Version 01

Your Body's Systems

Literacy Foundations Science: Biology

OPEN SCHOOL BC

Project Manager: Jennifer Riddel

Production Technician: Caitlin Flanders

Course History

New, June 2012

Table of Contents

Viewing Your PDF Learning Package

This PDF learning package is designed to be viewed in Acrobat. If you are using the optional media resources, you should be able to link directly to the resource from the pdf viewed in Acrobat Reader. The links may not work as expected with other pdf viewers.

Download Adobe Acrobat Reader:
http://get.adobe.com/reader/

Learning Package Overview

This learning package is made up of several lessons.

Lessons

Lessons have a combination of reading and hands-on activities to give you a chance to process the material while being an active learner. Each lesson contains several topics, self-marked activities, and some lessons contain links to online multimedia resources.

At the end of the learning package you will find:

Solutions

This contains all of the solutions to the Activities.

Glossary

This is a list of key terms and their definitions.

Throughout the learning package, you will see the following icons:

Check your answers using the Solutions at the end of the package.

Go online to view a multimedia resource.

Materials and Resources

There is no textbook required for this course.

You will be expected to have certain tools and materials at your disposal while working on the activities. These materials are listed in the activity and should be easy to find around the house or nearby.

In some lessons you will be directed to an online multimedia resource. Internet access is required.

The Science Orientation Skills (SOS) package is an online student resource for the basic science skills. Throughout this learning package, you will be directed to the *SOS Package* to read and review information that is central to the practice and study of science. The *SOS Package* can be found at:
www.openschool.bc.ca/courses/sos/sc08/index.html

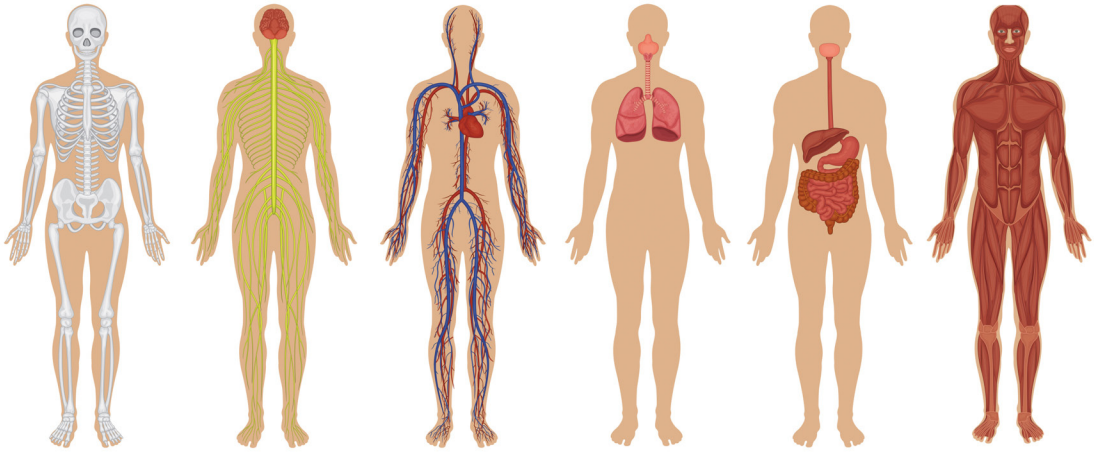
Your Body's Systems

In this learning package, you'll apply what you know about cell biology to learn about tissue development, and organ systems.

You'll learn about four of the major body systems:

- the circulatory system
- the respiratory system
- the digestive system
- the excretory system

While you'll be learning about each system separately, it's important to remember that each system connects and works with the other systems to keep your whole body functioning.



In this learning package. you will learn about:

- the relationship among cells, tissues, organs, and organ systems
- the parts and functions of the circulatory system
- the parts and functions of the digestive system
- the parts and functions of the excretory system
- the parts and functions of the respiratory system
- how the body's systems work together

Lesson A
Levels of Organization in Organisms

Introduction

Systems are made up of individual parts that work together and are usually connected to one or more other systems. If one part of the system is damaged, the system will not function well or may not function at all. These characteristics are true of systems in the human body. The human body is a complex system of interdependent parts that work together—understanding how these parts work help us to understand the whole system.

