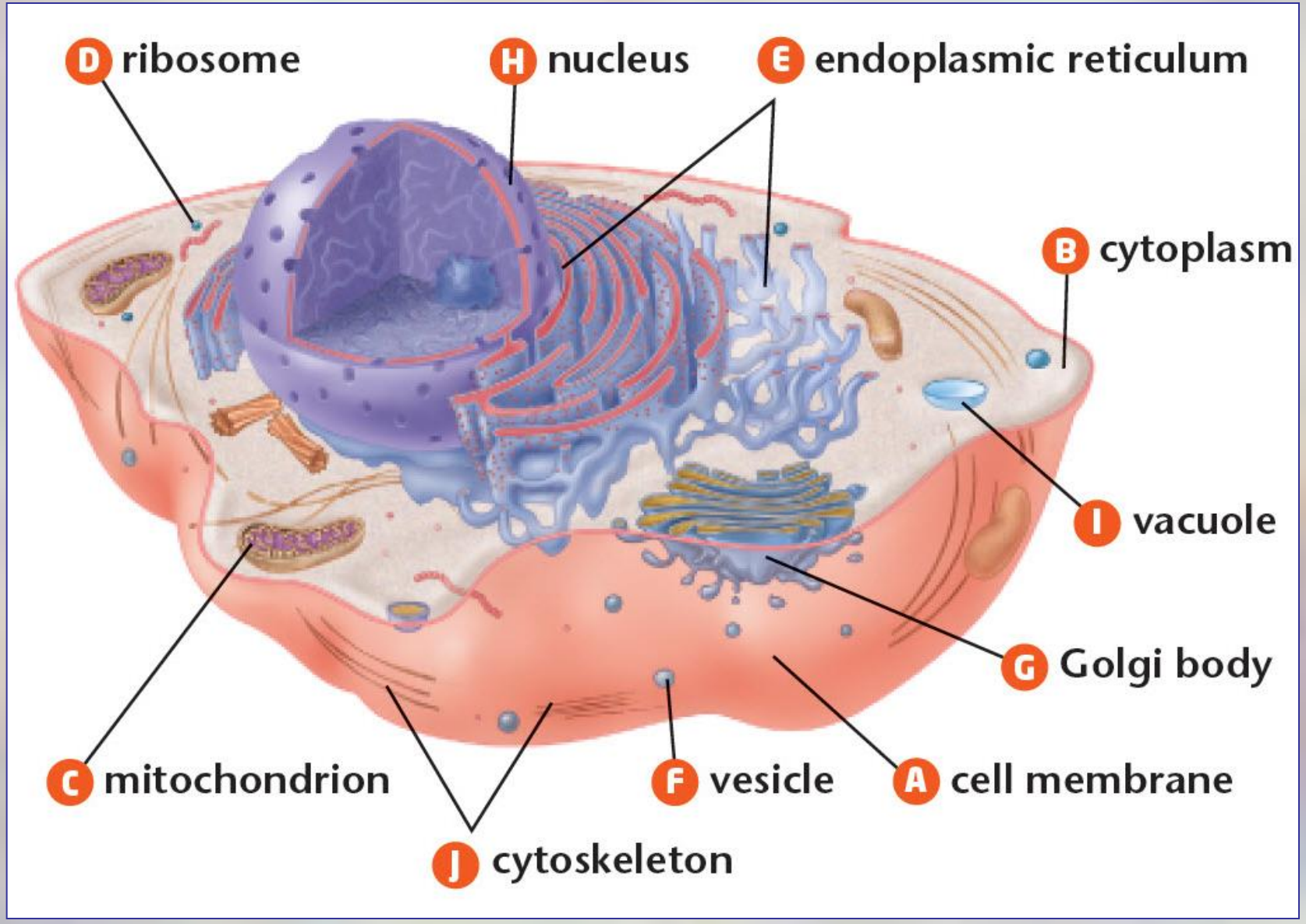


Animal Cell Organelles

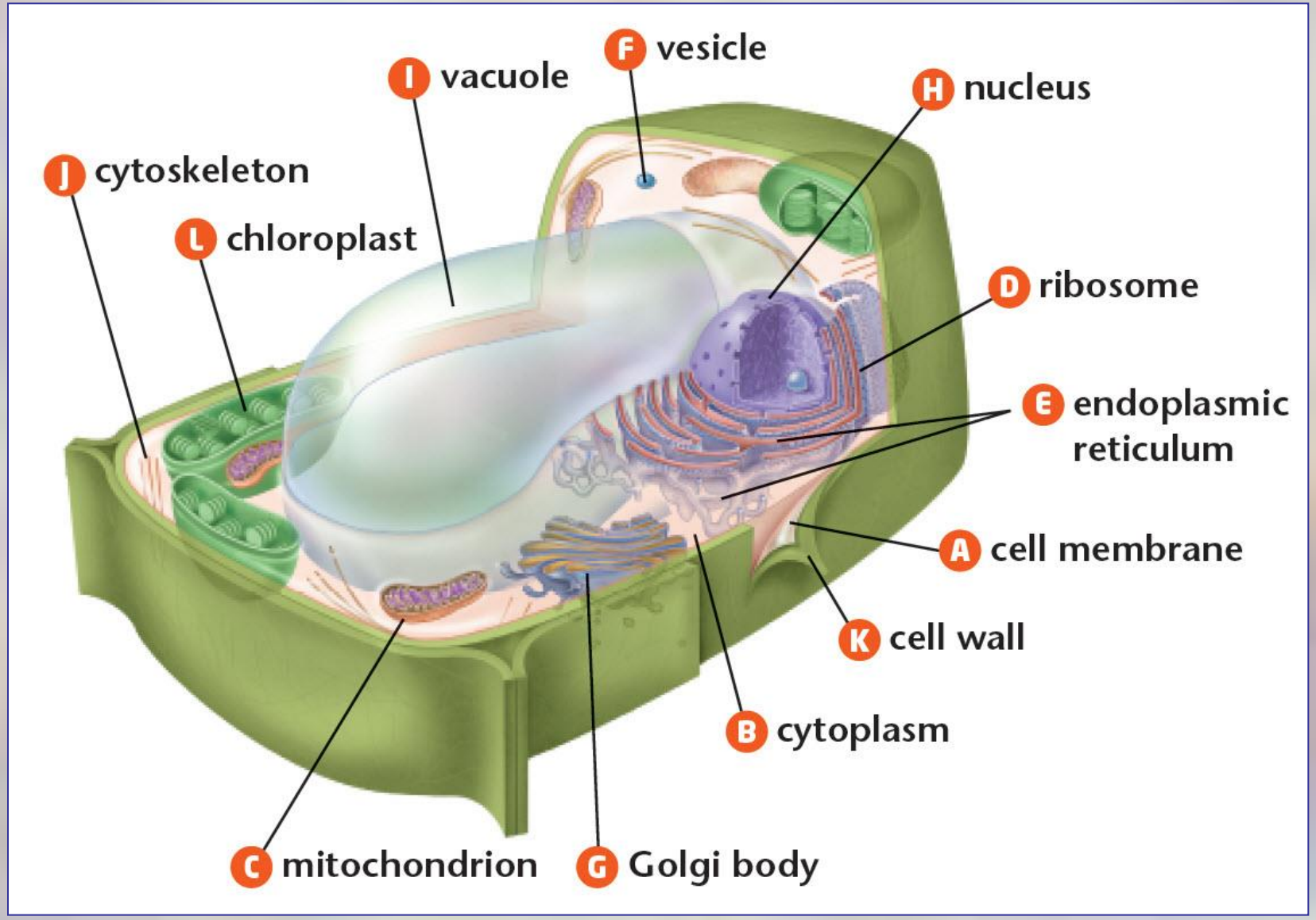


Plant Cell Organelles

Animal Cell Organelles

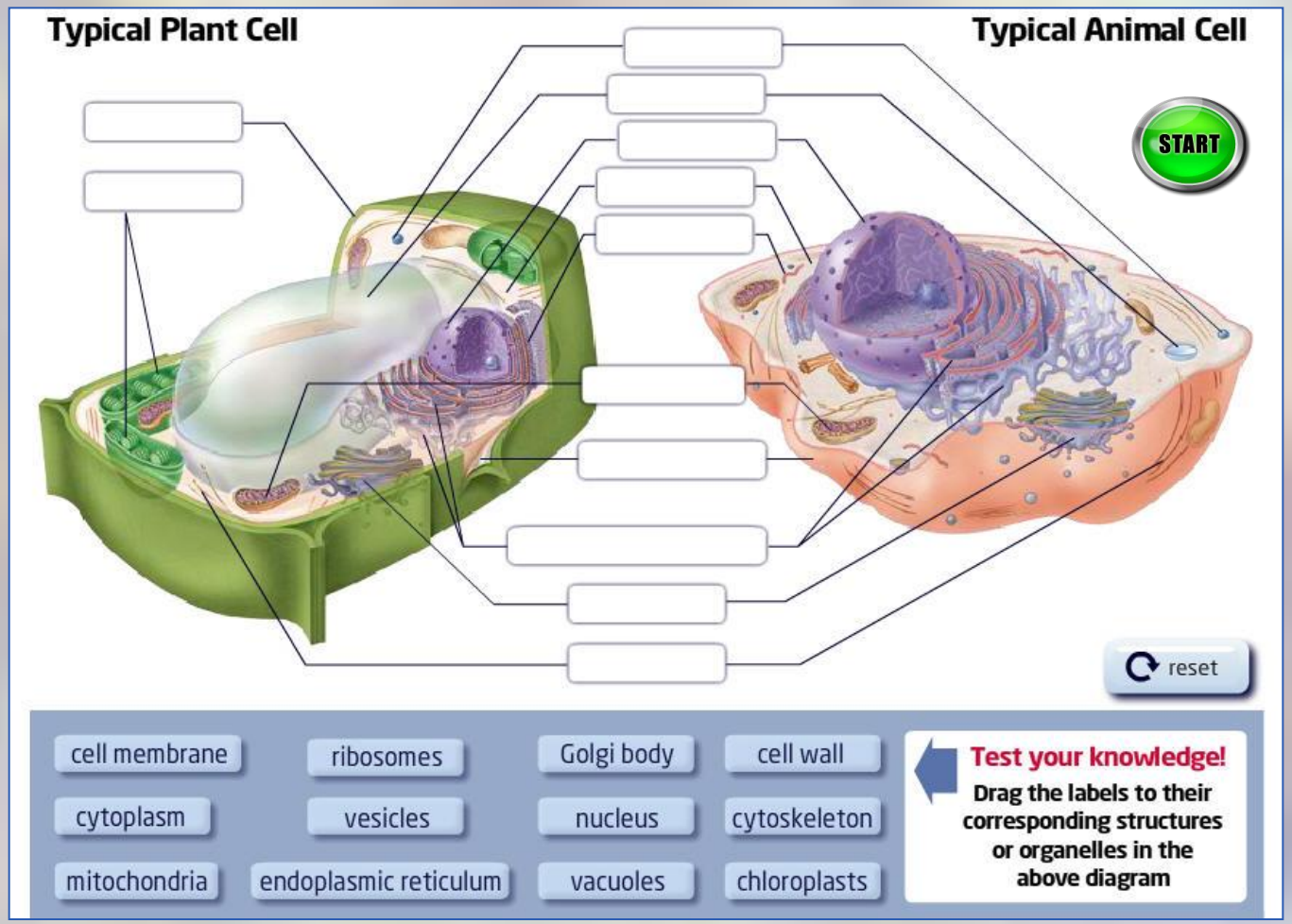


Plant Cell Organelles



Reviewing Organelles

Click the "Start" button to review organelles in animal and plant cells.



Cellular processes enable organisms to meet their basic needs.

Diffusion is the movement of molecules (or other particles) from an area of high concentration to an area of low concentration until they are evenly distributed.

Concentration refers to the number of molecules of a substance in a given volume.

Name some everyday examples of **diffusion**.

Cellular processes enable organisms to meet their basic needs.

Diffusion occurs:

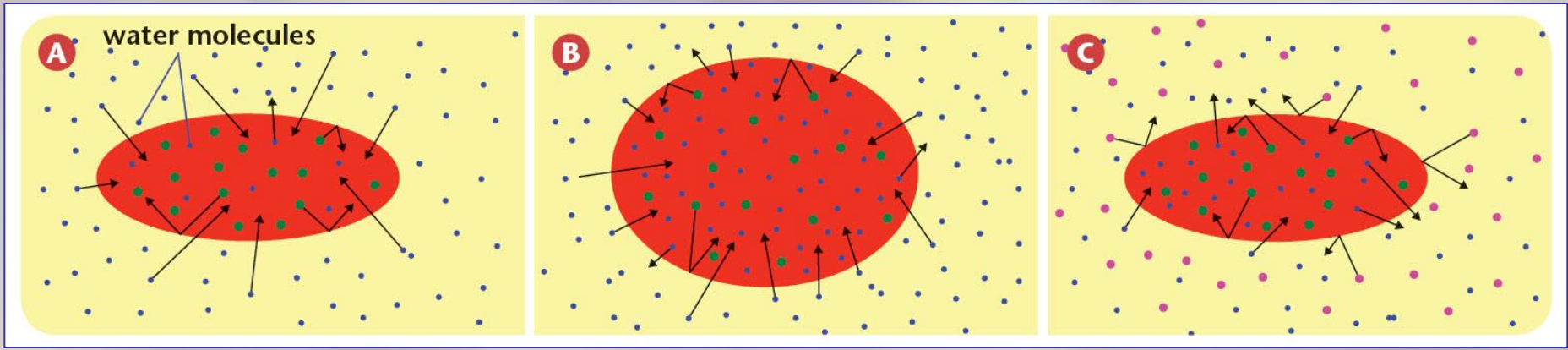
- Within a cell
- Across the cell membrane
- Outside a cell in body fluids.

Reviewing Diffusion

Click the "Start" button to review the process of diffusion.

Cellular processes enable organisms to meet their basic needs.

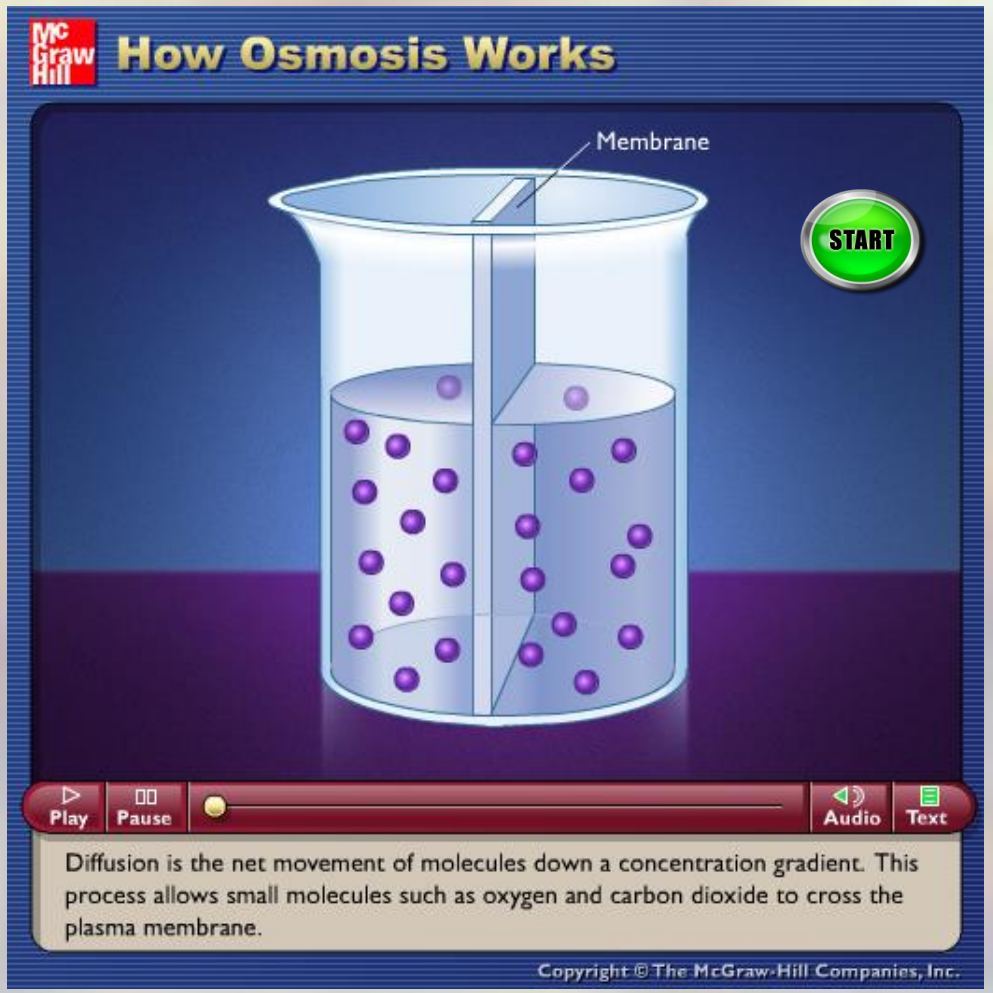
Osmosis is the movement (diffusion) of water molecules across a **semi-permeable membrane** in response to concentration differences.



A **semi-permeable membrane** lets water and some molecules diffuse across it but keeps molecules of other substances from penetrating it.

Reviewing Osmosis

Click the "Start" button to review the process of osmosis.



Topic 1.1 Review

Key Concepts to be reviewed:

- Studying cells helps us understand how organisms function.
- Cellular components work together to carry out life functions.
- Cellular processes enable organisms to meet their basic needs.

Topic 1.2 Why do animal cells divide and what happens when they do?

(Pages 20-37)

Key Concepts

- Cells must divide for an organism to survive.
- Hereditary material is passed on during cell division.
- Animal cells have a life cycle that includes both growth and division.
- New animal cells are created during the cell cycle.
- Uncontrolled, rapid division of animal cells can be cancer.

Why do animal cells divide and what happens when they do?

Certain organisms, such as a starfish, can **regenerate** (grow back) entire body parts.

Why would an organism need to produce new cells?

Why do you think that some organisms (like a planarian) can grow back entire body parts (like a head), but you cannot?

Although cells can divide quite rapidly to produce new cells, their size is limited. "Man-eating" insects made of giant cells are only found in science fiction stories.

Why do you think that cells are limited to a certain size?

Cells must divide for an organism to survive.

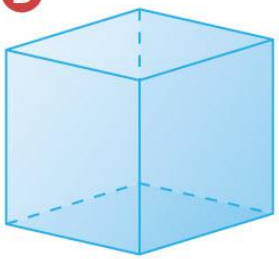
Cells divide because there is a limit to the size they can grow. The larger a cell becomes, the less efficiently it carries out a variety of processes, including:

- absorption of nutrients, oxygen, water
- processing of waste products
- transportation of materials throughout the cell

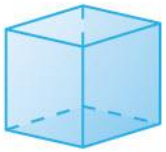
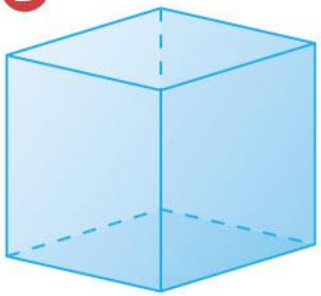
The bigger a pool gets, the harder it is to transport materials across the pool.

Cell Number Crunch

The **cell surface** is the area of the cell over which all nutrients must enter and all wastes must leave. The **cell volume** determines how much the cell holds. It also determines how far nutrients and waste must diffuse in order to be used or removed.

Cube	Side Length	Surface Area (length × width × number of sides)	Volume (length × width × height)
A 	1 mm	1 mm × 1 mm × 6 = 6 mm^2	1 mm × 1 mm × 1 mm = 1 mm^3
B 	2 mm The length of any side on Cube B is two times larger than on Cube A.	2 mm × 2 mm × 6 = 24 mm^2 The surface area of Cube B is four times larger than the surface area of Cube A.	2 mm × 2 mm × 2 mm = 8 mm^3 The volume of Cube B is eight times larger than the volume of Cube A.

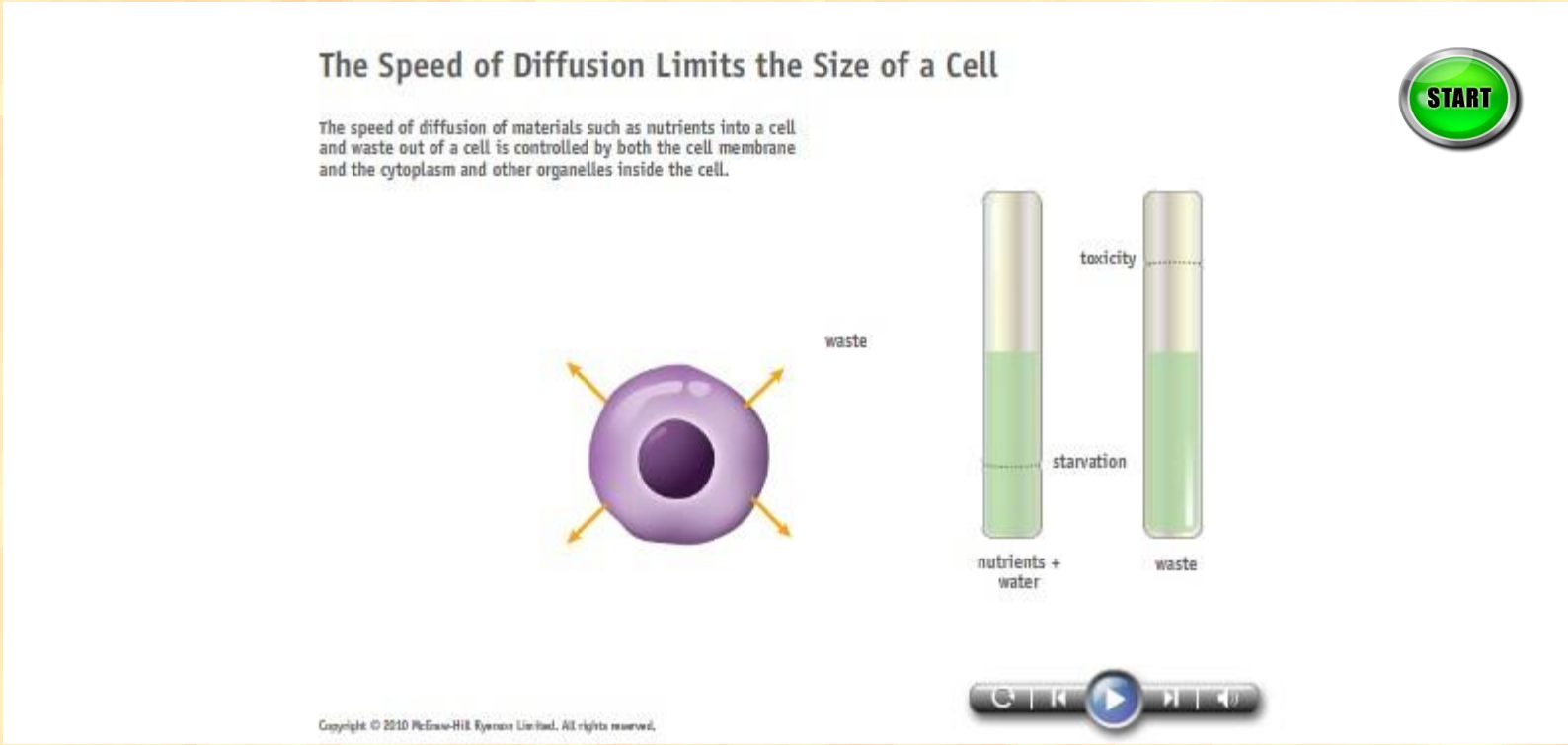
Cell Number Crunch

Cube	Side Length	Surface Area (length × width × number of sides)	Volume (length × width × height)
A 	1 mm	1 mm × 1 mm × 6 = 6 mm^2	1 mm × 1 mm × 1 mm = 1 mm^3
B 	2 mm The length of any side on Cube B is two times larger than on Cube A.	2 mm × 2 mm × 6 = 24 mm^2 The surface area of Cube B is four times larger than the surface area of Cube A.	2 mm × 2 mm × 2 mm = 8 mm^3 The volume of Cube B is eight times larger than the volume of Cube A.

In which of the cell sizes illustrated above would it be easier to move materials in and out of the cell or to different locations within the cell? Explain your answer.

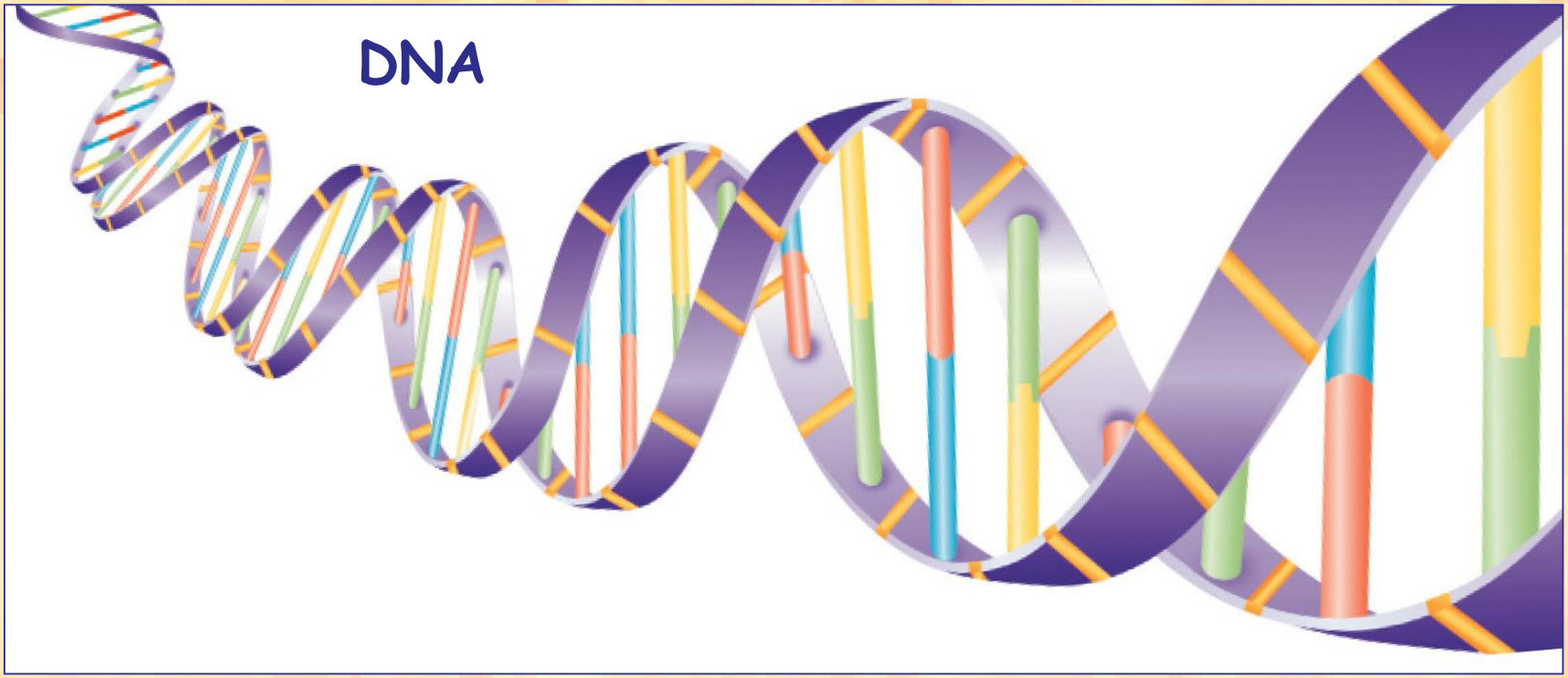
Reviewing Cell Growth

Click the "Start" button to review the limits on cell growth.



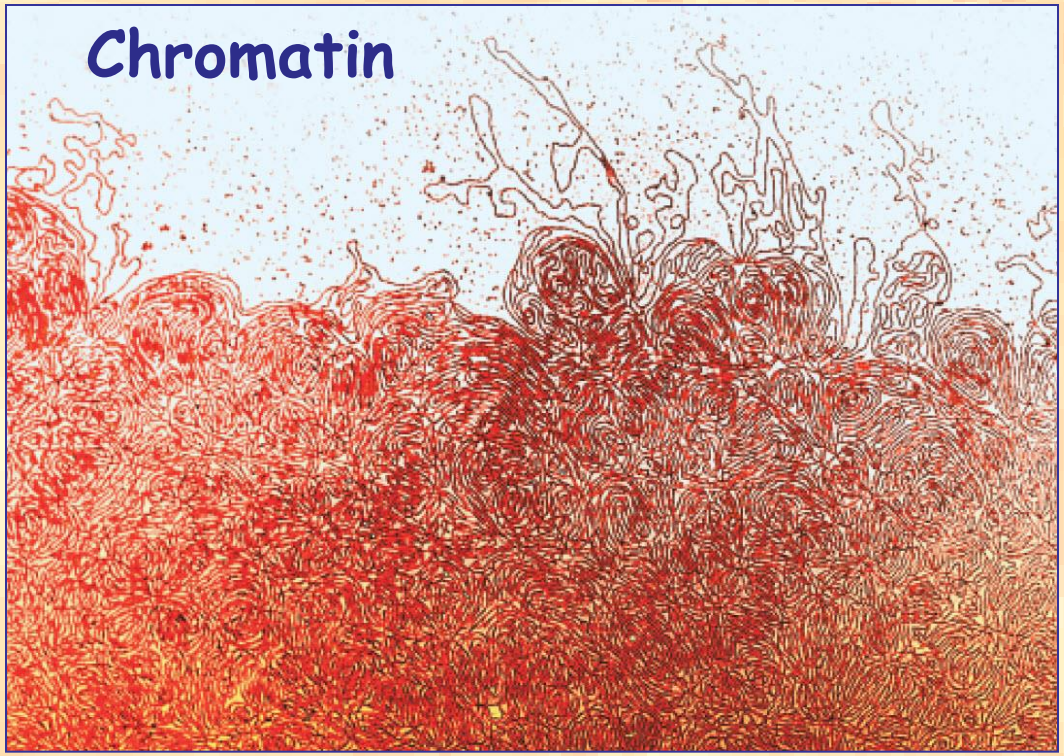
Hereditary material is passed on during cell division.

When a cell divides, two new cells are created. Each cell is identical to the original cell. The set of instructions each cell inherits is stored in a unique molecule called **DNA** (**deoxyribonucleic acid**).



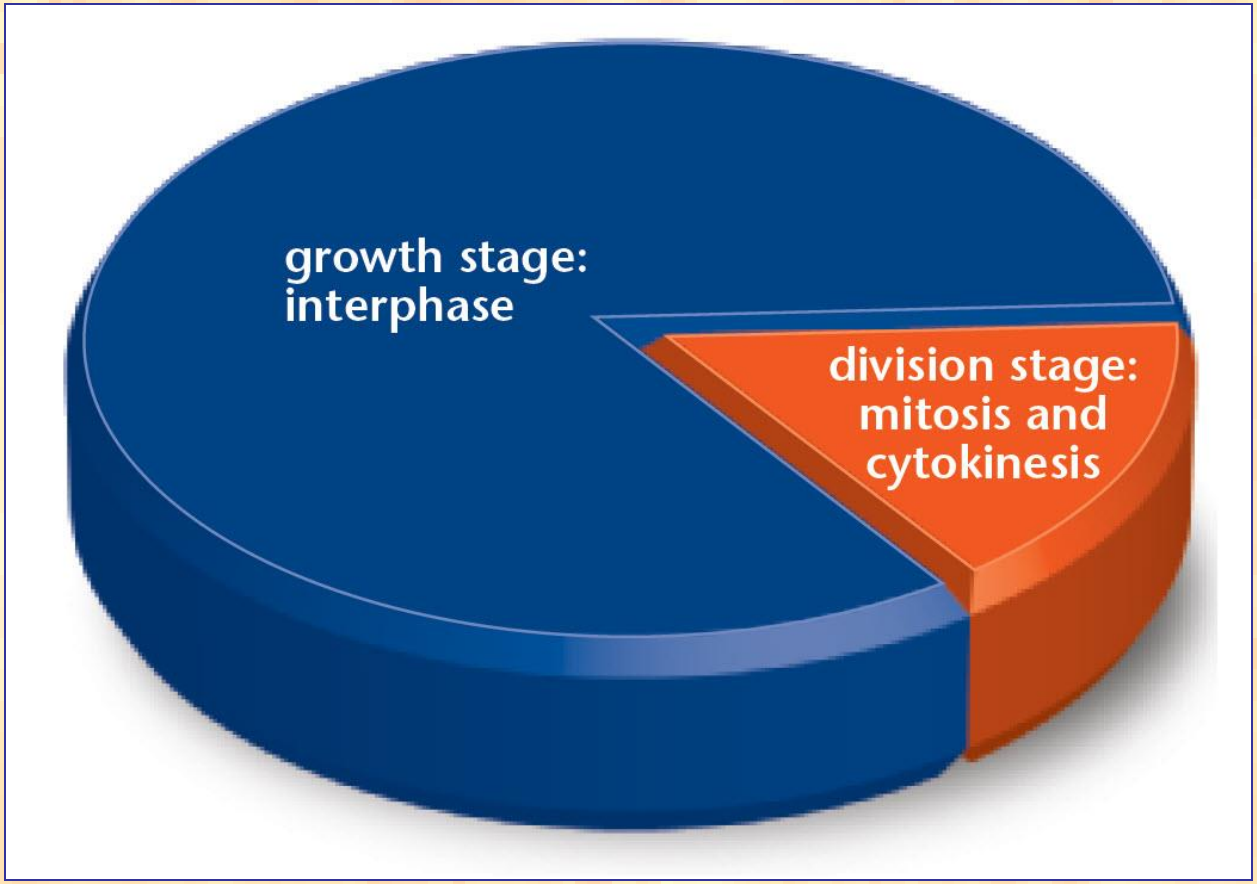
Hereditary material is passed on during cell division.

The **DNA** is compacted and coiled to form threads called **chromatin**. The chromatin is packed into **chromosomes** that are found in the nucleus.



Animal cells have a life cycle that includes both growth and division.

The **cell cycle** is a continuous series of life events in which a cell is born, grows, reproduces, and dies.

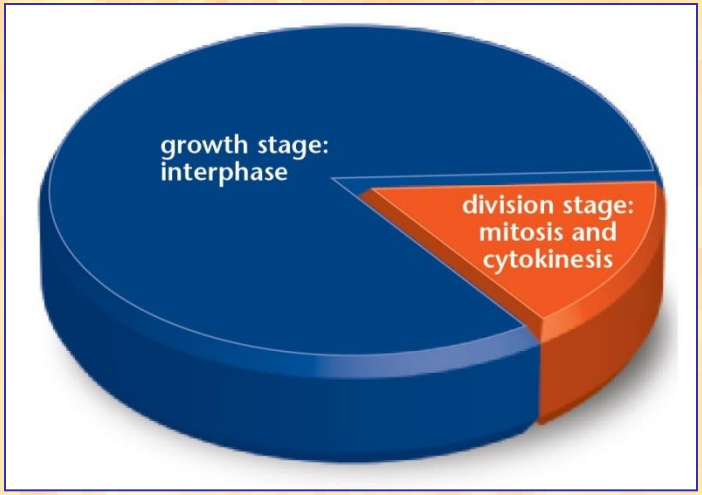


The two main stages in the cell cycle are the **growth stage** (interphase) and the **division stage** (mitosis and cytokinesis).

Animal cells have a life cycle that includes both growth and division.

The Growth Stage: Interphase

Most of a cell's life cycle is spent in a growth stage called **interphase**. During interphase, the cell grows and carries out its usual functions. The cell also makes a copy of its organelles and the DNA in its nucleus to prepare for division. The majority of cells spend most of their lives in interphase. Interphase ends when a cell begins its division stage.

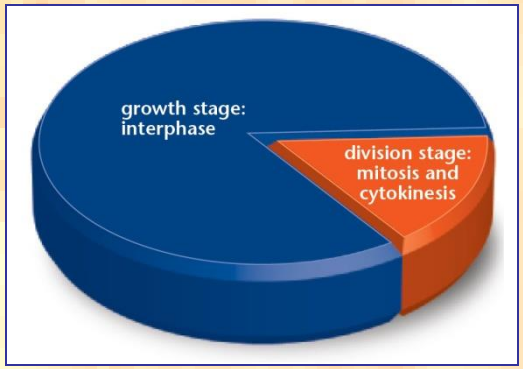


Animal cells have a life cycle that includes both growth and division.

The Division Stage: Mitosis and Cytokinesis

Cell division is a process in which one cell produces two new cells that are exact copies of the original cell. There are two main phases of cell division:

1. **Mitosis**: During mitosis, the contents of the nucleus separate into two identical copies.
2. **Cytokinesis**: During cytokinesis, the cytoplasm and organelles divide into two identical, separate cells. Each of these cells will now go on to complete its own cell cycle.



Why Cell Division is Important

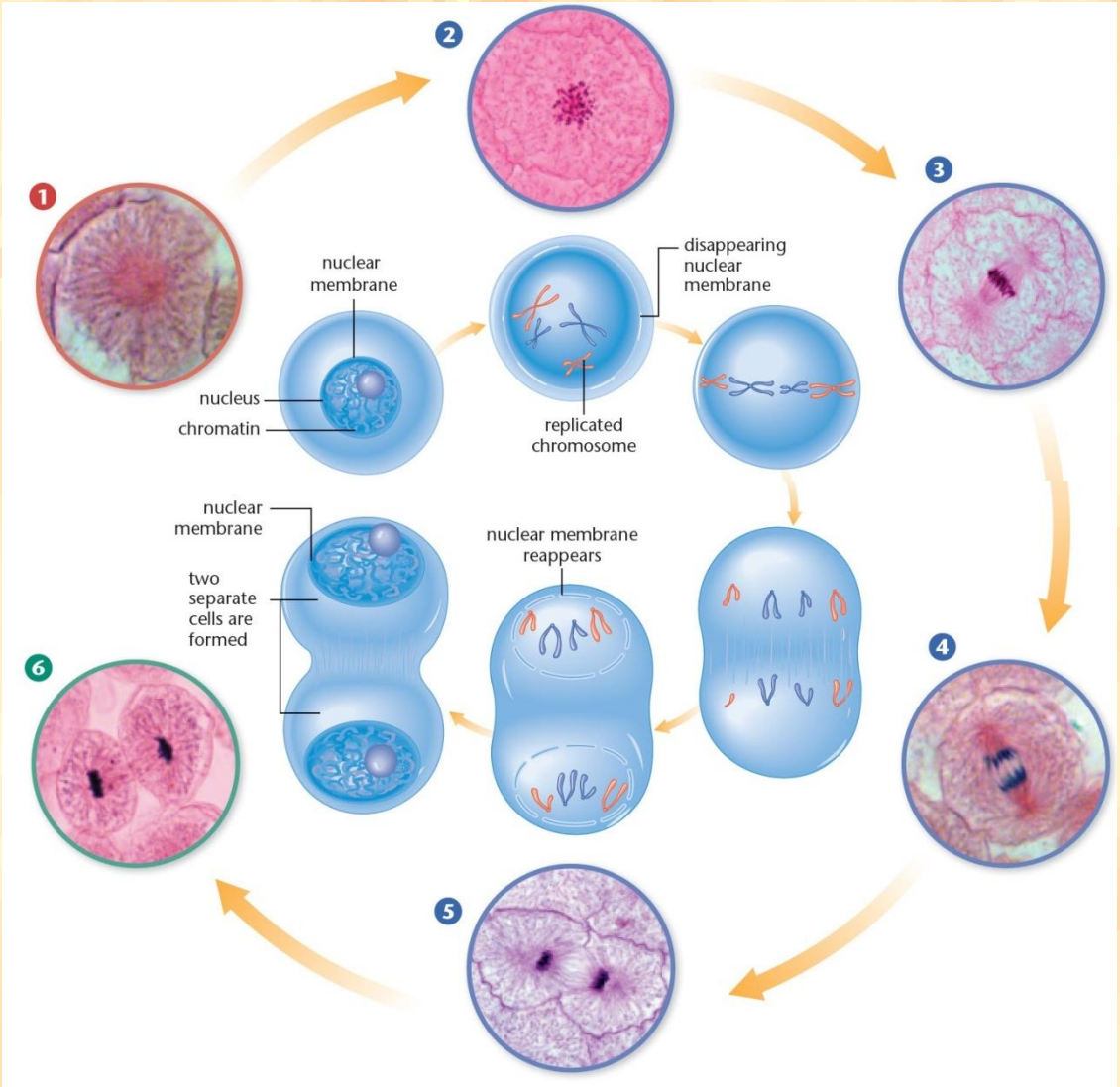
Cell division enables organisms to carry out three important functions:

- **growth** (to grow from a single cell into a multi-celled organism)
- **maintenance** (the replacement of worn-out or dead cells)
- **repair** (regenerating damaged tissues)

Regeneration is the ability to grow new cells or to replace damaged or lost body components.

What cells do you replace most often?

New animal cells are created during the cell cycle.



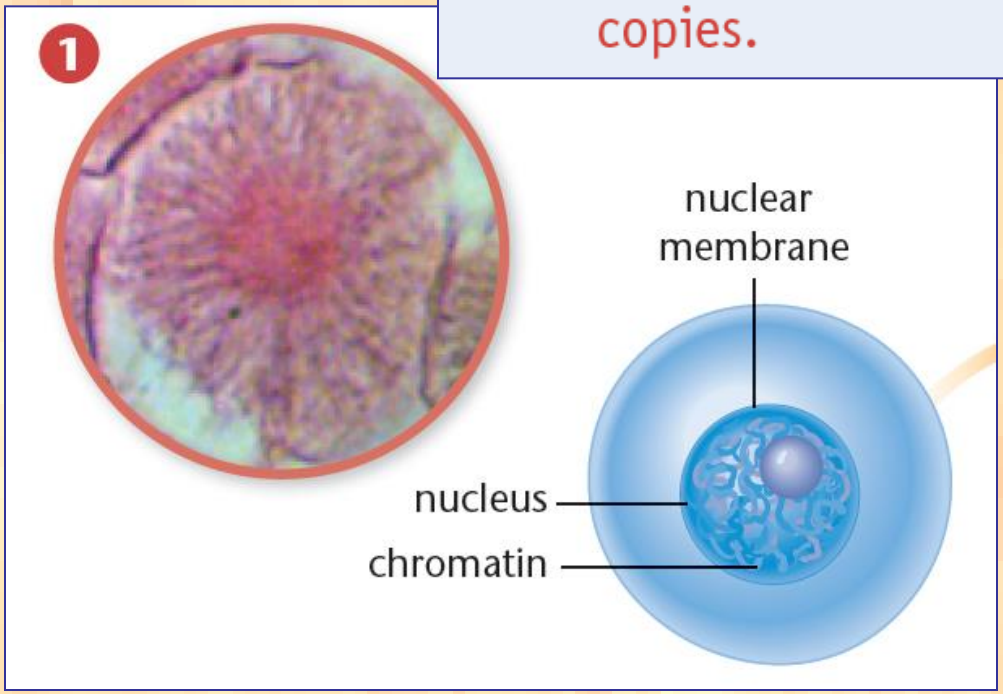
In the cell cycle, a precise sequence of events leads to the creation of new cells. The events are:

- **interphase**
- **mitosis** (including prophase, metaphase, anaphase, and telophase)
- **cytokinesis**

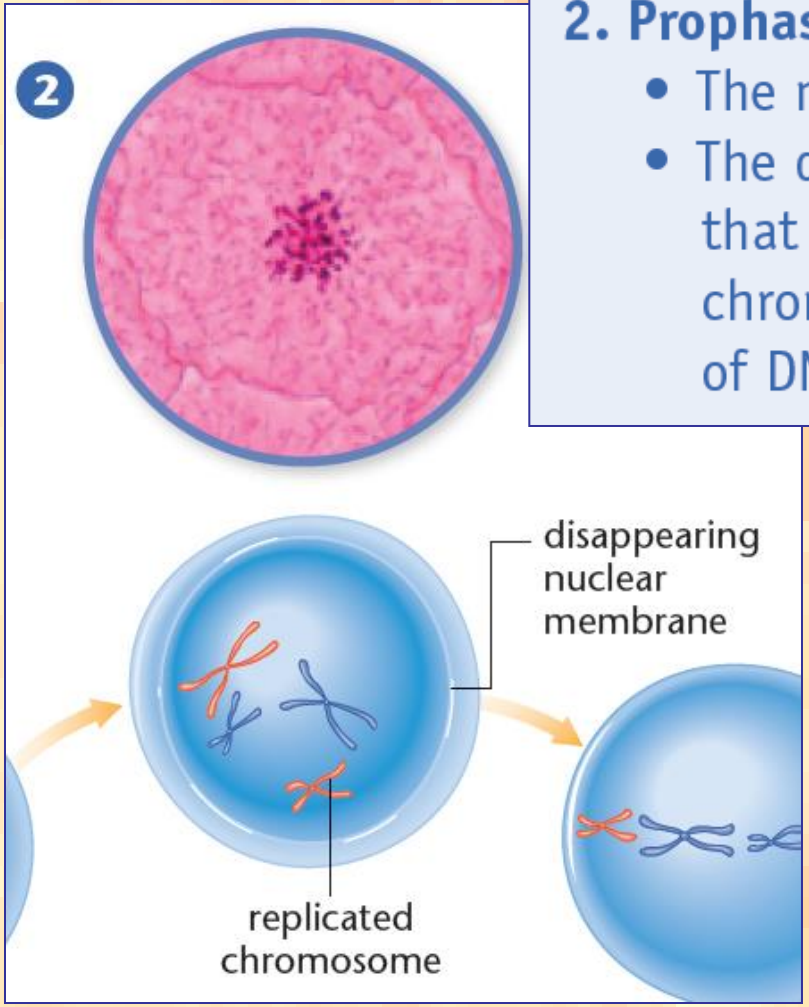
New animal cells are created during the cell cycle.