Cell Organization

In a multicellular organism, such as humans, cells are specialized and organized to work together. Groups of similar **cells** that have a common function form a **tissue**. Tissue cells are often stuck together with fibres or other sticky material.

Groups of tissues having a common function are organized into **organs**. Many organs are made up of several different types of tissues. Some examples of organs in your body include the heart, lungs, kidney, liver, skin, eye, brain, and ears. Some examples of organs in plants are the roots, stems leaves, stamens, and ovaries.

Groups of organs having a common function form an **organ system**. The human body is made up of many systems including the:

- circulatory system
- digestive system
- excretory system
- respiratory system
- immune system
- skeletal system
- nervous system

Tissues

There are four types of tissues in the human body:

- muscle tissue
- nerve tissue
- connective tissue
- epithelial tissue

Muscle tissue is responsible for movement in the body. Think of all the different ways you can move your body: walking, lifting, writing all involve muscle tissue. Muscle tissue also allows your body to move in ways you can't often see. For example, did you know that your heart contains muscle tissue? The muscle tissue in your heart allows it to contract so it can pump blood to your whole body.

Nerve tissue transmits messages through the body. It is crucial for our safety because it tells us how to respond to various changes inside and outside the body. For example, when you touch something hot, nerve tissues are what detect the heat and send a warning message to your brain.

Connective tissue holds other tissues together, and protects and insulates organs. This tissue is fibrous and helps give organs their shape.

Epithelial tissue covers our body and the surface of various internal organs. This tissue provides a barrier between the organ it is covering and the environment around the organ. Its functions can include protection, absorption, and secretion.

Organs and Organ Systems

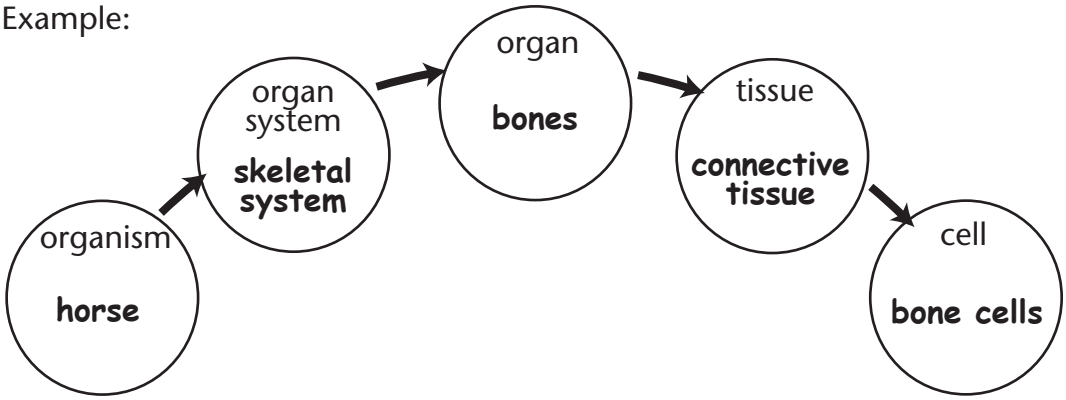
Your body is an amazing machine! Tissues are organized into organs and organs are organized into organ systems. Get ready—in the upcoming lessons in this learning package you will learn about four of the major body systems:

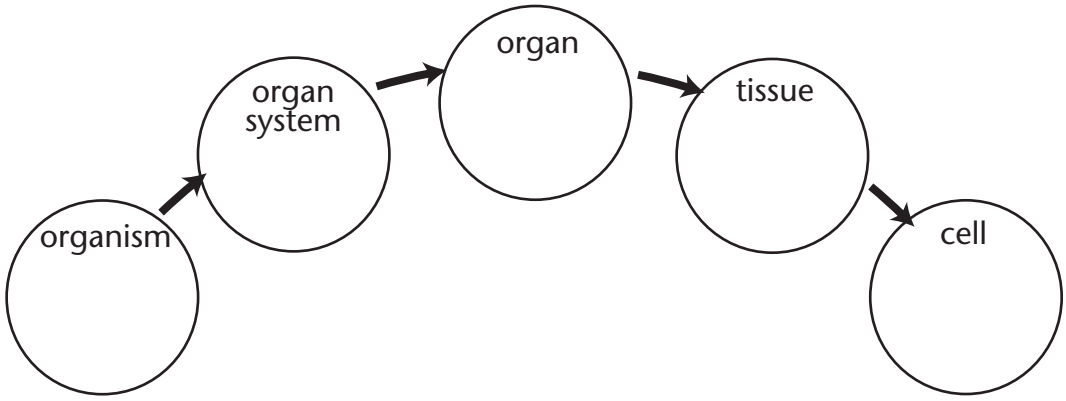
- the circulatory system
- the respiratory system
- the digestive system
- the excretory system

Activity 1
Organization

Complete the flow chart.