1. Interphase

- The cell grows to nearly twice its original size.
- The number of organelles in the cytoplasm increases.
- The DNA in the nucleus duplicates into two identical copies.



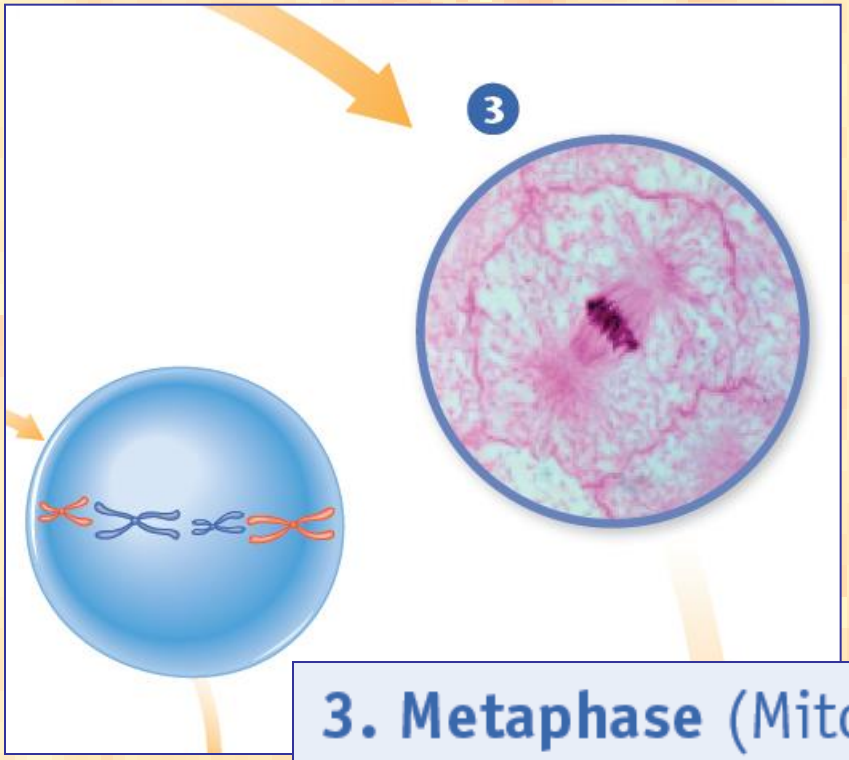
New animal cells are created during the cell cycle.



2. Prophase (Mitosis Phase 1)

- The nuclear membrane begins to disappear.
- The duplicated DNA condenses into chromosomes that are visible under the microscope. Each chromosome is made up of two identical copies of DNA that are joined at one point.

New animal cells are created during the cell cycle.



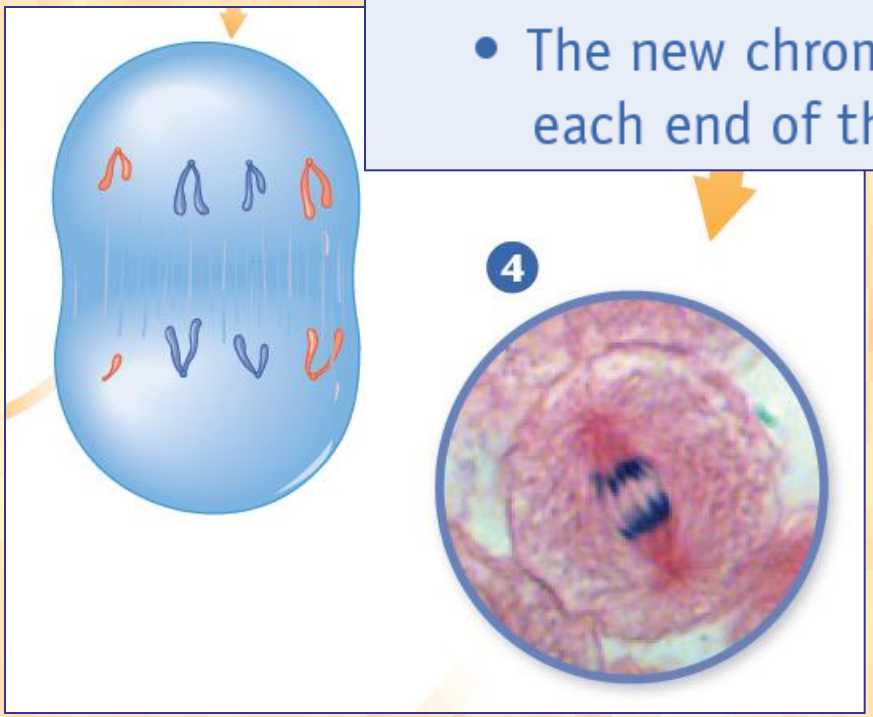
3. Metaphase (Mitosis Phase 2)

- Fibres in the cytoplasm push the chromosomes together, lining them up in the middle of the cell.

New animal cells are created during the cell cycle.

4. Anaphase (Mitosis Phase 3)

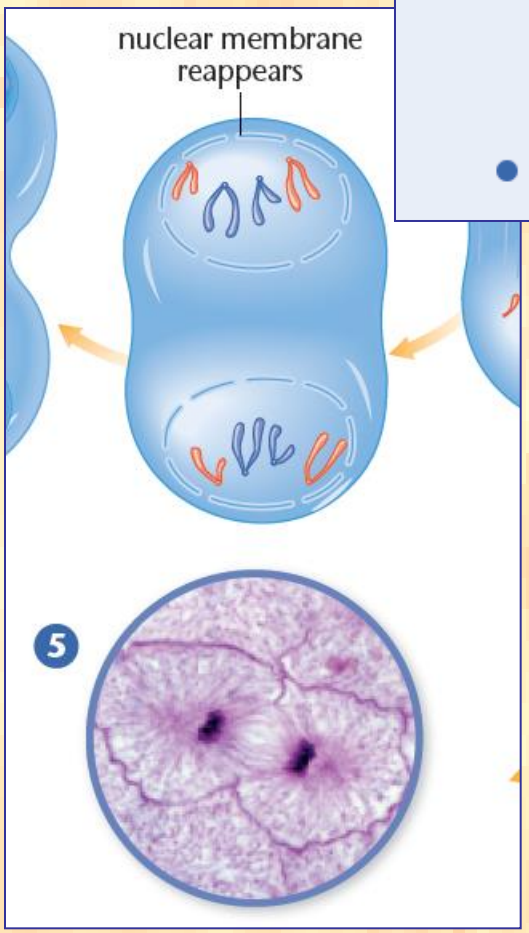
- The points where the two copies of DNA were attached in each chromosome split apart, separating the identical copies of DNA. Each part is now called a chromosome.
- The new chromosomes are pulled apart and drawn to each end of the cell.



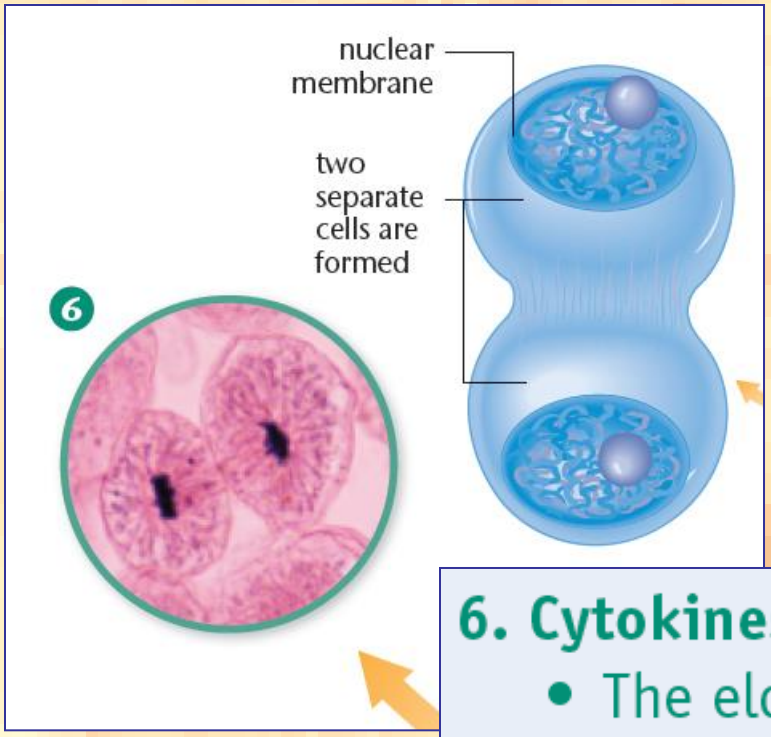
New animal cells are created during the cell cycle.

5. Telophase (Mitosis Phase 4)

- Membranes begin to form around the two new nuclei. Each nucleus has a complete set of chromosomes that contain a complete copy of the cell's DNA.
- The chromosomes begin to uncoil.



New animal cells are created during the cell cycle.

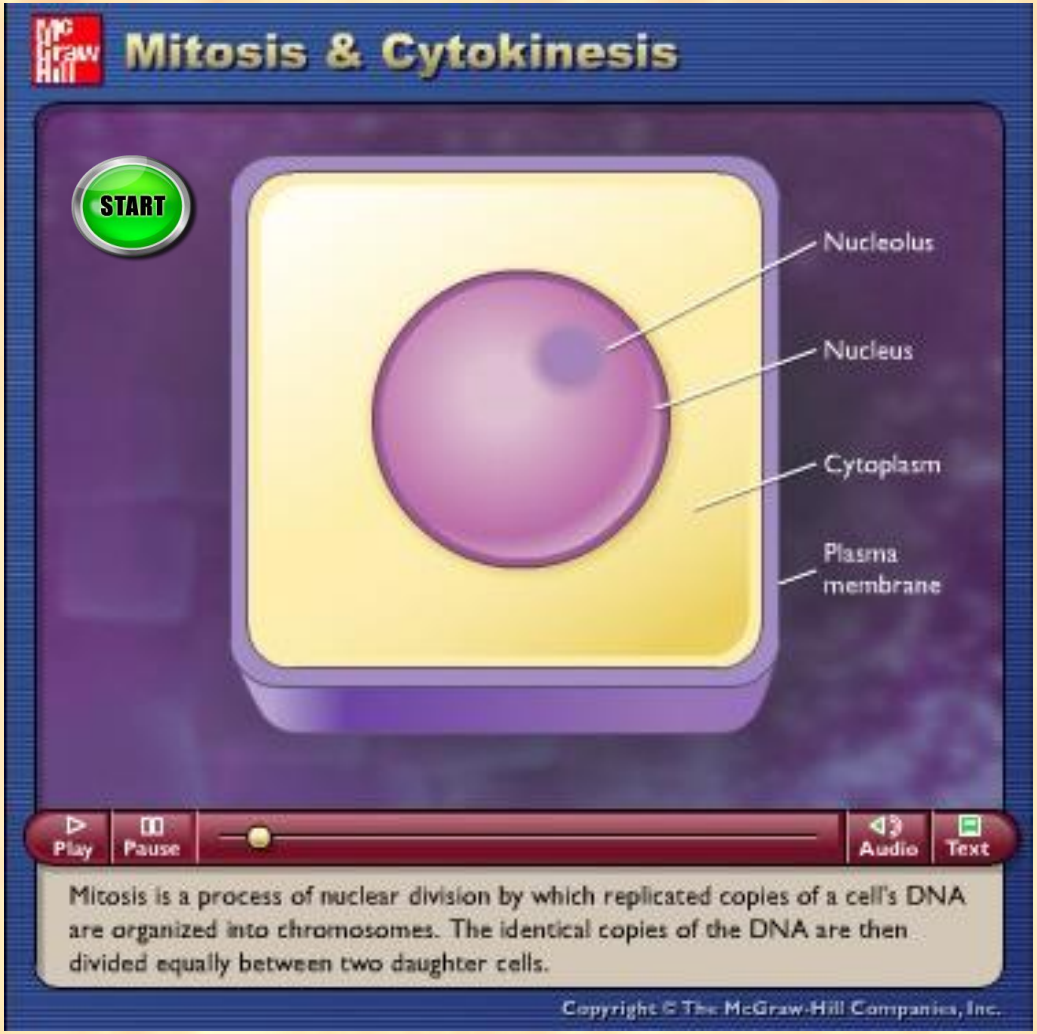


6. Cytokinesis

- The elongated cell begins to pinch apart at the centre, dividing the cytoplasm into two parts.
- Cytokinesis ends when there are two identical, separate cells.

Reviewing Mitosis and Cytokinesis

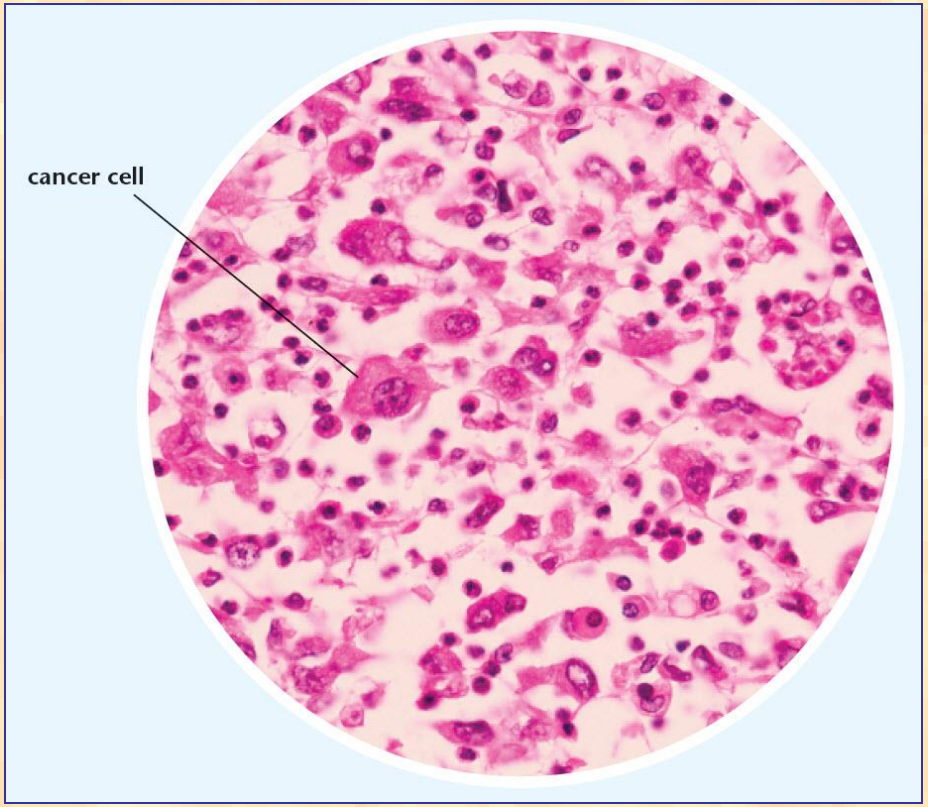
Click the "Start" button to review mitosis and cytokinesis.



Uncontrolled, rapid division of animal cells can be cancer.

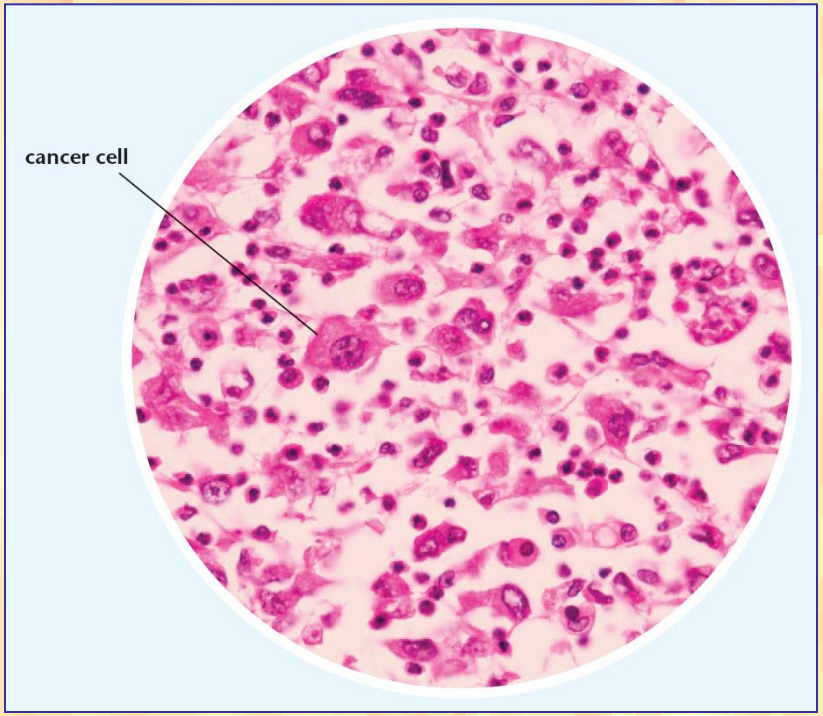
If a cell ignores a signal to stop dividing, unchecked cell growth can result. Over time, the newly divided cells form a mass called a **tumour**.

A **mutation** (a permanent change in a cell's DNA) is what causes the cells to ignore the "stop" signals. Cancer cells differ from normal cells in shape, size. and content.



Uncontrolled, rapid division of animal cells can be cancer.

Mutations can be inherited, can occur randomly, or can result from environmental factors such as exposure to ultraviolet light, radiation, or chemicals such as those found in cigarettes, alcohol, and other drugs.

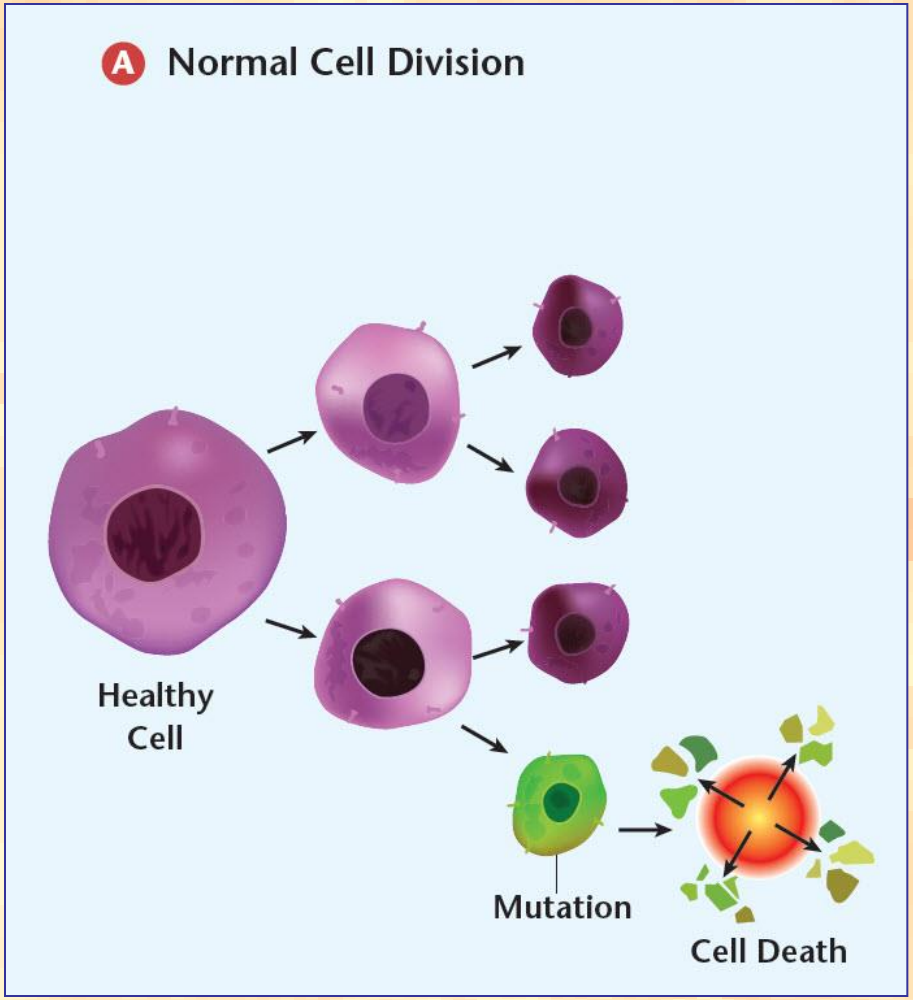


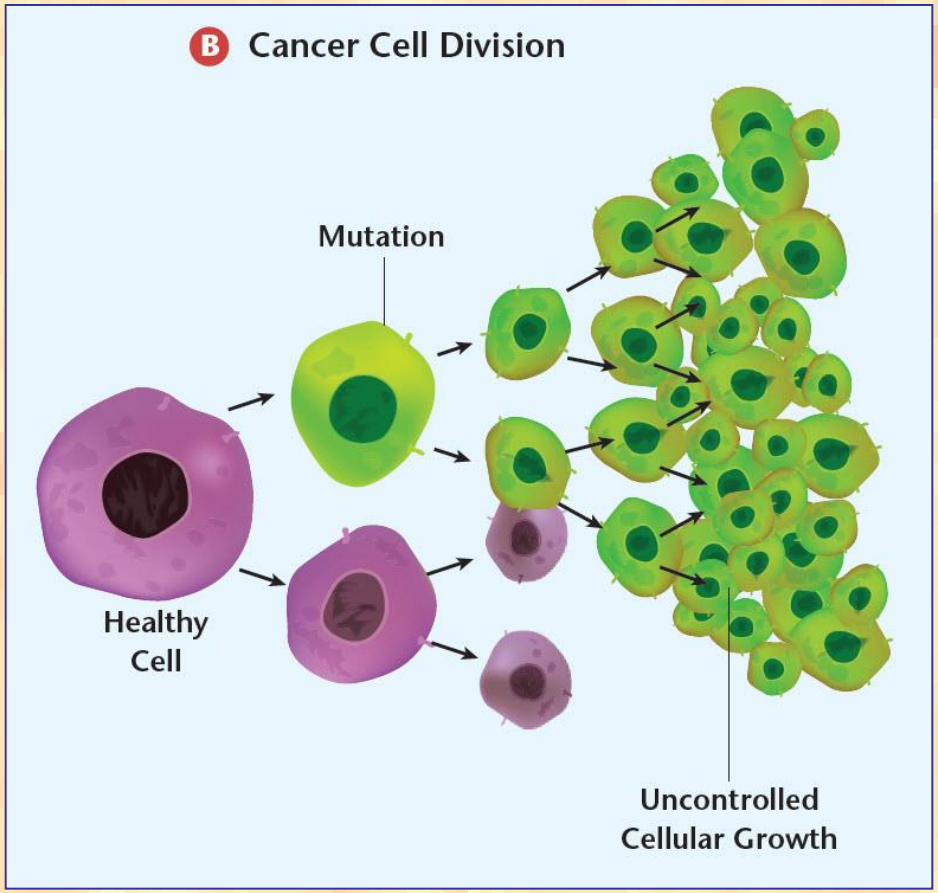
Some Tumours are Cancerous

Several factors that distinguish a cancerous tumour from a **benign** (non-cancerous) tumour are listed below.