Example:





Check your answers using the Solutions at the end of this learning package.

Summary

Completing this lesson has helped you to:

- define the terms tissue, organ, and organ system
- explain the relationship among cells, tissues, organs, and organ systems

Once you have completed these parts, move on to Lesson B.

Lesson B
The Circulatory System

Introduction

The first system you'll be examining in this learning package is the circulatory system. The circulatory system transports substances around our bodies; it delivers essential nutrients to every one of our cells, and it helps to transport waste products to waste-disposal sites—the lungs, the skin, and the kidneys.

The Circulatory System—the Body's Moving Company

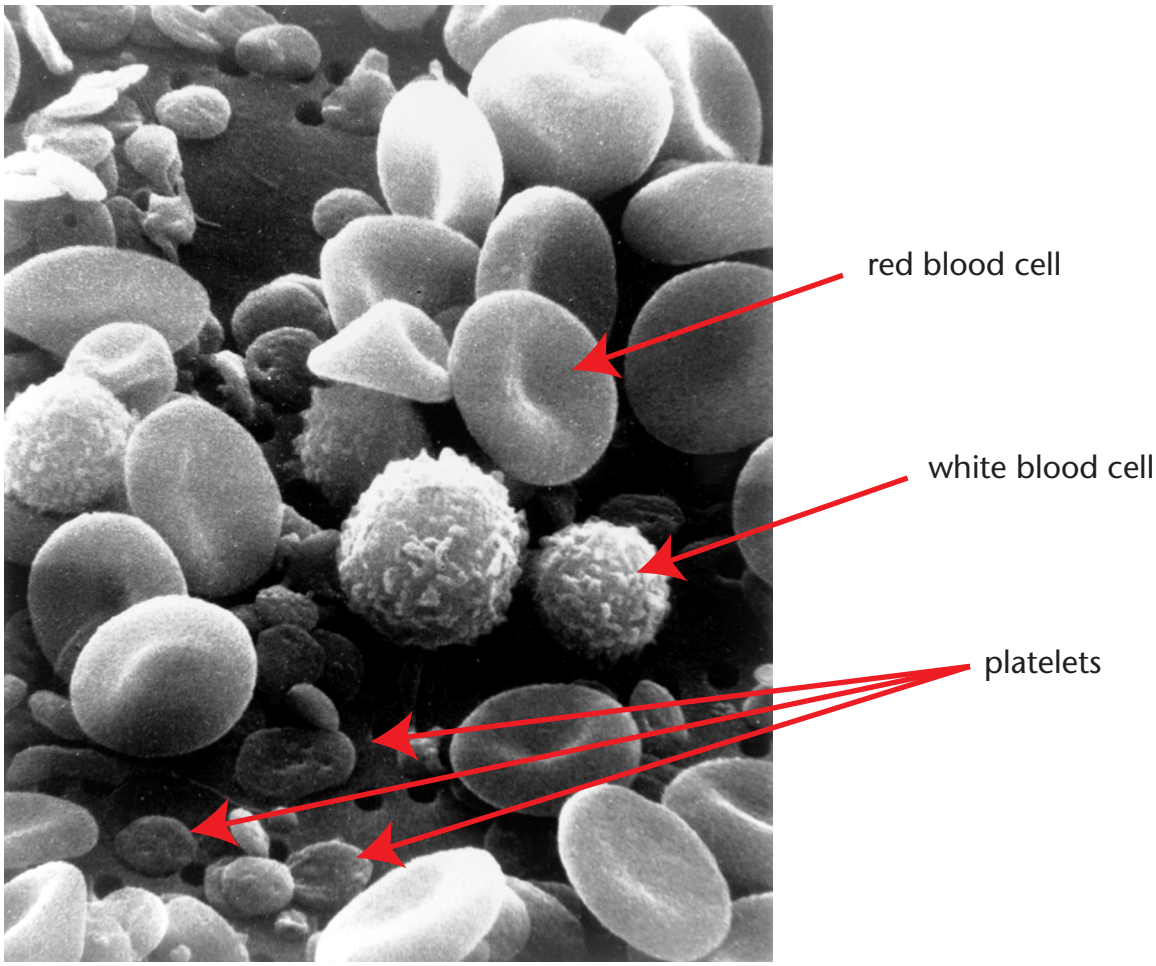
The circulatory system is an organ system that includes the **heart**, the **blood vessels**, and the **blood** itself. It has three functions:

- to transport materials (i.e., nutrients and oxygen) and cells from one place to another
- to defend the body against invasion by harmful organisms by taking white blood cells to an area of injury or infection
- to maintain a constant body temperature

Your body has a closed network of blood vessels—hollow tubes—that move blood and nutrients. A pumping organ—the heart—pushes blood through this network of vessels.

What is Blood?

Blood circulates through the body delivering nutrients and removing waste materials. Blood is made up of **red blood cells**, **white blood cells**, and **platelets** all suspended in plasma.



Plasma

About 55% of your blood is made up of plasma. Plasma is a liquid made up of proteins, minerals, dissolved salts, and water.

Red Blood Cells

Your body produces two million red blood cells every second. Red blood cells are responsible for carrying oxygen from your lungs to your cells and for carrying carbon dioxide from your cells to your lungs where it is exhaled.

White Blood Cells

White blood cells defend the body against attack from foreign organisms, such as bacteria and some viruses and form antibodies that protect the body from future attacks.

If the body is invaded by harmful organisms, the production of white blood cells increases dramatically. When a white blood cell encounters a smaller organism, it simply engulfs it. If the invading organism is larger, a number of white blood cells surround and consume it.

Platelets

Platelets contain the enzymes needed to turn clotting agents into fibrin—fibrous strands that heal wounds. Platelets collect around the edges of a wound, break themselves open, and release enzymes that promote the chemical reaction needed to heal the wound.

Blood Vessels—the Highways and Byways of the Blood

The body's transportation network is a lot like a road system with highways, streets, and small winding back alleys. The major difference is that the roads in the body are all one way. Three types of blood vessels make up this network:

- **arteries**
- **veins**
- **capillaries**

Did You Know?

If your blood vessels were stretched out end-to-end, they would make a strand more than 160 000 km long. That's equal to four times around the earth at the equator!

Arteries

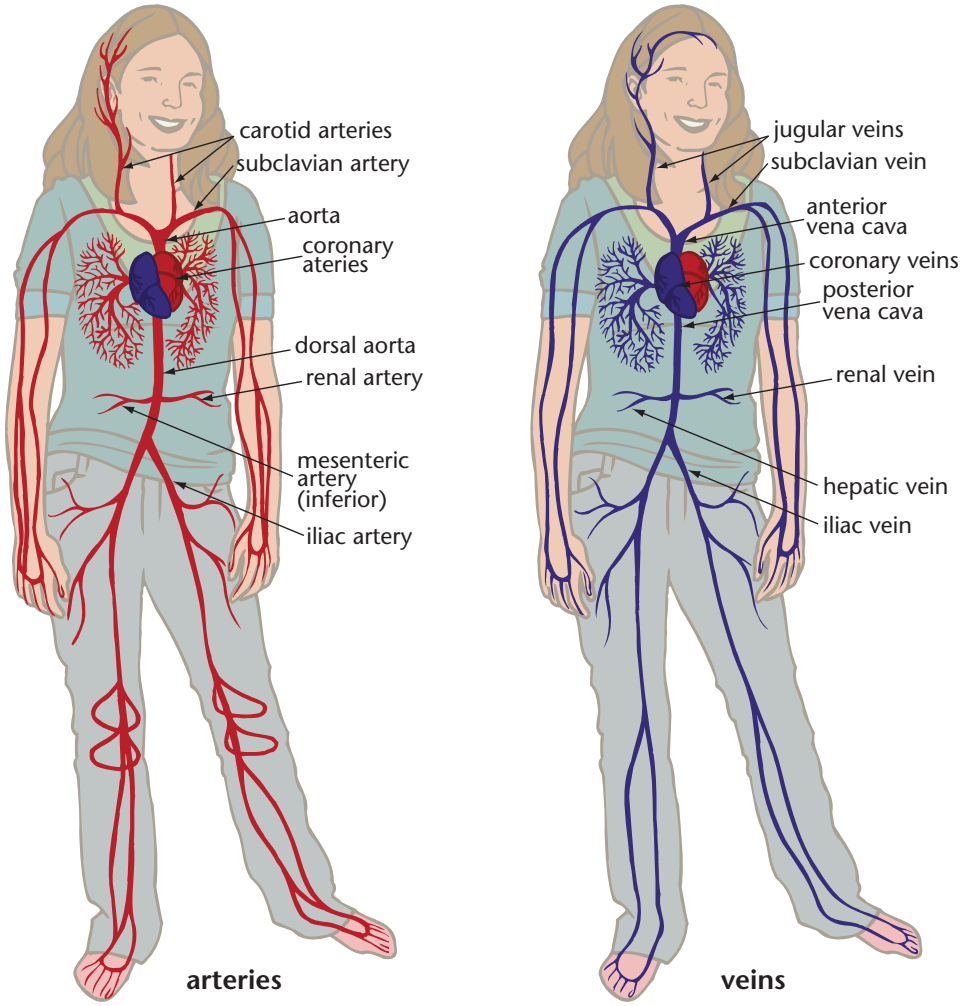
Arteries are blood vessels that carry blood away from the heart. They have muscular walls that send the blood on its journey to the outer regions of the body.