Tumour	Characteristics
Benign	• Cell division is unchecked and proceeds at a moderate rate. • Does not invade surrounding cells, but may push nearby cells out of the way. • Does not spread to other parts of the body • Relatively harmless unless found in a part of the body, such as the brain, where it may press on other cells
Cancer (malignant tumour)	• Cell division is unchecked and occurs very quickly. Cells spend little time in interphase. • Damages and destroys surrounding cells by invading them • Can spread to other parts of the body • May interfere with the function of other cells, sometimes resulting in death if the tumour is not destroyed or removed

Normal vs Cancerous Cell Division





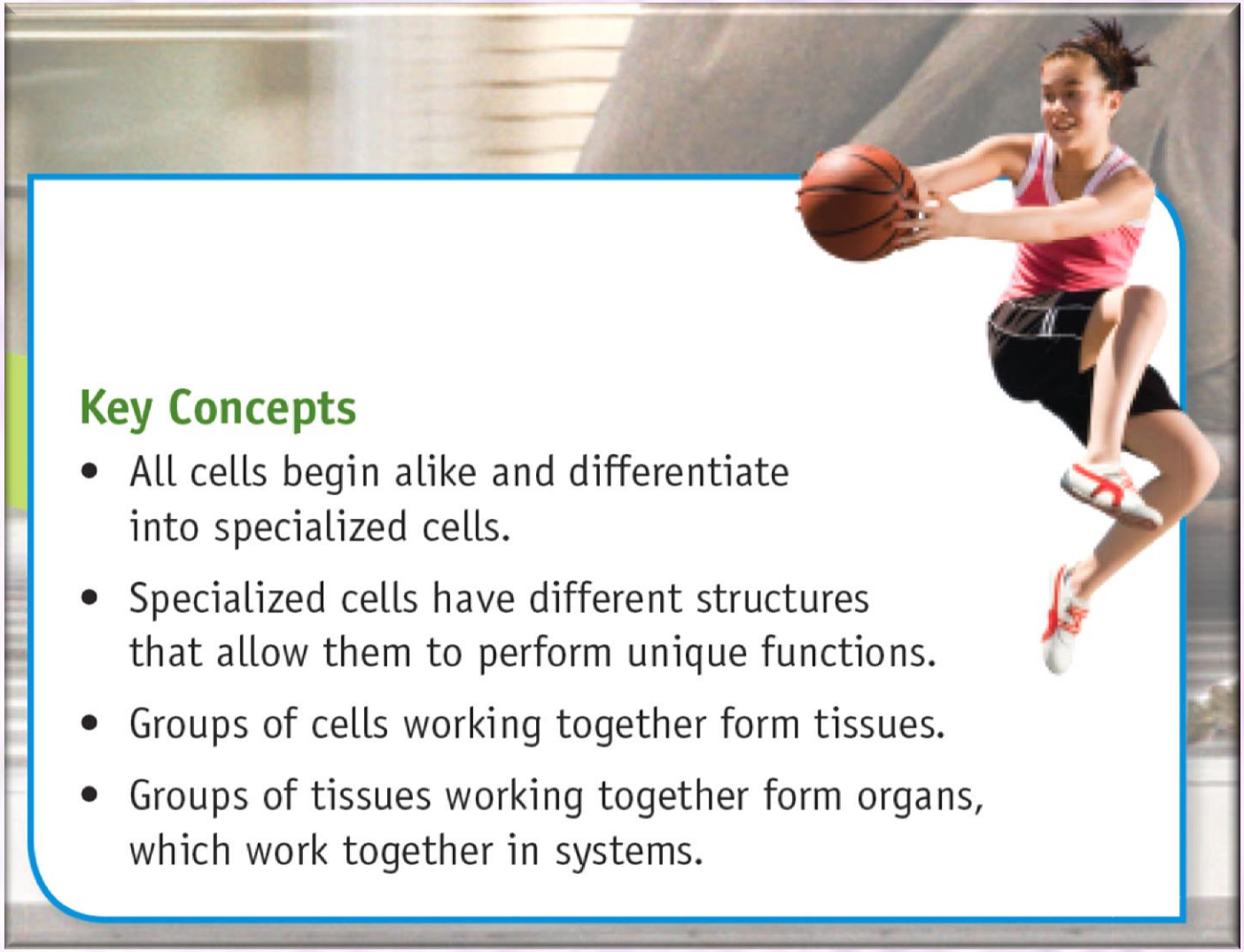
Topic 1.2 Review

Key Concepts to be reviewed:

- Cells must divide for an organism to survive.
- Hereditary material is passed on during cell division.
- Animal cells have a life cycle that includes both growth and division.
- New animal cells are created during the cell cycle.
- Uncontrolled, rapid division of animal cells can be cancer.

Topic 1.3 How do cells work together in the human body?

(Pages 38-57)



Key Concepts

- All cells begin alike and differentiate into specialized cells.
- Specialized cells have different structures that allow them to perform unique functions.
- Groups of cells working together form tissues.
- Groups of tissues working together form organs, which work together in systems.

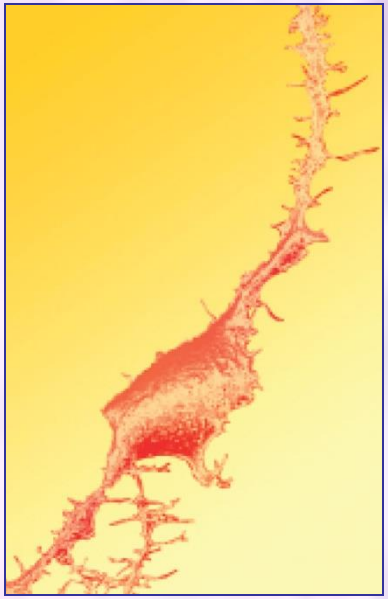
How do cells work together in the human body?

Life comes in an enormous range of sizes. Single-celled organisms rely on organelles to carry out life functions. Multi-celled organisms have specialized cells that work together in systems to carry out life functions such as digestion, breathing, and circulation.

All cells begin alike and differentiate into specialized cells.

Single-celled organisms must carry out all life functions with just one cell. Multi-celled organisms contain a variety of different types of cells specifically designed to carry out certain functions.

A single-celled amoeba

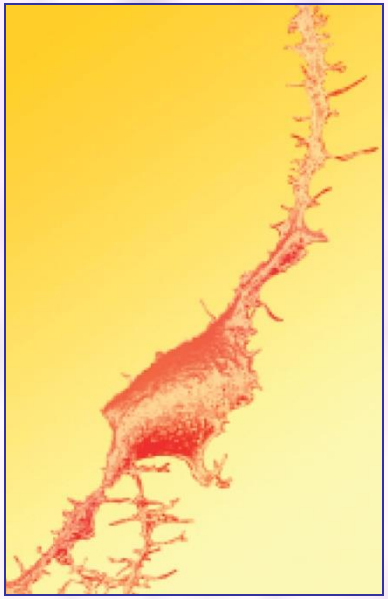


A specialized nerve cell

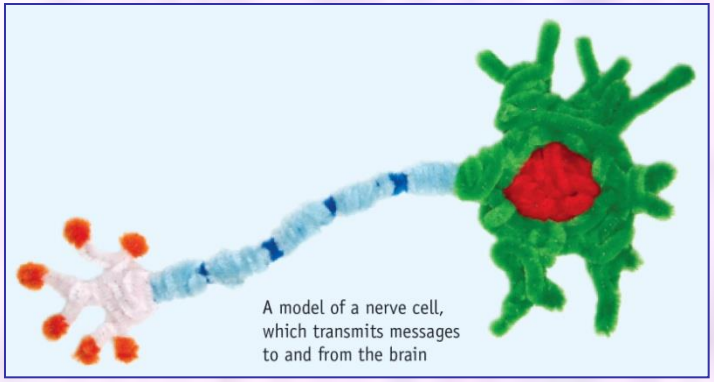
Glass Frog Organs

Cell Specialization and Differentiation

Cell specialization refers to the fact that different types of cells have different structures and abilities that enable them to perform their functions efficiently.



A specialized nerve cell



Cell differentiation is the series of events through which stem cells develop into specialized cells.

What other types of specialized cells can you think of? What special functions do they carry out?

Specialized cells have different structures that allow them to perform unique functions.

The structure of each specialized cell is adapted for the task that it performs. There are over 200 different types of cells in the human body.

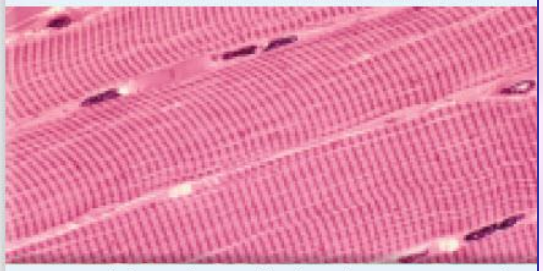
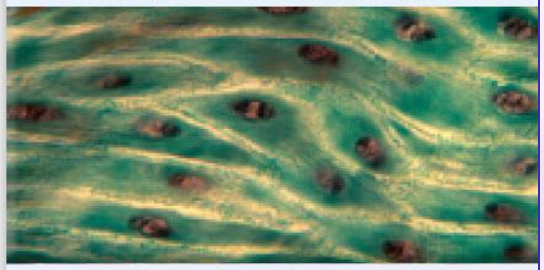
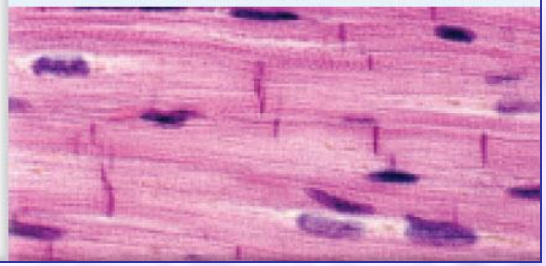
The image on the left shows five specialized cells found in humans.

Specialized cells have different structures that allow them to perform unique functions.

Specialized Cells	How Structure Influences Function
Muscle cells	• Long and thin structure allows the cells to change size drastically when they contract. • Some have a branching pattern that increases muscle strength. • High concentration of mitochondria supply the energy required to change shape.
Nerve cells (called *neurons*)	• Long, threadlike branches enable the cells to receive and transmit signals from other cells throughout the body.
Red blood cells	• Doughnut-like shape with a depression in the centre provides a large surface area to carry oxygen.
Bone cells	• Framework of hard material, which contains minerals that provide strength and support, hold the cells together.
Skin cells	• Thin, flat, and layered cells form a gap-free barrier to keep out potential invaders and keep in moisture.

Groups of cells working together form tissues.

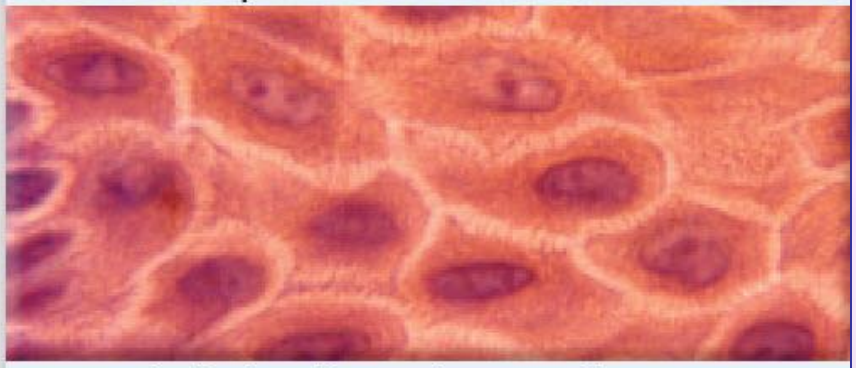
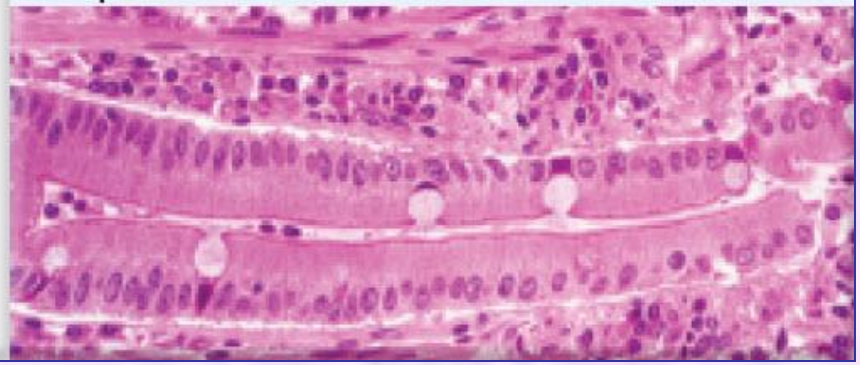
Muscle Tissue

Tissue	Function	Example
Muscle	• Enables body parts to move, exert force, or change shape	Muscle cells in an arm  Muscle cells in the stomach  Muscle cells in the heart 

Tissue is a group of specialized cells working together to perform a function. There are four main types of tissue: muscle, epithelial, connective, and nervous.

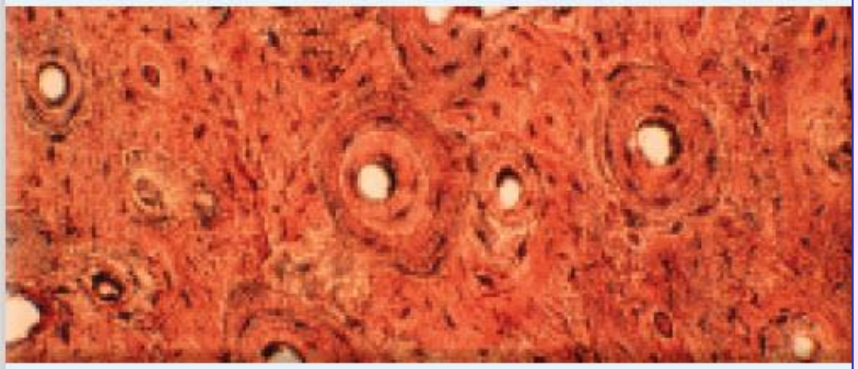
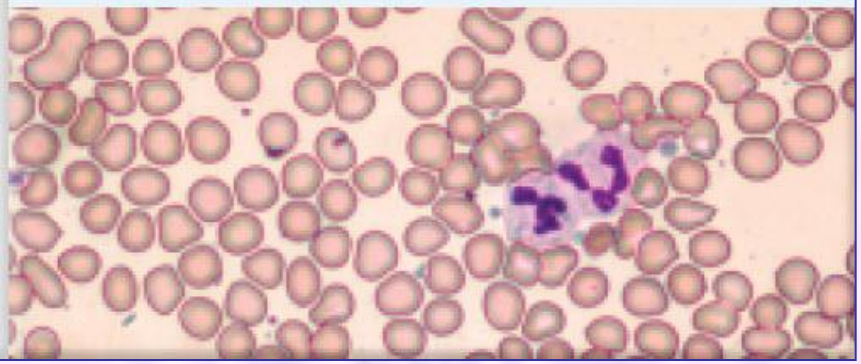
Groups of cells working together form tissues.

Epithelial Tissue

Tissue	Function	Example
Epithelial	• Covers the external and internal body surfaces	Epithelial cells in skin  Epithelial cells in the small intestine 

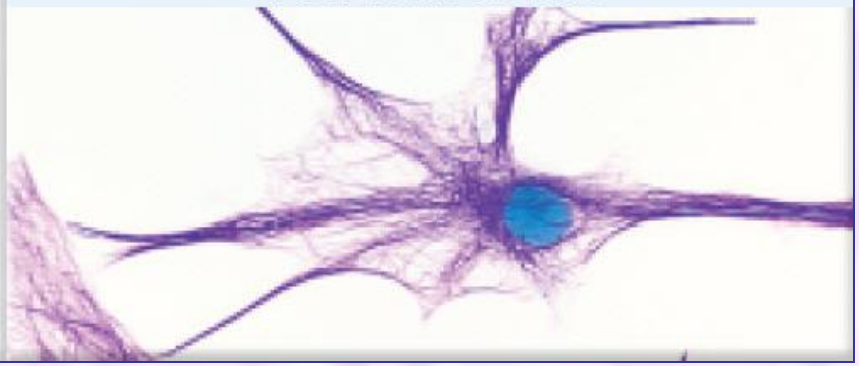
Groups of cells working together form tissues.

Connective Tissue

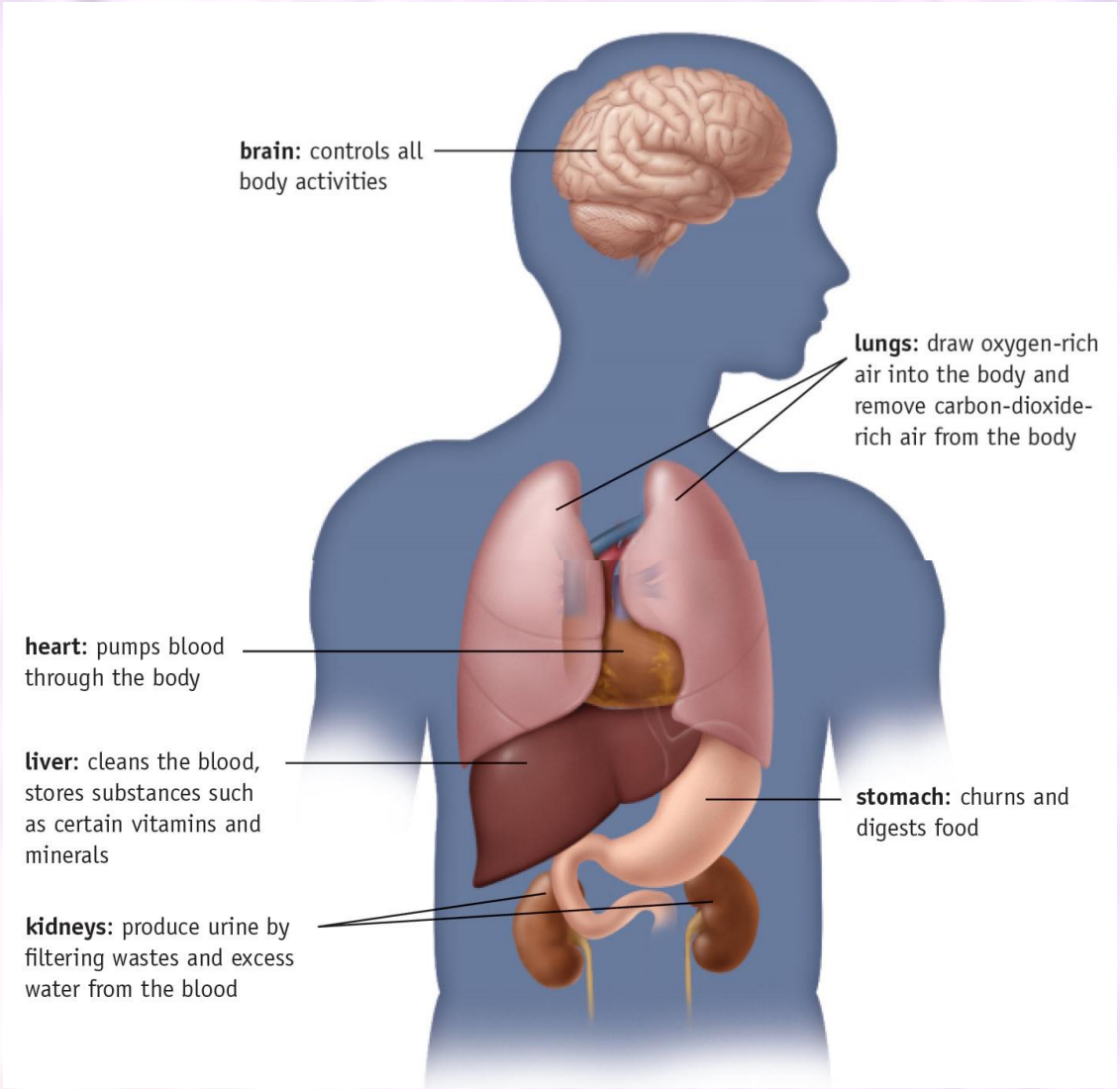
Tissue	Function	Example
Connective	• Strengthens, supports, or connects cells and tissues	Bone connective tissue  Blood connective tissue 

Groups of cells working together form tissues.

Nervous Tissue

Tissue	Function	Example
Nervous	• Senses, conducts, and transmits information	Nervous tissue 

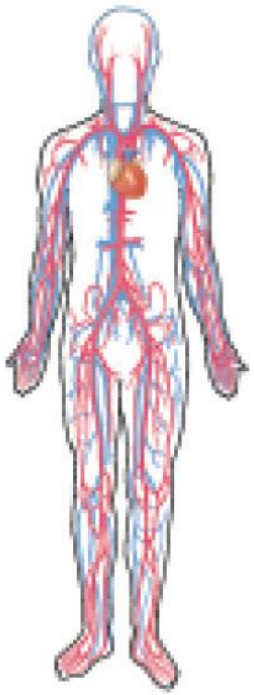
Groups of tissues working together form organs, which work together in systems.



Organs are different tissues working together to perform a specific task. Organs contain at least two different types of tissues.

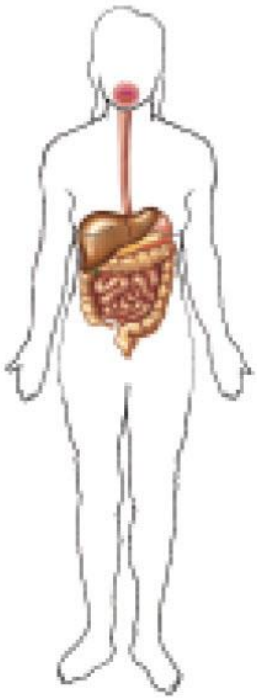
Several major human organs are shown on the diagram to the left.

Organs Working Together Form Systems



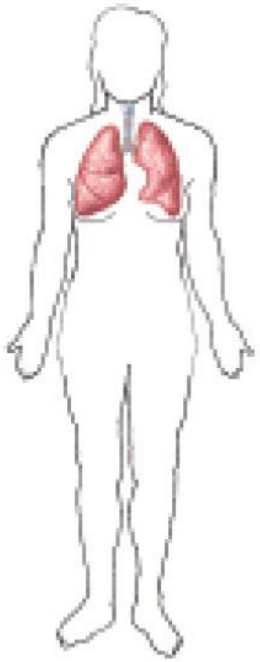
Circulatory System

- transports blood, nutrients, gases, and wastes
- helps to control temperature, fluid balance, and acidity



Digestive System

- takes in and breaks down food
- absorbs nutrients
- rids the body of solid waste



Respiratory System

- controls breathing
- delivers oxygen to the blood and removes carbon dioxide from the blood

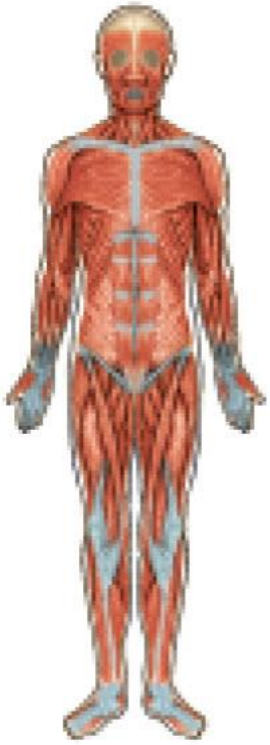
An Organ system is a group of organs that interact with each other to perform a common task.

Details about 11 human body systems are described on the next 4 slides.

Organs Working Together Form Systems

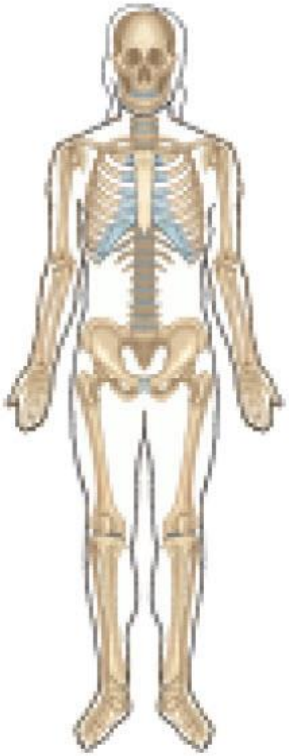
Excretory System

- eliminates liquid waste from the body
- helps to control fluid balance and acidity



Muscular System

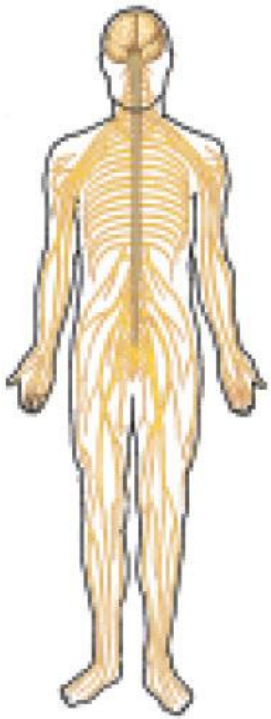
- moves body parts (such as arms) and organs (such as the stomach)
- maintains posture



Skeletal System

- provides a framework for muscles to attach to
- protects the soft organs
- makes blood cells
- stores minerals, such as calcium

Organs Working Together Form Systems

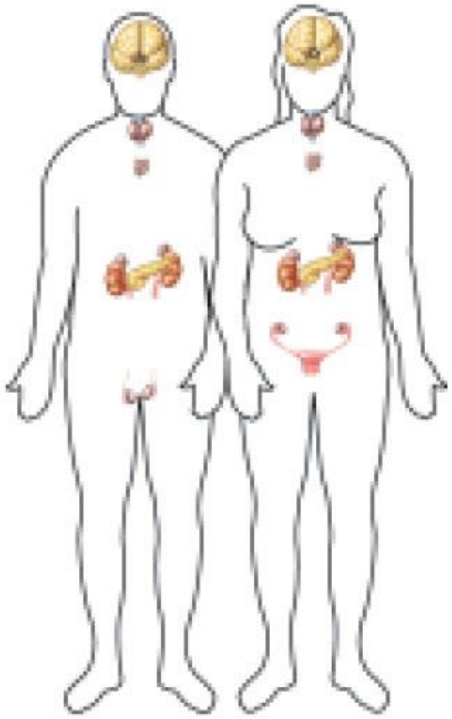


Nervous System

- gathers and interprets sensory information from outside and inside the body
- coordinates all the functions of the organ systems

Immune System

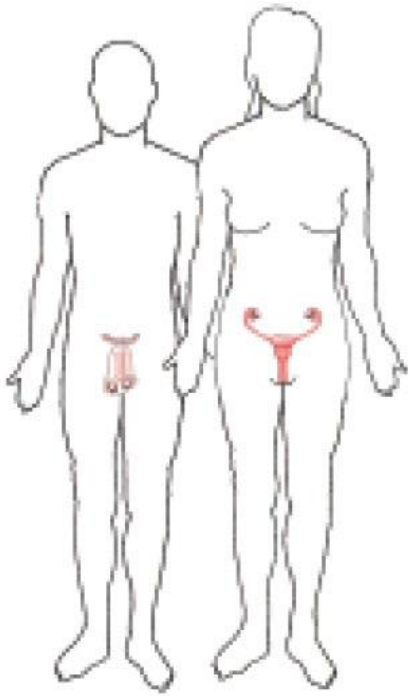
- defends the body against infections



Endocrine System

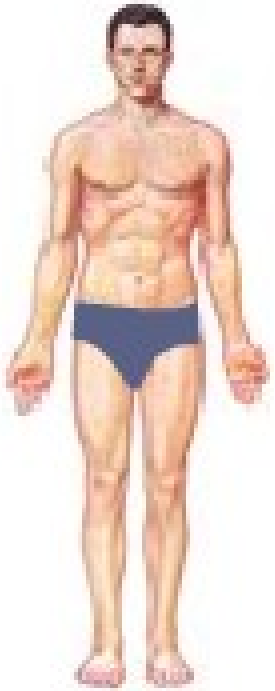
- produces and releases hormones (chemical messengers)
- helps to coordinate the organ systems
- responds to stress
- helps to regulate fluid balance, acidity, and metabolism

Organs Working Together Form Systems



Reproductive System

- produces eggs (in females) and sperm (in males)
- produces estrogen, testosterone, and the other sex hormones
- in females, allows for the growth and delivery of offspring



Integumentary System

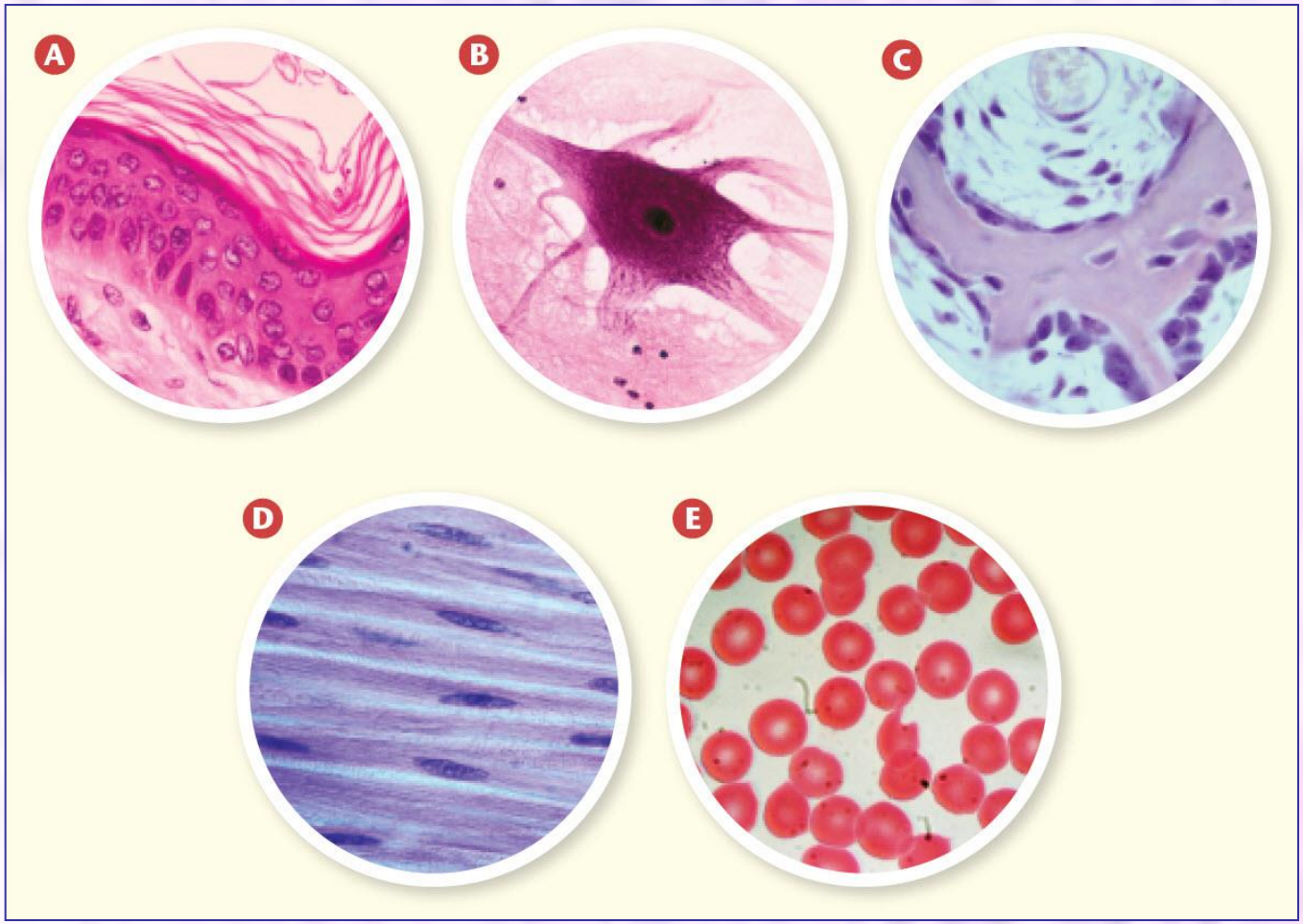
- includes the skin, hair, and nails
- provides a protective barrier around the body
- receives sensory information
- helps to control body temperature

Organs Working Together Form Systems

When you take your pulse, which system are you checking?

Organs Working Together Form Systems

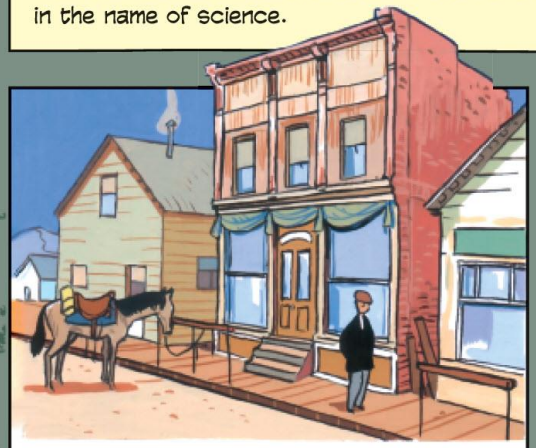
Which systems would the cells shown below belong to? Explain your choices.



Strange Tales of Science

Stomach for Science

In the early 1800s, the stomach was an unknown frontier for scientists. Little was known about the digestive system or what happened to food once it was swallowed. Until one fateful day in 1822, that is, when an unfortunate accident provided a unique "window" into the world of digestion. The following story is pieced together from actual notes and letters from the 1800s. Read it and see if you have the stomach for the price one man paid in the name of science.



June 6, 1822. This trading post on Mackinac Island in Lake Huron was about to witness the creation of the most famous stomach in scientific history.

An accidental discharge of a musket blew open the stomach and chest wall of unsuspecting French-Canadian canoe guide, Alexis St. Martin.

Luckily, Dr. William Beaumont was stationed at the nearby US military camp. He reached St. Martin within minutes of the blast.

Dr. Beaumont has cleaned the wound as best he can. Still, it does not look good for St. Martin. But wait...

STOMACH for SCIENCE

So... What do you think?

1. Did Beaumont convince St. Martin to return? Create a graphic novel that tells how this story might end.
2. Beaumont achieved fame when he published a book about St. Martin's stomach. The book contained 240 of the experiments he completed. Find out three things Beaumont learned about digestion from his experiments.
3. Years later, Dr. Beaumont was quoted as saying that St. Martin left in part because of "unwillingness to submit himself for public experiments." Would you have been willing to take part in these experiments as St. Martin did? Explain why or why not.
4. Beaumont could have closed the hole in St. Martin's stomach with simple surgery, yet he chose not to. In your opinion, was this acceptable? Explain your reasoning.

Topic 1.3 Review

Key Concepts to be reviewed:

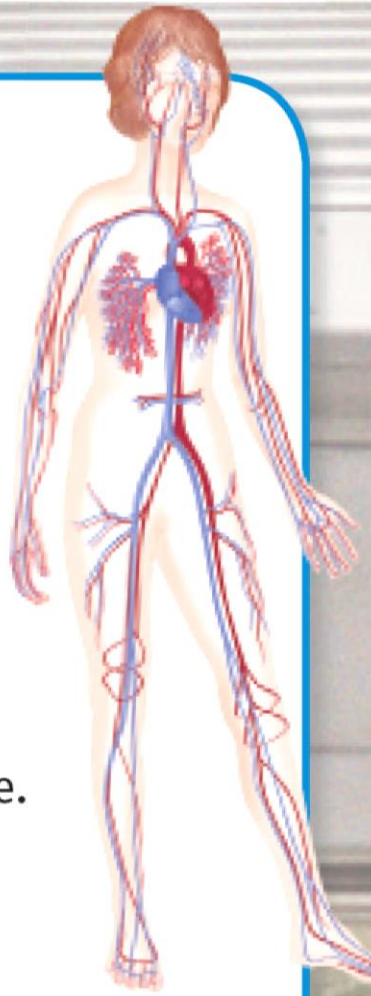
- All cells begin alike and differentiate into specialized cells.
- Specialized cells have different structures that allow them to perform unique functions.
- Groups of cells working together form tissues.
- Groups of tissues working together form organs, which work together in systems.

Topic 1.4 How do systems work together in the human body?

(Pages 56-75)

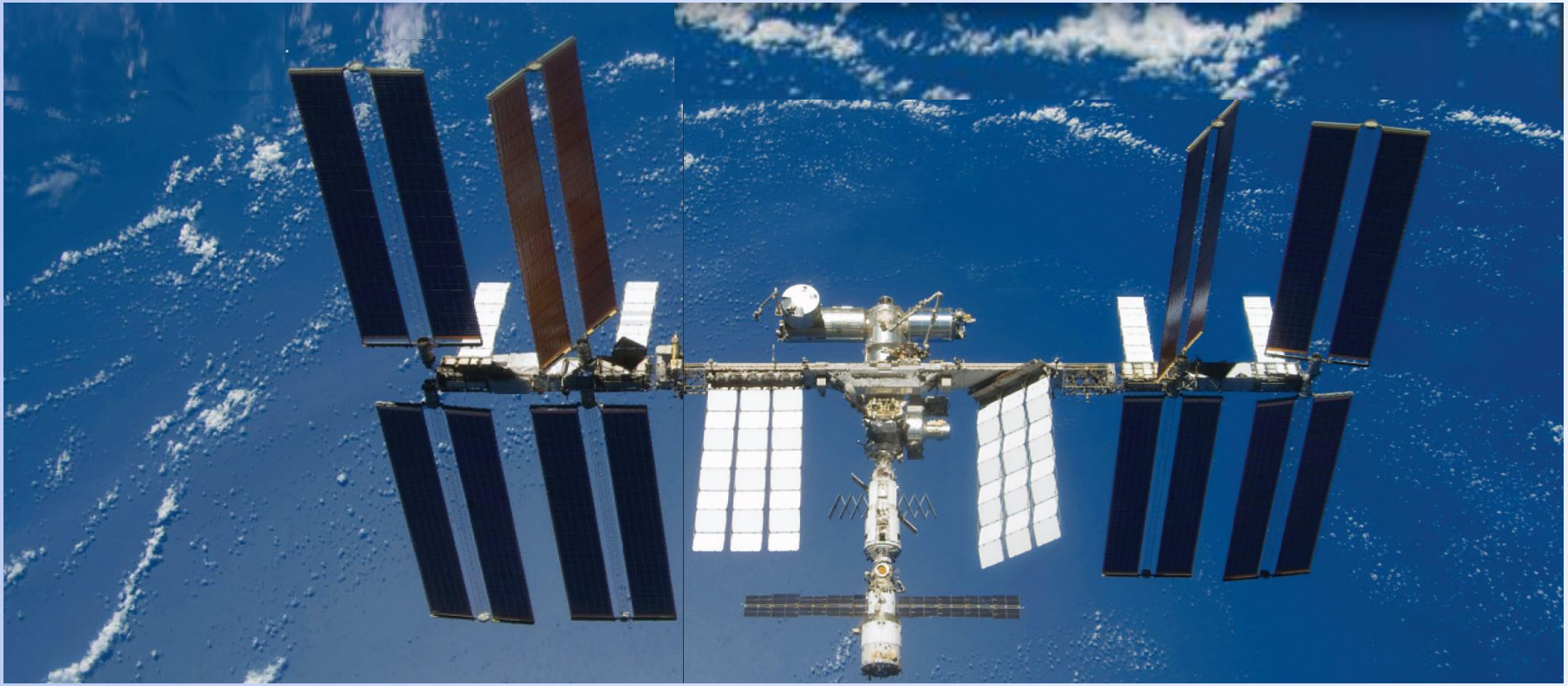
Key Concepts

- The respiratory system carries oxygen to and removes carbon dioxide from the blood.
- The circulatory system transports dissolved gases and nutrients through the body.
- The digestive system breaks down food, absorbs nutrients, and eliminates solid waste.
- Organ systems working together carry out important tasks in the body.



How do systems work together in the human body?

All the systems inside the International Space Station must work together to support life on board. The same is true of all the systems inside your body.

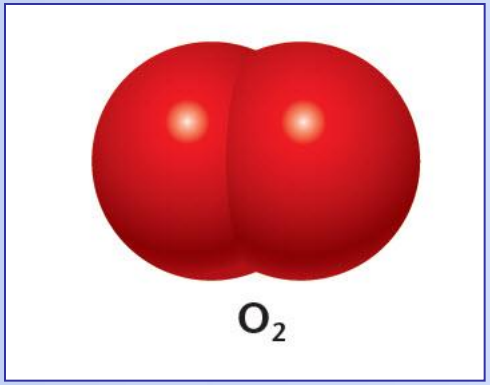


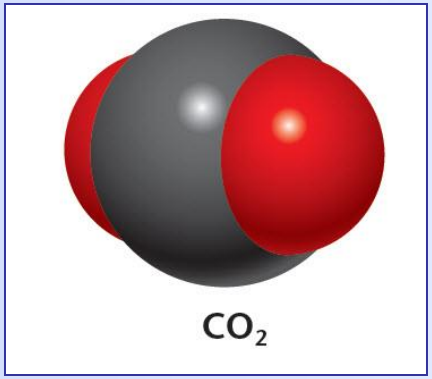
How do systems work together in the human body?

What life support systems in the International Space Station are similar to organ systems in your body?

The respiratory system carries oxygen to and removes carbon dioxide from the blood.

Cells in your body need energy to perform their day-to-day tasks. The energy comes from the food you eat.