So, exactly how does an artery work? Think about squeezing that last bit of toothpaste from the tube. You squeeze from the bottom to the top, pushing the toothpaste ahead of your fingers. Arteries work in a similar way.

Each time the heart contracts, it sends out a gush of blood under high pressure. As high-pressure blood enters the main artery, the artery wall expands and balloons out. Between each heartbeat or contraction, the pressure decreases and the arteries return to their normal shape. Each time the artery expands and contracts, it pushes the blood along.

The rhythm of arterial expansion and contraction is called the **pulse**. Your pulse rate is the same as your heartbeat rate because it's a single beat of the heart that causes each expansion and contraction of the artery.

Arteries are much thicker than veins and most are located deep within our bodies. There's a good reason for this. Arterial blood is under high pressure. If a large artery is cut, blood literally spurts out in great gushes and the victim can bleed to death very quickly. The chances of an artery being cut are reduced because it's located deep inside the body rather than near the skin.



Veins

Veins are blood vessels that carry blood toward the heart. Veins don't have muscles of their own, but they do have valves. Valves are folds or flaps of skin that prevent blood from backing up in the vein. Since the blood in your veins is at a much lower pressure, veins are located closer to our body's surface. Blood doesn't spurt from a cut vein, so clotting can easily stop the flow.

The way blood moves through the veins is similar to the way air is forced out of the lungs. In both instances, an external set of muscles squeezes the organ, reduces its volume, and increases its pressure. The pressure difference causes the flow of blood (or air) from a region of high pressure to one of low pressure. One difference is that veins have valves to prevent the back flow of blood. Lungs don't need valves because there is nowhere for the air to flow back to.

Capillaries

Capillaries are the tiny blood vessels that join arteries to veins. Their walls are usually no more than one cell thick. Nutrients and gases diffuse into the cells through the capillary walls. Wastes diffuse from the cells to the capillaries.

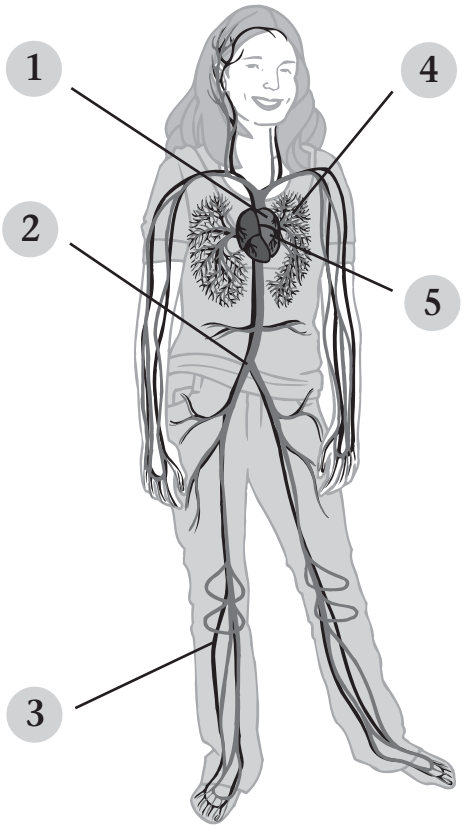
Voyage of the Blood

One complete circuit of blood consists of a main trip through the body and a side trip through the lungs.

To see how blood moves through the body, go to *Voyage of the Blood* at the link below and follow the instructions.
http://media.openschool.bc.ca/osbcmedia/sc08/html/sc0812b1f_blood.htm

Activity 1
Circulation Sequence

Match the descriptions listed below to the labels on the diagram.



_____ Deoxygenated blood returns through the veins into the heart.

_____ Deoxygenated blood is pumped through the heart to the lungs to pick up oxygen.

_____ Re-oxygenated blood travels from the lungs to the heart to be pumped into the arteries.

_____ The heart pumps out oxygenated blood into the body's arteries.

_____ Main arteries branch into smaller arteries, and then into millions of capillaries. The blood releases oxygen and nutrients to the body's tissues.

Check your answers using the Solutions at the end of this learning package.

The Heart's Beat

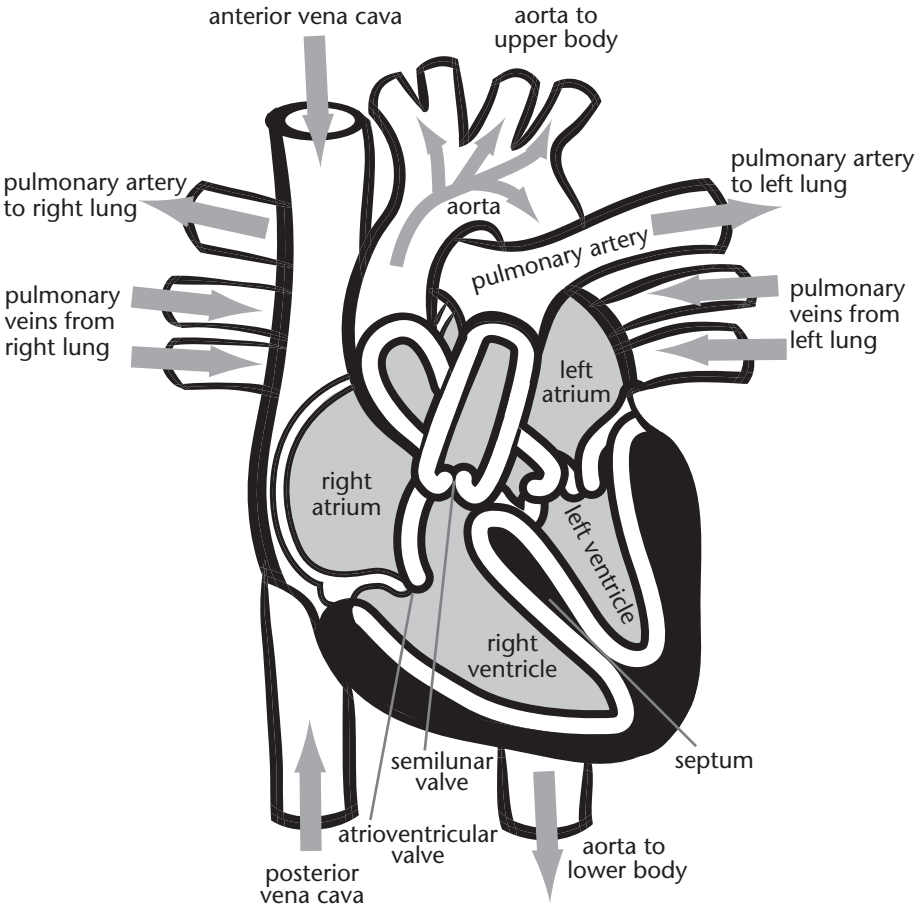
The heart—the driving force behind the flow of blood in your circulatory system—is a four-chambered pump that contracts about 70 times a minute. That's over 2 577 204 000 times in a seventy-year life span!

The heart adjusts its contraction rate (heartbeat) to match the body's needs. When you're resting, your heart pumps from 2.5 to 4.0 litres of blood every minute. If you begin to exercise, your heartbeat speeds up within seconds, increasing the volume of blood pumped per minute to meet your increased need for oxygen and nutrients. When you stop exercising, your heart rate slows down. All this from a muscular organ the size of your fist!