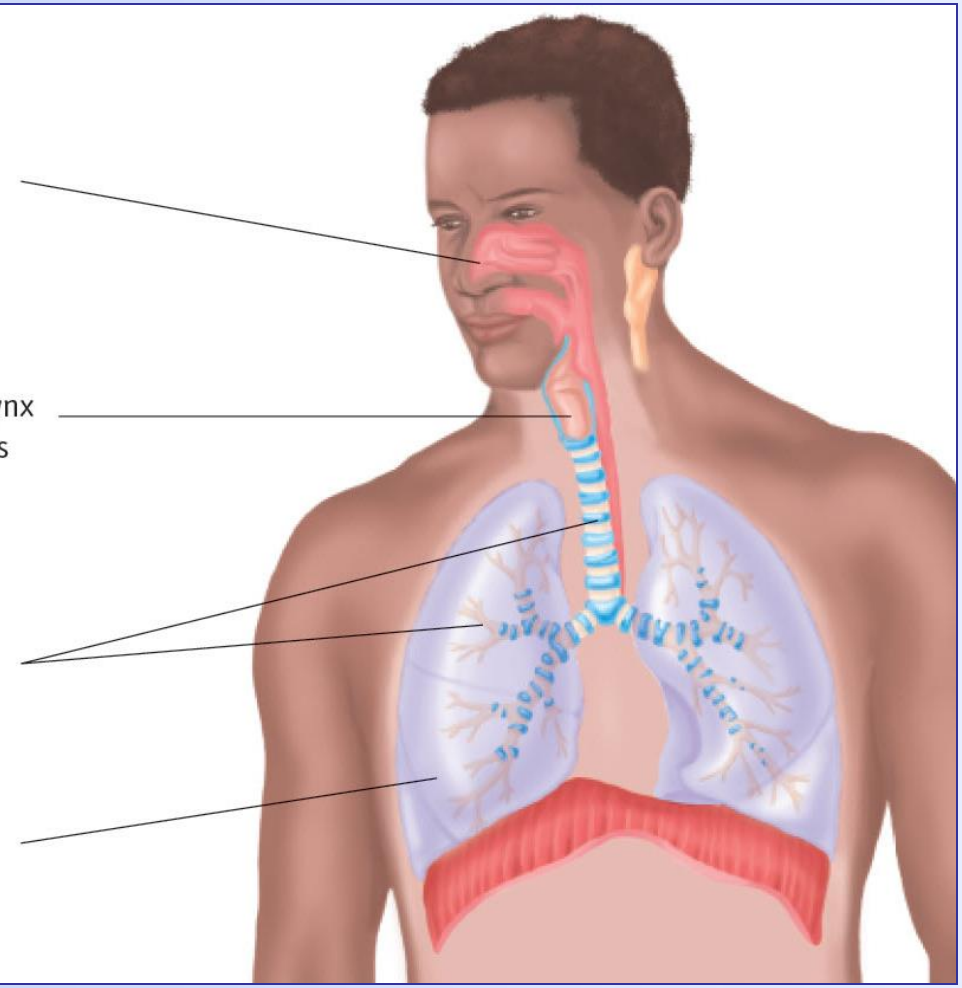


The energy is released from food through the process of **cellular respiration**. In this process, food (glucose) is mixed with the oxygen you breathe to produce the energy needed to power your cells; carbon dioxide and water are produced as waste products.

Components of the Respiratory System

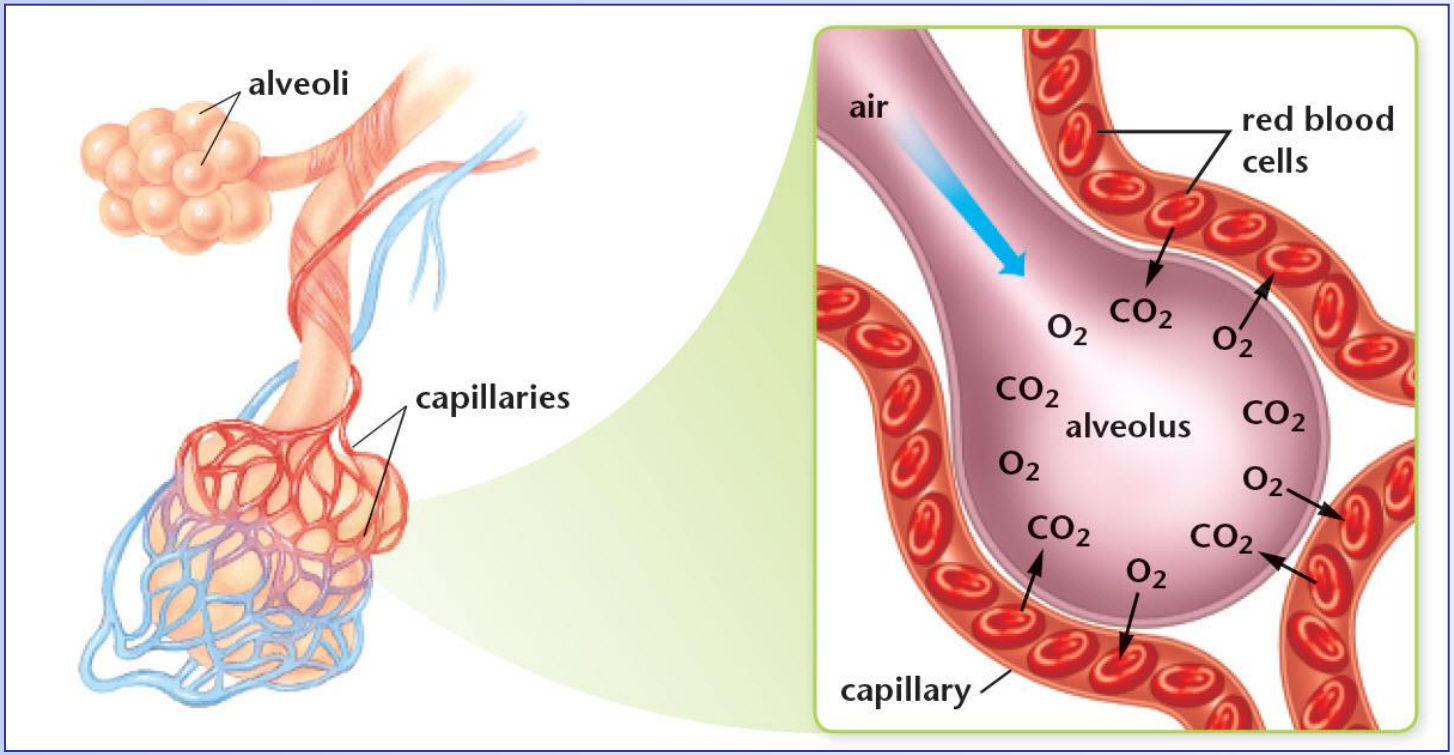
The taking in of oxygen and release of carbon dioxide is called **gas exchange**. Gas exchange occurs in the lungs.

1. When air is inhaled, dirt and other particles are trapped by tiny hairs and sticky fluid in the nose.
2. The air flows into the throat and passes through the larynx. The larynx contains vocal cords that vibrate as the air moves through them. This produces the sound of your voice.
3. The air continues through a series of tubes that connect the throat to the lungs.
4. The tubes become smaller and smaller as they travel deeper into the lungs. This enables them to carry air to all parts of the lungs.



Gas Exchange Takes Place in the Alveoli

Alveoli are air sacs in the lungs where gas exchange occurs. In the alveoli, oxygen passes into and carbon dioxide leaves the blood where the **capillaries** (the smallest blood vessels) meet the alveoli. The **red blood cells** in the blood vessels carry oxygen and carbon dioxide throughout the body.



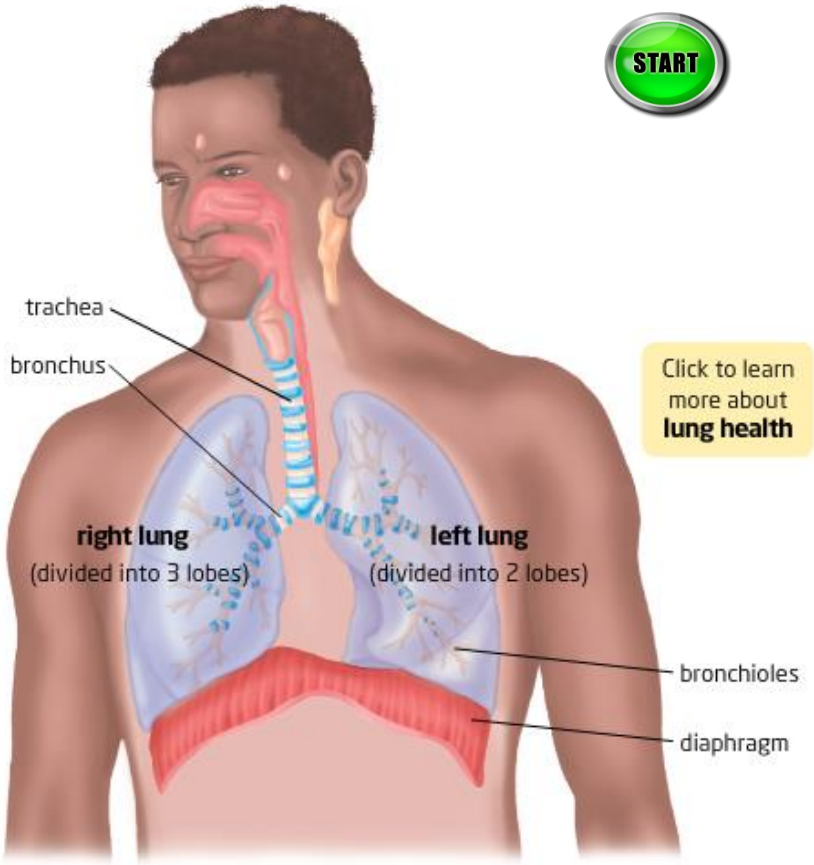
Reviewing Gas Exchange

Click the "Start" button to review the process of gas exchange.

The Respiratory System - Gas Exchange in the Lungs

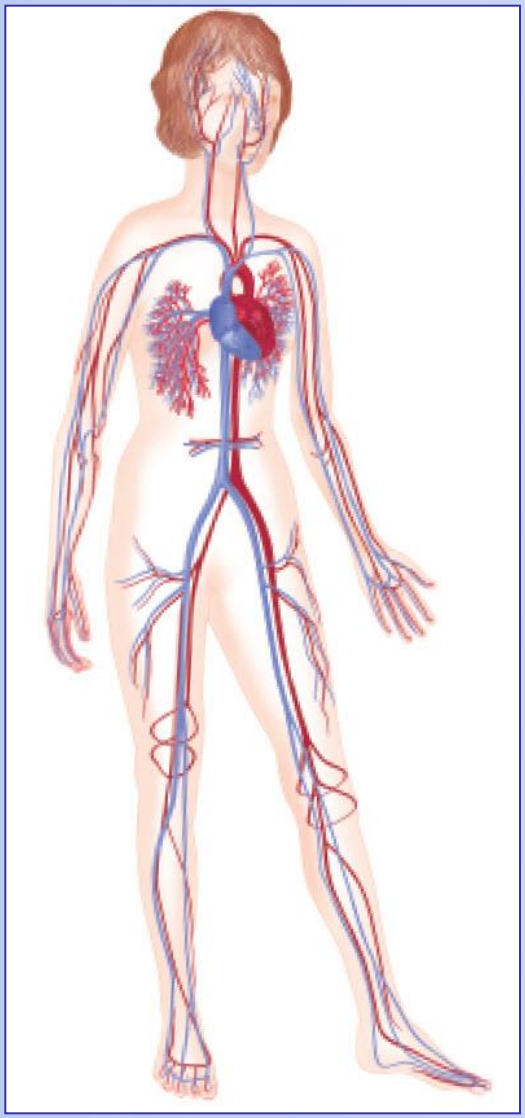
The organs of the respiratory system - the lungs and the airways - are responsible for gas exchange in the body, bringing oxygen into the body and getting rid of carbon dioxide.

The respiratory system is closely connected to the circulatory system - they work hand in hand for the exchange and transportation of these gases throughout the body.



Click to learn more about **gas exchange**

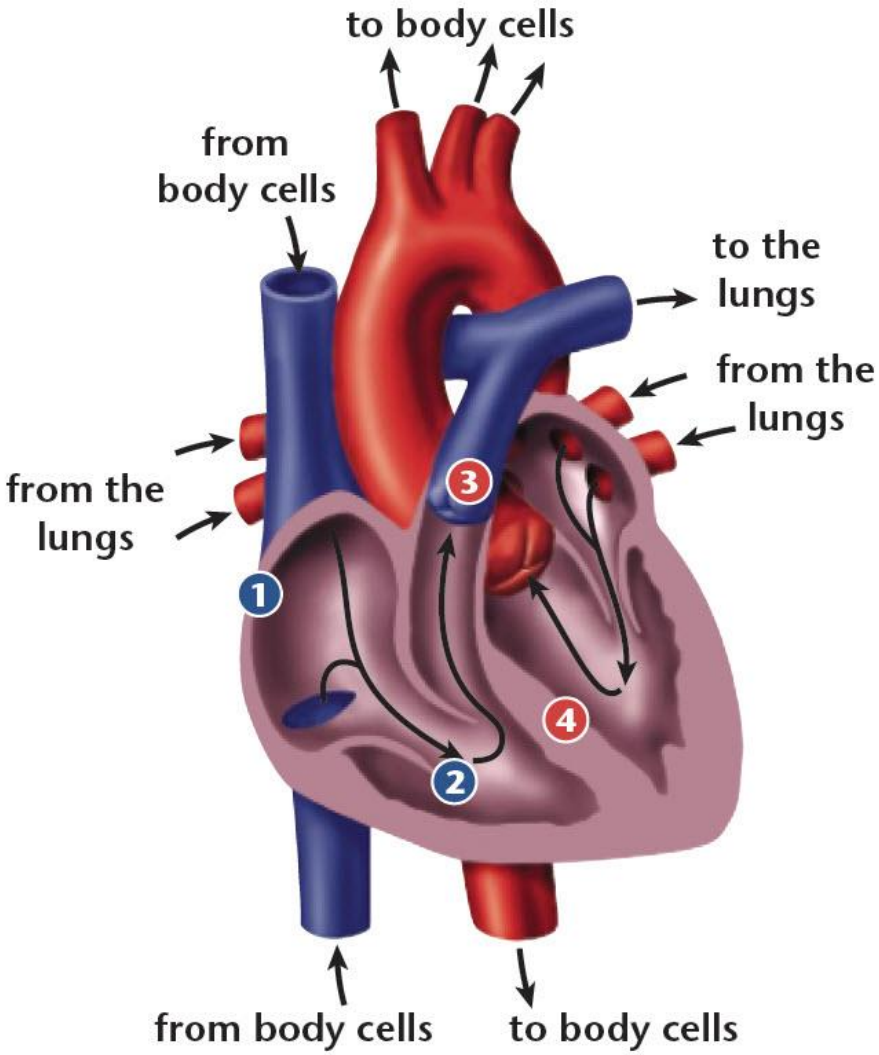
The circulatory system transports dissolved gases and nutrients through the body.



The system that transports gases between the lungs and the cells is the **circulatory system**. The circulatory system also ensures that nutrients are delivered to all of the cells in the body and waste products are removed.

Blood is pumped through the circulatory system by the heart. It travels to and from the cells in blood vessels.

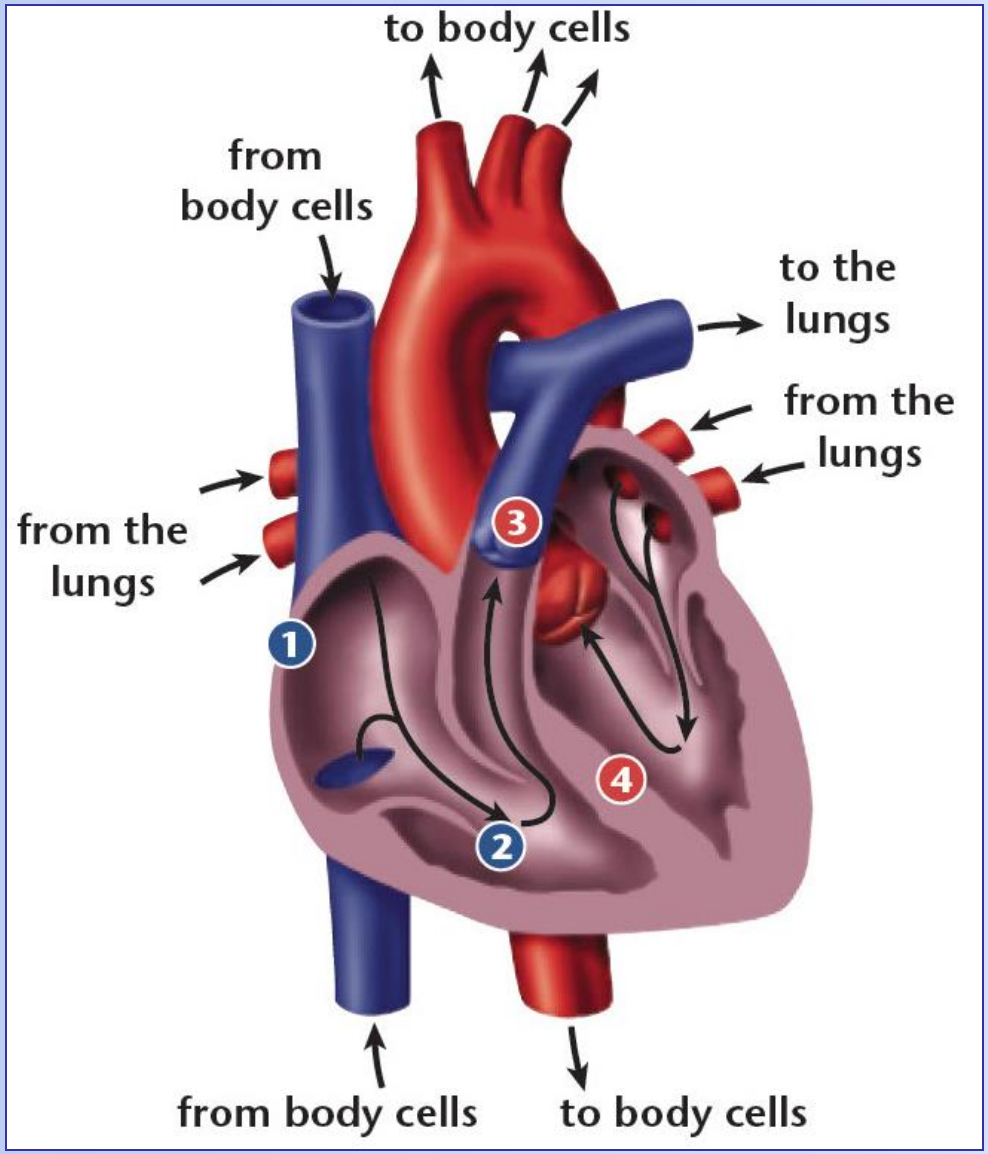
The Heart: The Pump of the Circulatory System



The **heart** is the muscular organ that drives the circulatory system. It pumps blood to the cells and back to the heart.

The arrows and numbers on the diagram to the left show the path that the blood takes.

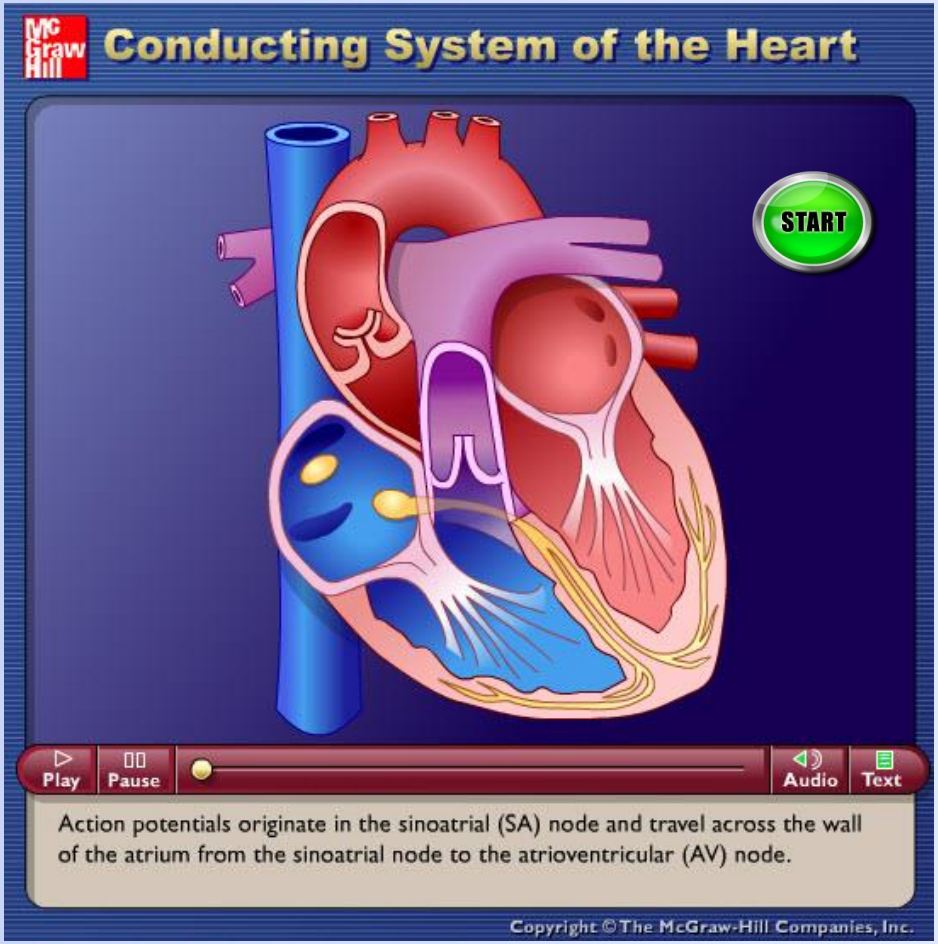
The Heart: The Pump of the Circulatory System



1. The upper-right chamber (right atrium) receives carbon dioxide-rich blood from the body.
2. The carbon-dioxide-rich blood moves into the lower-right chamber (right ventricle), which pumps it to the lungs. Inside the lungs, the blood gets rid of the carbon dioxide and picks up oxygen again.
3. The upper-left chamber (left atrium) receives the oxygen-rich blood from the lungs.
4. The oxygen-rich blood moves into the lower-left chamber (left ventricle), which pumps it to the body cells.

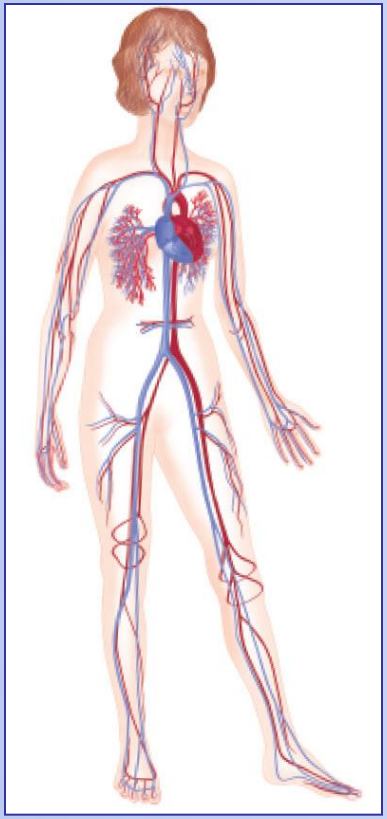
Reviewing the Function of the Heart

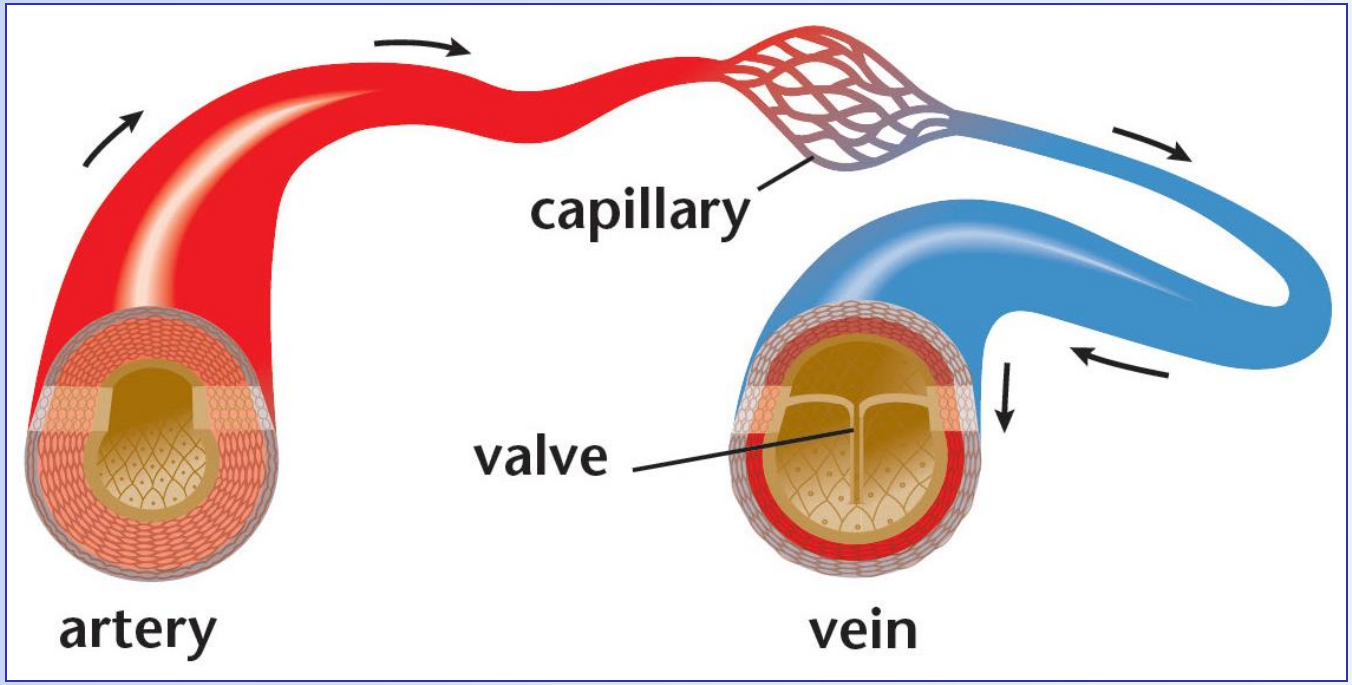
Click on the "Start" button to review the function of the heart.



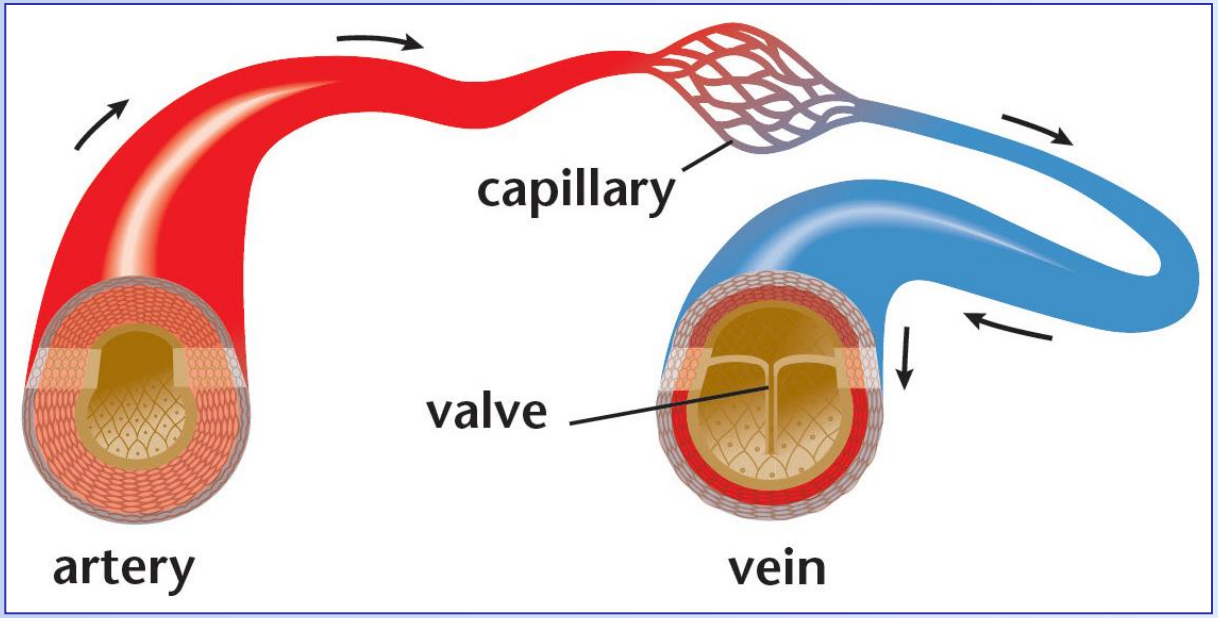
Blood Vessels: The Branches of the Circulatory System

There are many different blood vessels in the human body. The main vessels are **arteries** and **veins**, and they are large. The vessels closest to the cells are tiny.





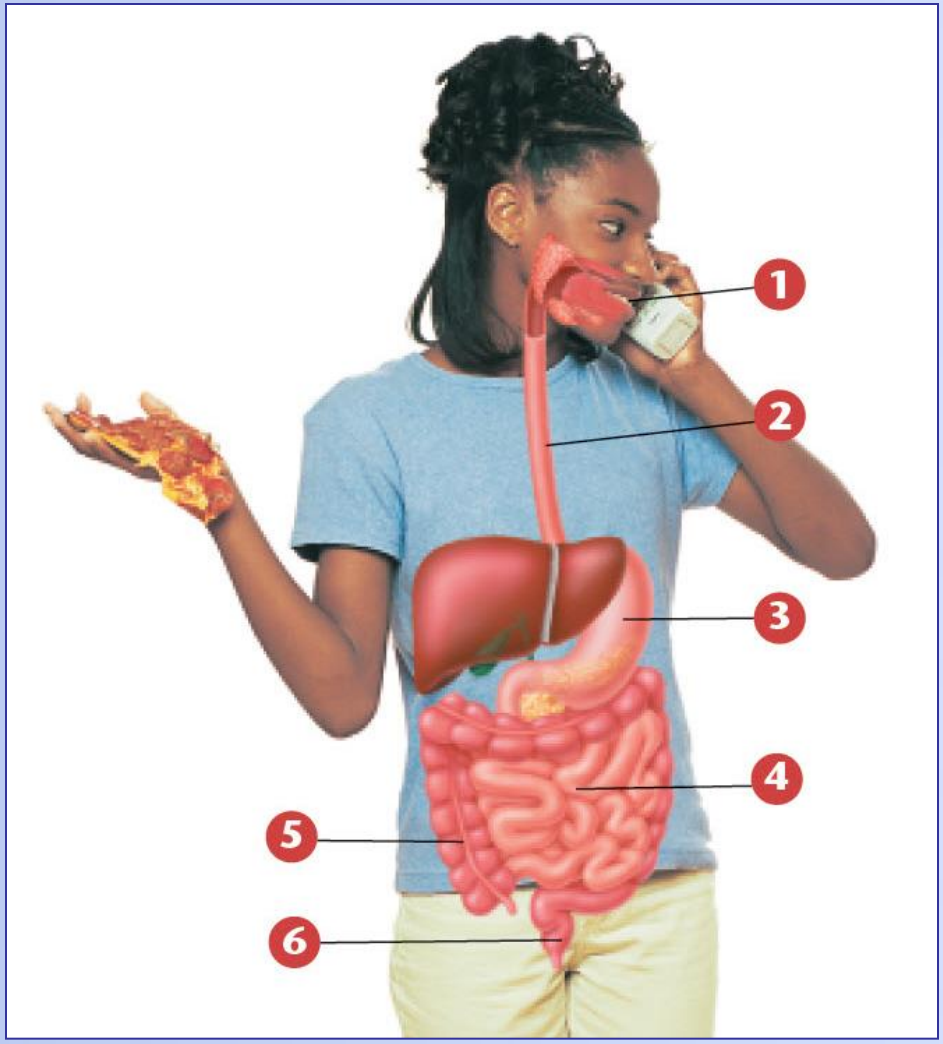
Blood Vessels: The Branches of the Circulatory System



Arteries are thick-walled, elastic blood vessels that carry oxygen-rich blood away from the heart.

Veins are thin-walled, inelastic blood vessels. They have valves that keep blood carrying carbon dioxide from backing up as it is carried toward the heart.

The digestive system breaks down food, absorbs nutrients, and eliminates solid waste.



The body's **digestive system** completes four tasks:

- **ingestion**
- **digestion**
- **absorption**
- **elimination**

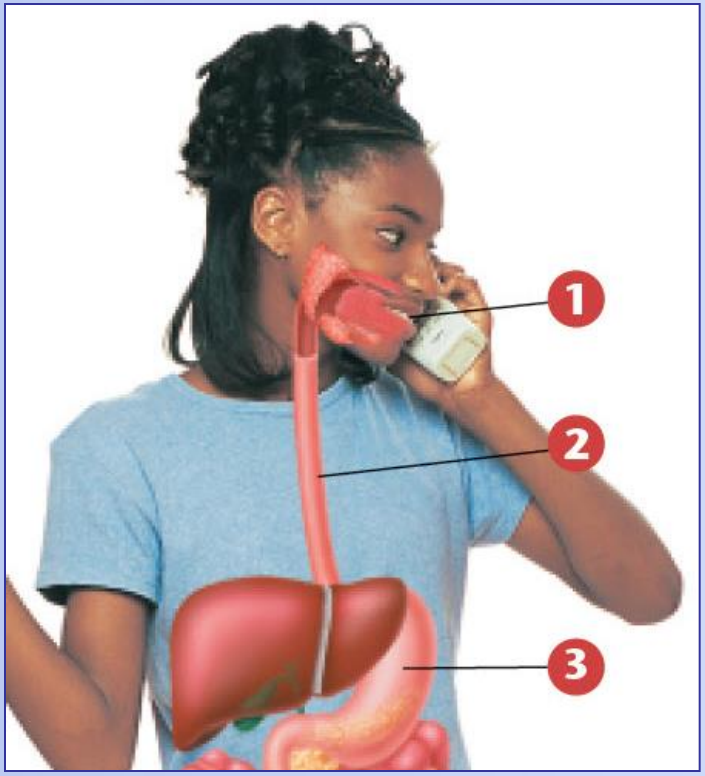
The digestive system breaks down food, absorbs nutrients, and eliminates solid waste.

Ingestion: Food is taken into the body

What parts of the digestive system are involved with **ingestion**?

The digestive system breaks down food, absorbs nutrients, and eliminates solid waste.

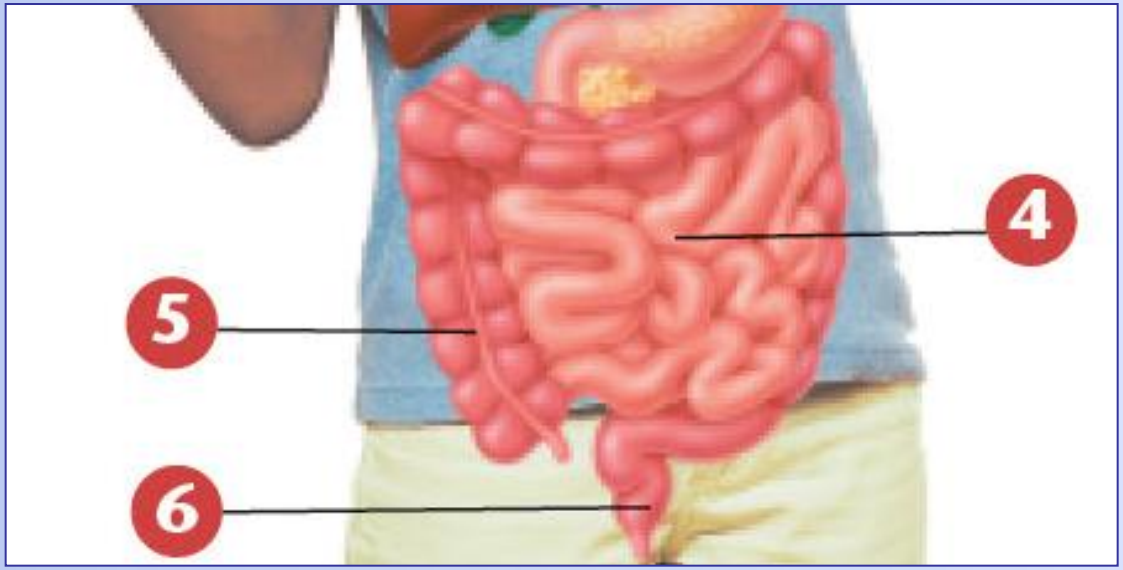
Digestion: Food is physically broken down into nutrients (through dissolving and breaking into smaller bits) and also broken down chemically (through chemical reactions).



What parts of the digestive system are involved with **digestion**?

The digestive system breaks down food, absorbs nutrients, and eliminates solid waste.

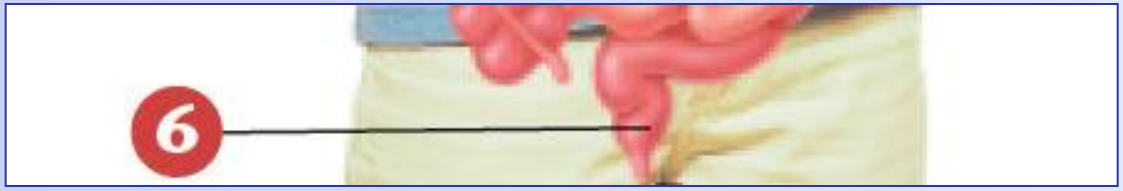
Absorption: During **absorption**, nutrients diffuse or are moved into the blood and carried to the cells. Energy from these nutrients is made available to cells through cellular respiration.



What parts of the digestive system are involved with **absorption**?

The digestive system breaks down food, absorbs nutrients, and eliminates solid waste.

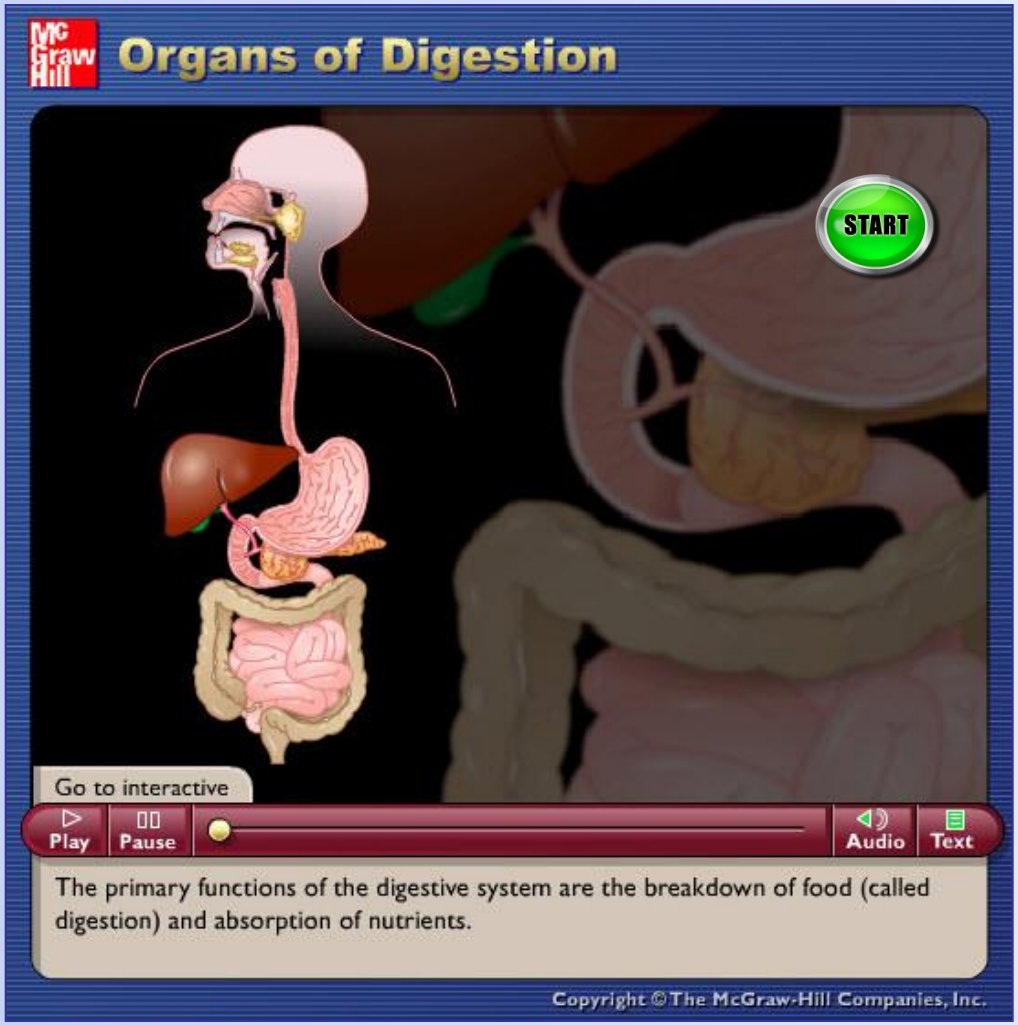
Elimination: Solid waste passes from the digestive system out of the body.



What parts of the digestive system are involved with **elimination**?

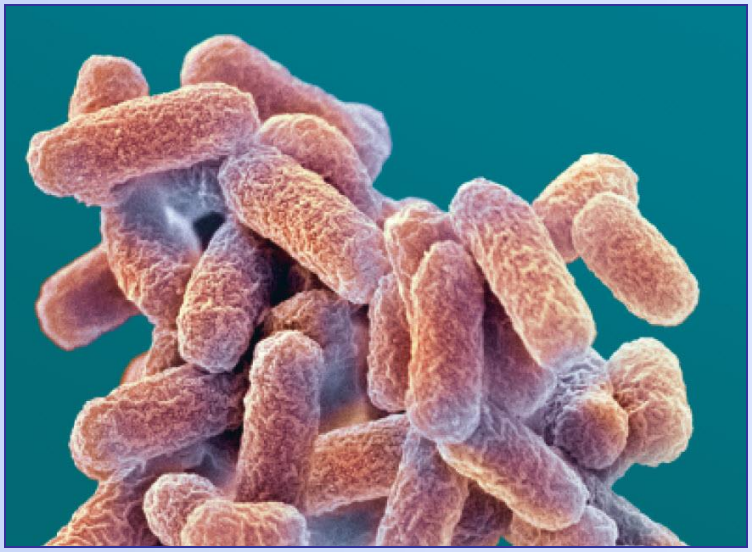
Reviewing Digestion

Click the "Start" button to review digestion.



The digestive system breaks down food, absorbs nutrients, and eliminates solid waste.

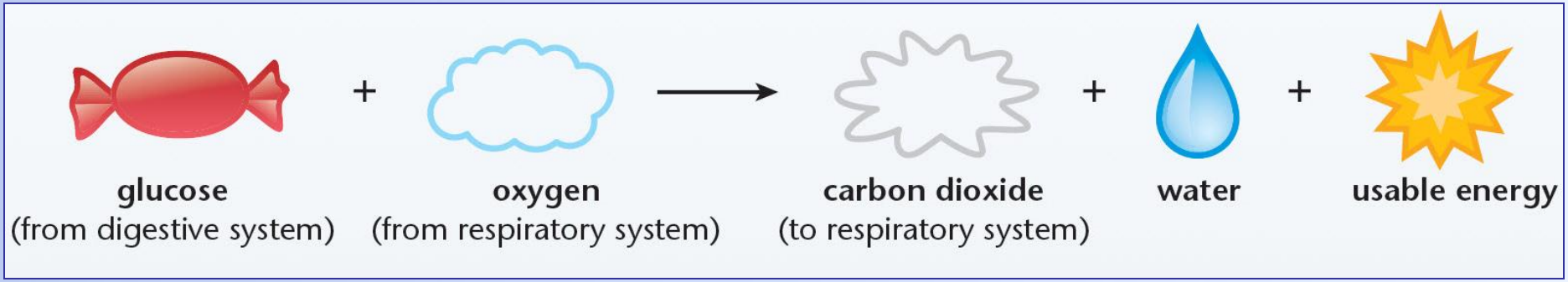
Bacteria like those shown in the picture below are a vital part of your digestive system. As they break down food, they release gases such as methane as a by-product. The gas you pass (100 L of gas each year!!) is produced by bacteria.



What types of food give you the most gas? Why?

Organ systems working together carry out important tasks in your body.

Most tasks in the body need the support of two or more organ systems working together. The reaction that occurs during cellular respiration and the body systems involved are shown below.



Topic 1.4 Review

Key Concepts to be reviewed:

- The respiratory system carries oxygen to and removes carbon dioxide from the blood.
- The circulatory system transports dissolved gases and nutrients throughout the body.
- The digestive system breaks down food, absorbs nutrients, and eliminates solid waste.
- Organ systems working together carry out important tasks in the body.

Topic 1.5

How do technology, substances, and environmental factors affect human health?

(Pages 76-93)

Key Concepts

- Medical imaging technologies are used to explore, diagnose, and treat the human body.
- Exposure to various technologies, substances, and environmental factors can impair health.
- Technology will affect human health in new ways in the future.

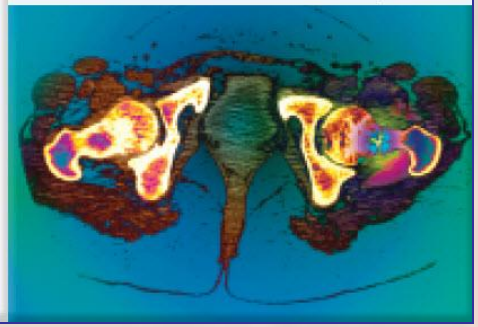
How do technology, substances, and environmental factors affect human health?