Anatomy of the Heart

The heart is made of a special kind of muscle. The muscle cells in the heart are connected so they contract and expand at exactly the same moment. This type of muscle is not found anywhere else in the body.

The human heart has four chambers or compartments: the left and right atria and the left and right ventricles. (Note: *atrium* is the singular of *atria*.)



The atria are smaller than the ventricles and their walls are thinner because they don't have to work as hard—they only pump blood to the next compartment. The ventricles, on the other hand, have to pump blood to the lungs and around the whole body. The left ventricle is the strongest of the heart's chambers.

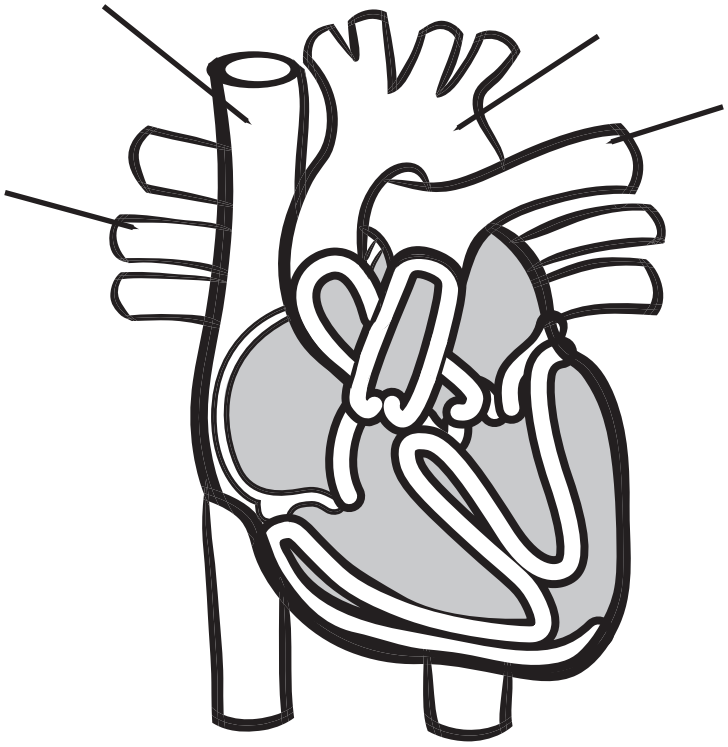
Each atrium is separated from its ventricle by a valve. Take a moment to find those two valves on the diagram. The valves act like one-way doors. When you push from one side, they open. If you push from the other side, they close.

Activity 2
The Heart

Below is a diagram of the heart.

1. Label the following parts: the aorta, the vena cava, the pulmonary artery, and the pulmonary vein.

2. Draw arrows to show in which direction blood flows as it makes a complete circuit through the system.



3. Why is there is a wall between the left and right sides of the heart?

_____

_____

_____

4. Describe the function of valves in the heart.

_____

_____

_____

 Check your answers using the Solutions at the end of this learning package.

Summary

Completing this lesson has helped you to:

- describe the functions of the circulatory system
- describe the components of the circulatory system
- describe the route that blood takes during its travels through the body

Once you have completed this part, move on to Lesson C.

Lesson C
The Digestive System

Introduction

The second system you'll be examining is the **digestive system**. How does your body get the nutrition it needs for optimal energy and performance? Buying food from the supermarket, preparing the meal, and eating it is only the start of the process. The real work begins after you finish eating.

The meal you just ate embarks on an eighteen to twenty-four hour journey through your digestive system—and a lot of the activity takes place without you even being aware of it.

Every meal and snack you eat is transformed into the nutrients and energy your body needs to work properly. The body eliminates what isn't needed. The process of digestion—everything that happens between eating and elimination—will be explored next.

In this lesson, you will look at the various tissues and organs that make up the human digestive system. You will be able to define the term digestion and list the names and functions of the various parts of the digestive system.

The Journey: The Big Picture

Most of the food we eat is made up of complex chemicals, yet the nutrients our cells need are simple chemicals—glucose, amino acids, fatty acids, and elemental minerals such as calcium and iron. The food we eat has to go through a lot of changes before our cells can use it.

Through a process called **digestion**, the food we eat is broken down into simple compounds that can be absorbed into our bloodstream and assimilated into our cells.