In the last 100 years there have been major advances in the technologies used by doctors to observe, diagnose, and treat patients.

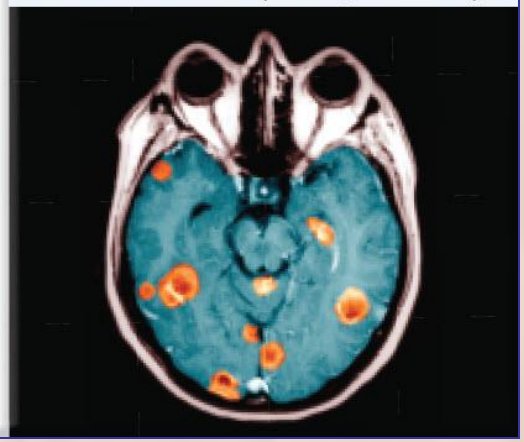
What advance in medical technology would you call the most important one in the past 100 years? Why?

Medical imaging technologies are used to explore, diagnose, and treat the human body.

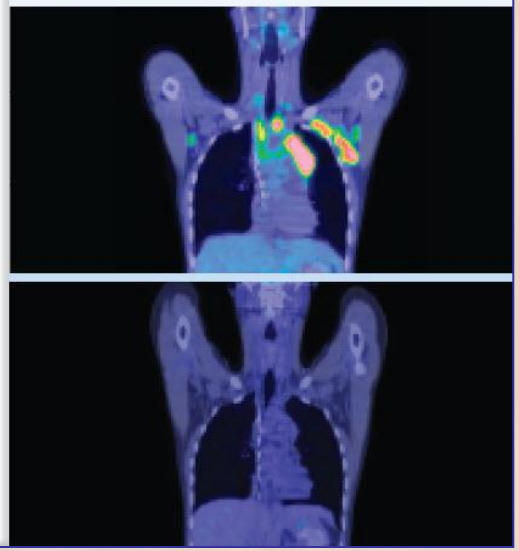
Medical imaging technologies are technologies used to make images of cells, tissues, and organs. The following slides describe a variety of common medical imaging technologies.

Technology	Description	Purposes	Image
X ray	• Involves sending electromagnetic radiation through the body to make an image	• To view hard tissue, such as bone • To diagnose bone injuries and malformations	A broken wrist 
CT scan (computerized axial tomography)	• An X ray source and sensor rotate around the body while slowly moving along the length of the body. A computer converts the data from the sensor into a 3-D image that looks like slices of the body.	• To view hard tissue, such as bone • To diagnose bone injuries and malformations	A fracture in the hip 

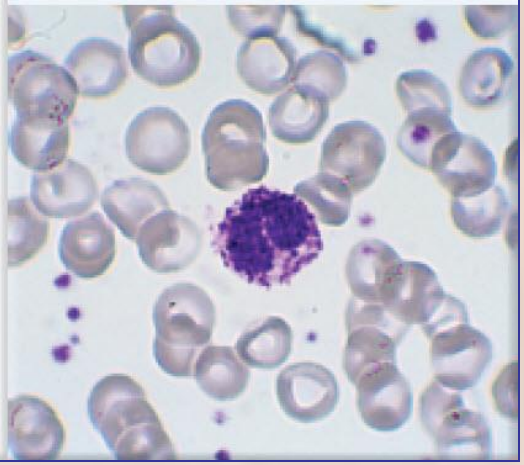
Medical imaging technologies are used to explore, diagnose, and treat the human body.

Technology	Description	Purposes	Image
Ultrasound	• Involves directing sound waves at a body part and measuring reflected sound waves to make an image	• To view soft tissue • To monitor fetal development, observe organ function, and detect cancer	A 23-week-old fetus 
MRI scan (magnetic resonance imaging)	• Involves passing radio waves through a magnetic field around the body, creating multiple images on a computer • Produces images that are similar to those produced by a CT scan, but shows soft tissue in much greater detail	• To contrast soft tissue (such as organs) and hard tissue (such as bones) • To diagnose disease in organs and soft tissues	Brain cancer (orange areas) 

Medical imaging technologies are used to explore, diagnose, and treat the human body.

Technology	Description	Purposes	Image
PET scan (positron emission tomography)	• Involves scanning small amounts of radioactive materials, which have been taken into the body • Reveals details of tissues and organs • Produces more detailed images if combined with another imaging technology, such as a PET-CT scan or PET-MRI	• To view soft tissues • To diagnose cancer or track cancer treatments	No tumours after treatment 

Medical imaging technologies are used to explore, diagnose, and treat the human body.

Technology	Description	Purposes	Image
Endoscopy	• Is conducted with a scope made up of a tiny camera and a light, which are attached to a flexible tube that is inserted into the body	• To view internal body parts without cutting open the body • To diagnose diseases, take tissue samples, and perform surgeries	Endoscopic surgery 
Microscopy	• Is conducted using a variety of microscopes including light microscopes and electron microscopes, which provide much greater enlargement and resolution	• To view small objects, such as cells • To diagnose various diseases	Blood cells 

Exposure to various technologies, substances, and environmental factors can impair health.

In recent years scientists have discovered that various technologies, substances, and environmental factors can affect your health. The health risks posed usually depend on the degree or length of exposure.

Health risks have been associated with all of the following:

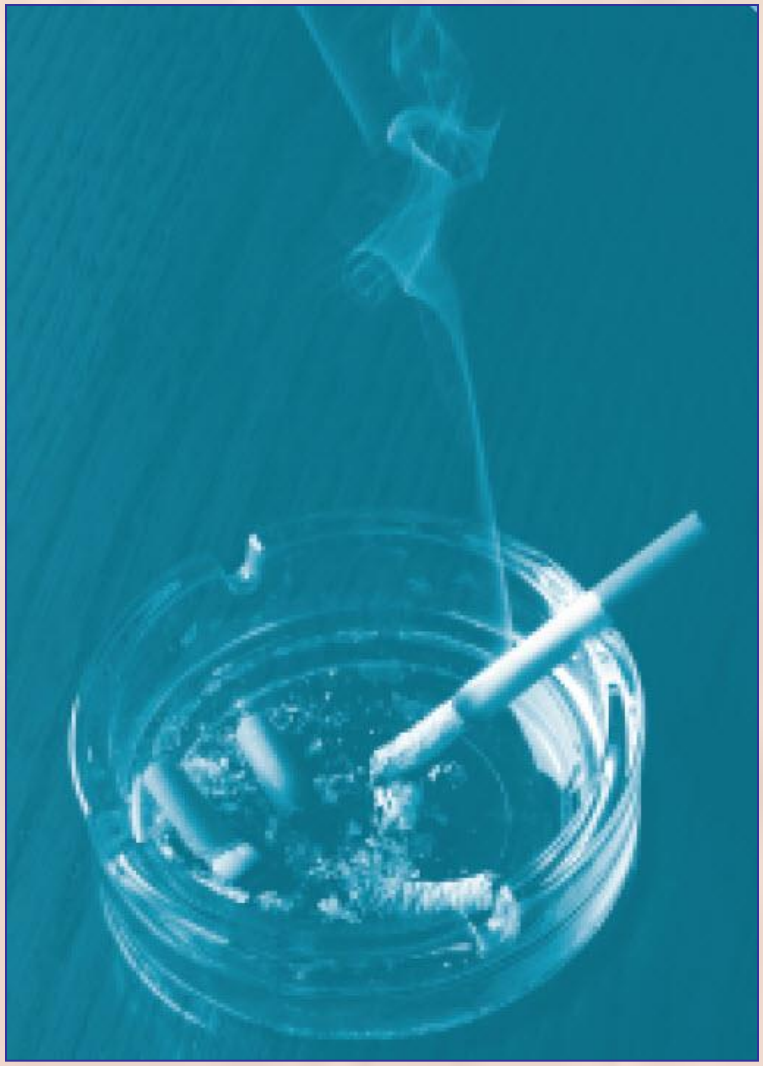
- ? You smoke.
- ? You use a cellphone.
- ? You had an X ray or CT scan.
- ? One of your friends or family members smokes.
- ? You listen to music at a high volume.
- ? You go out in the sunlight without sunscreen.

Do any of these risks apply to you?

Exposure to various technologies, substances, and environmental factors can impair health.

What is it about cellphone use that could be considered potentially harmful to your health?

Exposure to various technologies, substances, and environmental factors can impair health.



What health risks have been associated with smoking?

Exposure to various technologies, substances, and environmental factors can impair health.

What is the risk of extended exposure to the Sun's rays?

Technology will affect human health in new ways in the future.

New healthcare technologies are always under development and being tested. Some of these technologies hold huge potential for treatment of diseases.

The **i-Pill** could help doctors target and control the delivery of medication electronically.

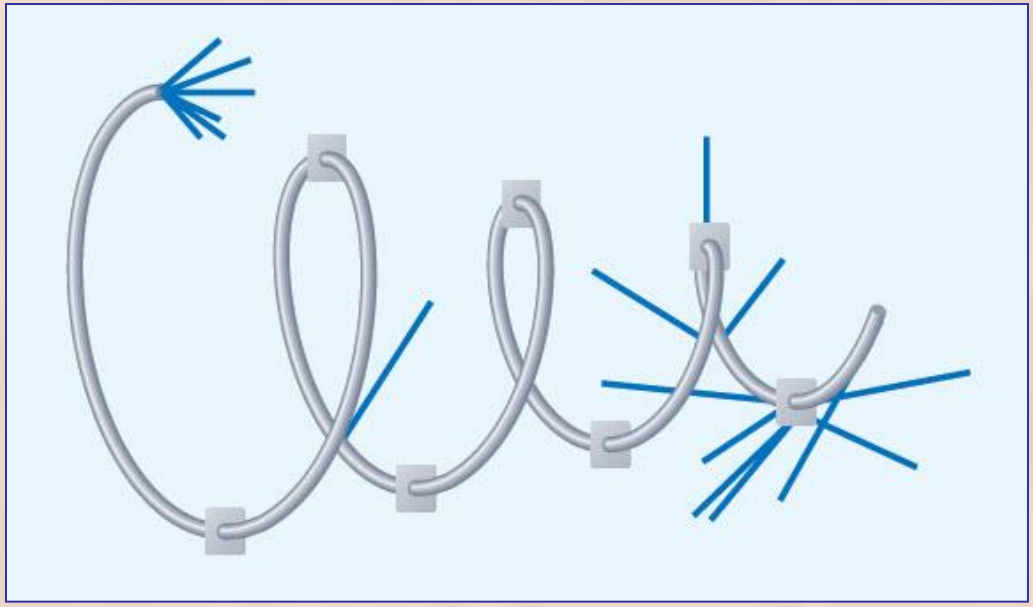
Technology will affect human health in new ways in the future.

Regenerative medicine could allow scientists to grow new cells, tissues, and organs to replace damaged ones.

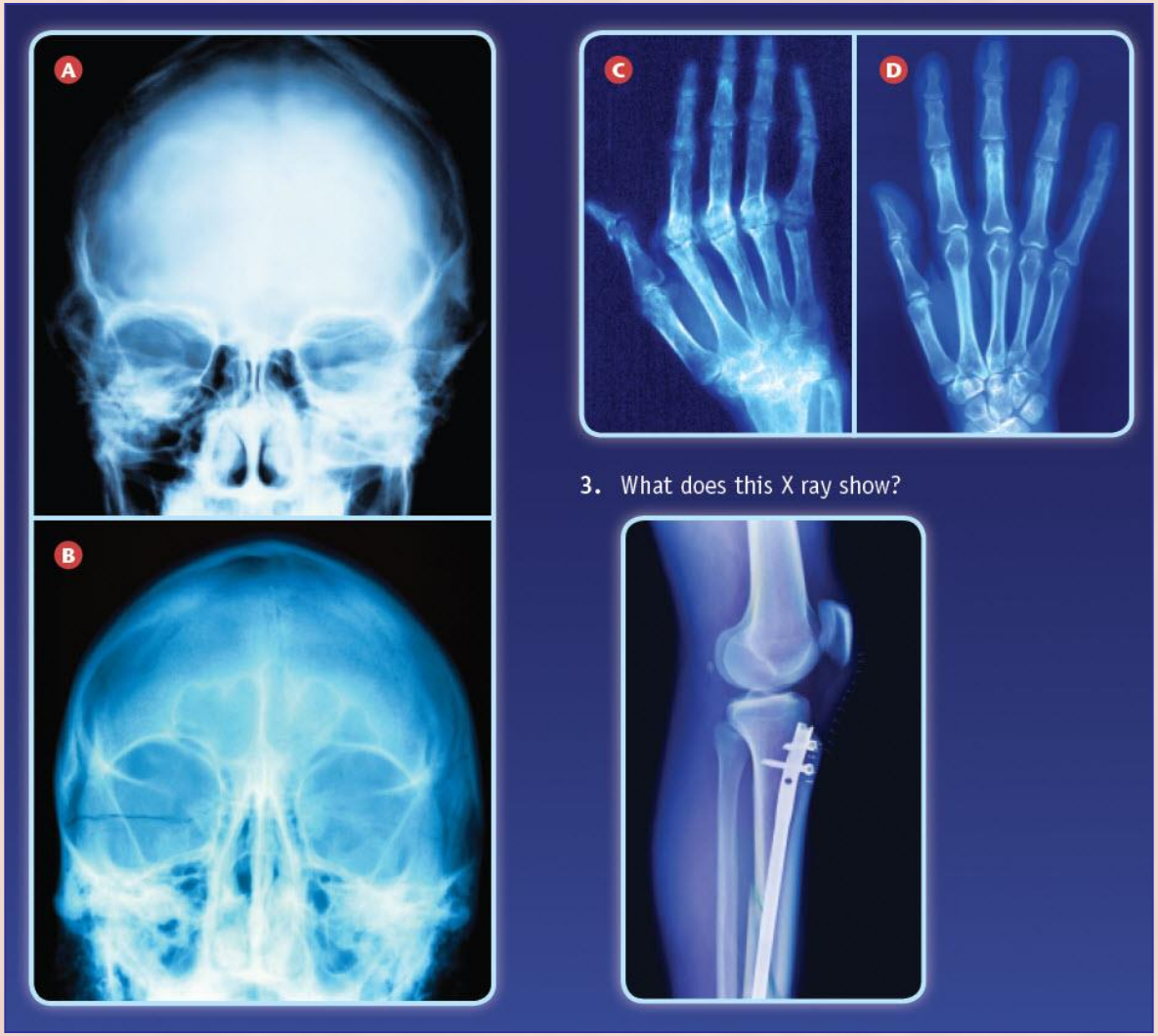
Scientists are currently researching artificial substitutes for real blood. The development of **artificial blood** would reduce our dependence on blood donations.

Technology will affect human health in new ways in the future.

The device pictured below can be used to remove blood clots. It is inserted into a blood clot as a straight wire. As your body heats the device, it coils up, attaching itself to the clot. The coil and the clot are then safely removed from the bloodstream.



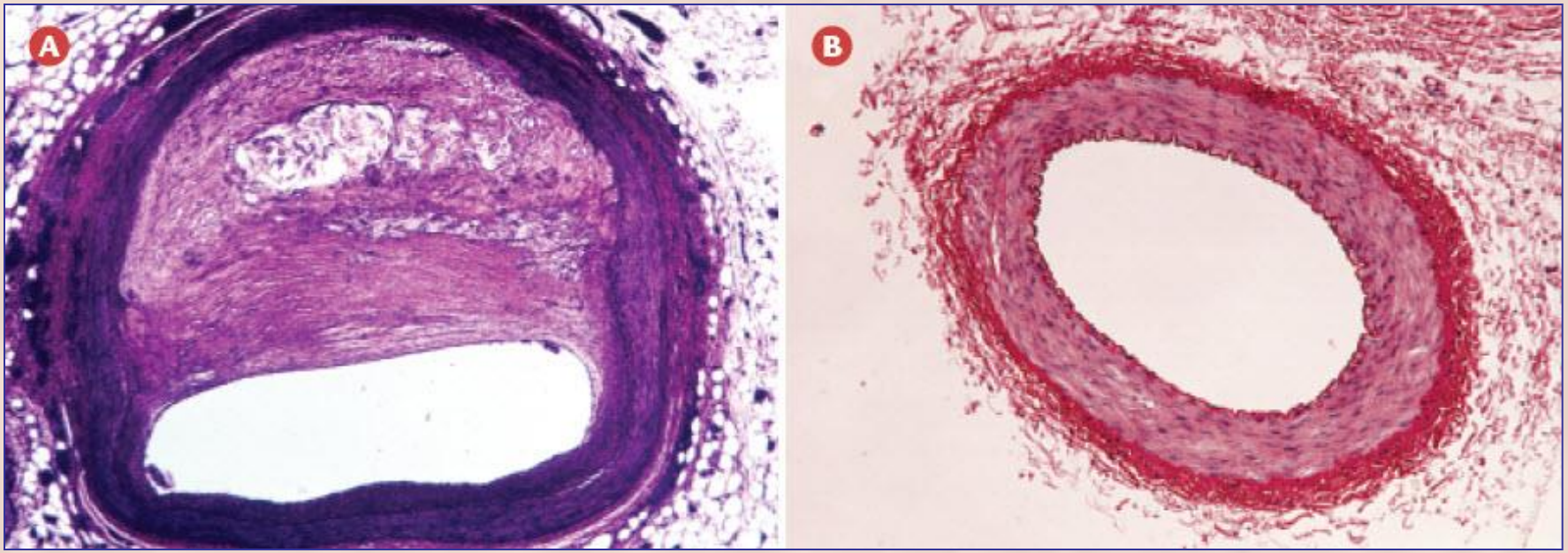
Interpreting X-rays



Analyze the X-ray images on the left, looking for evidence of fractures. Note differences in the appearance of bone and soft tissues.

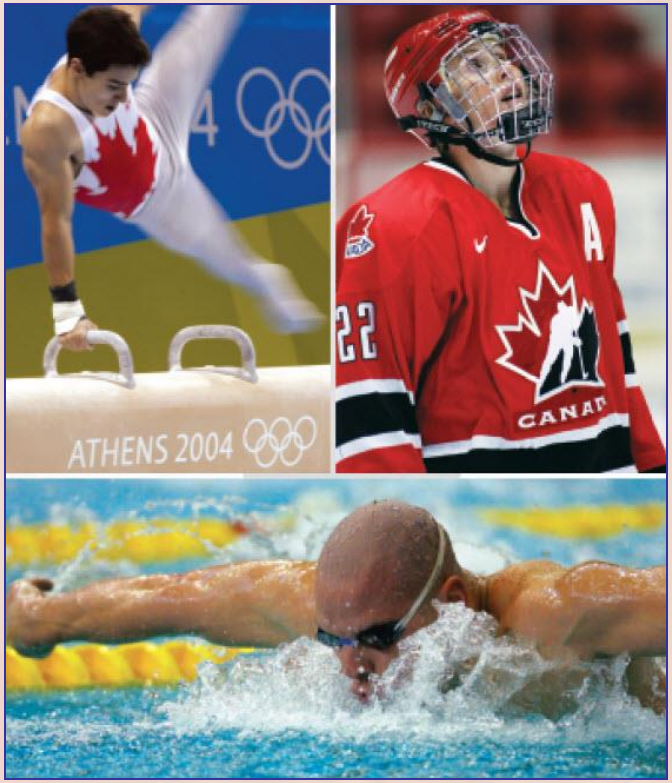
Analyzing Arteries

Analyze the images below, looking for evidence of what might have caused the death of a patient. Image **A** shows the patient's artery, and image **B** shows a healthy artery.



Case Study Investigation: What's the Price of Peak Performance?

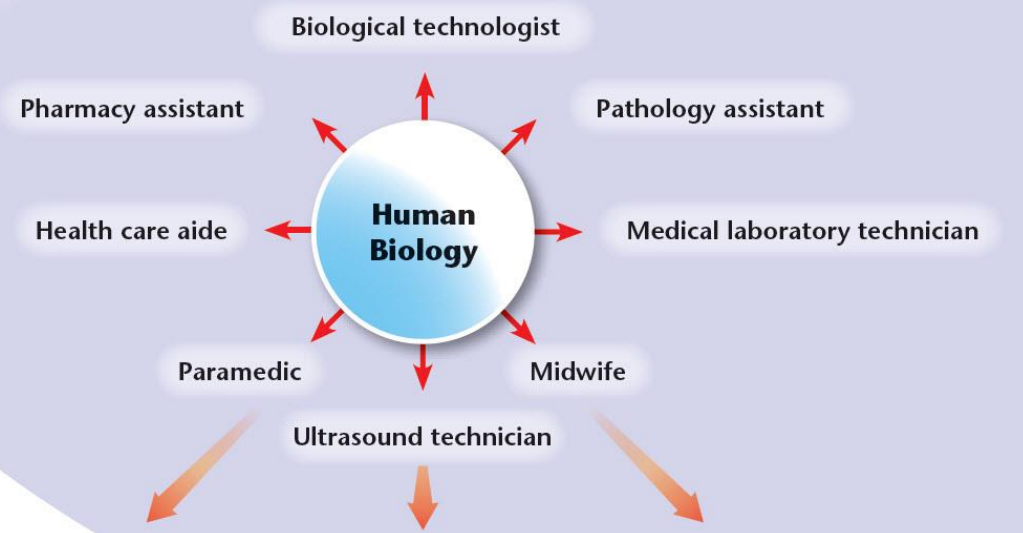
When polled, one out of five Canadians between the ages of 12 and 17 said that they would take performance-enhancing substances that would make them faster, stronger, or simply more buff, despite the risks involved.



What are the risks of using performance-enhancing substances?

Put Science To Work

The study of human biology contributes to these careers, as well as many more!



▲ Paramedics work for ambulance services. They respond to emergency calls, complete initial patient diagnosis, provide emergency treatment, and safely convey patients to the hospital if necessary.

▲ Ultrasound technicians use ultrasound medical imaging technology to generate images used to diagnose and assess medical conditions.

▲ Midwives deliver babies in hospitals, birthing centres, and private homes. They care for women during pregnancy and act as labour coaches. They also offer care to new mothers and infants.

Topic 1.5 Review

Key concepts to be reviewed:

- Medical imaging technologies are used to explore, diagnose, and treat the human body.
- Exposure to various technologies, substances, and environmental factors can impair health.
- Technology will affect human health in new ways in the future.