Digestion is carried out in a long, uneven, hollow tube that runs through the centre of the body. This tube is partly coiled. If it were stretched into a straight line, it would be about 10 metres long! The tube has two openings—the mouth and the anus—and is made up of many different tissues and organs, each of which has a special job to do.

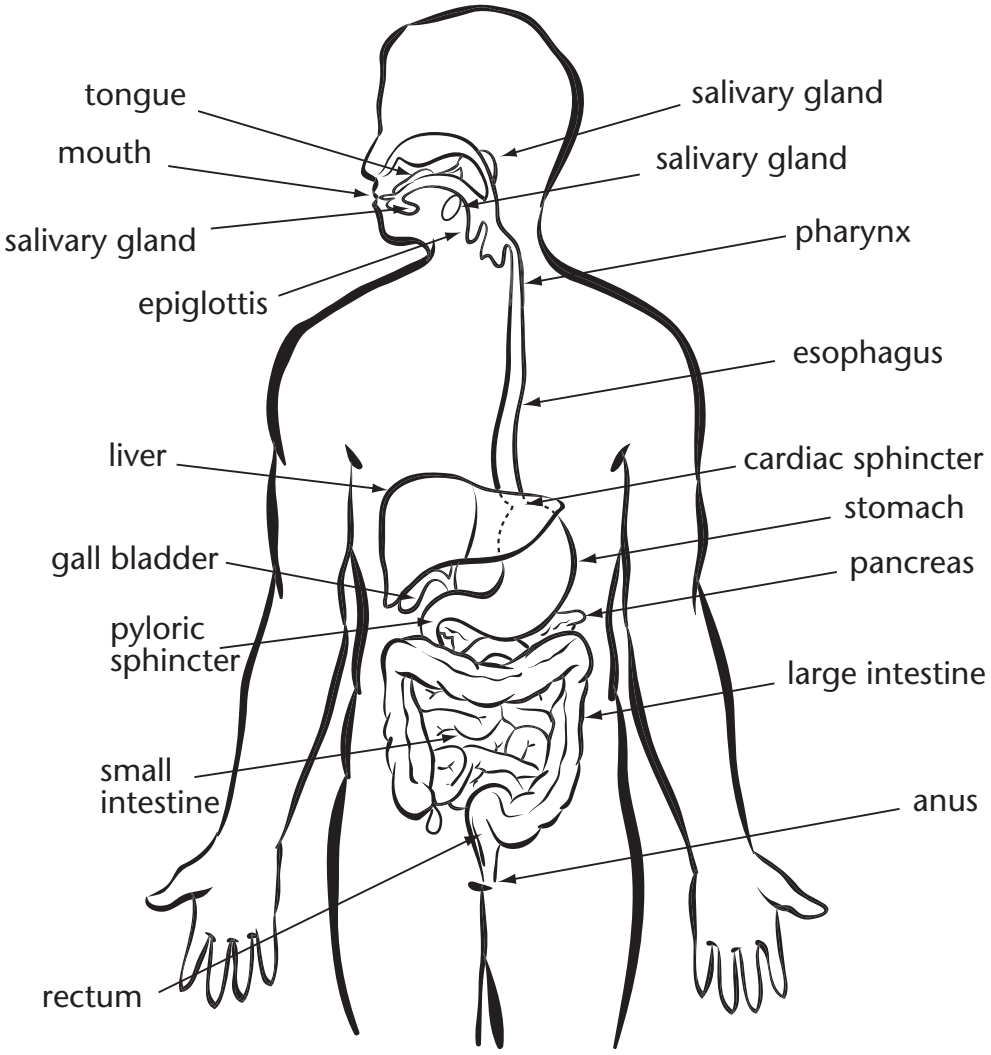
The Journey: The Details

To learn about digestion, follow a muffin through RJ's digestive system in *Round the Clock Digestion* found at the link below. Once you have viewed the media, come back to this lesson for a summary of the parts of the digestive system.

View *Round the Clock Digestion* at the following link:
http://media.openschool.bc.ca/osbcmedia/sc08/html/sc0812c1f_digestion.htm

Parts of the Digestive System

You learned about the digestive system and the process of digestion in *Round the Clock Digestion*. You may return to the media at any time to review the information. Below, you'll find an overview of the organs involved in digestion.



The **mechanical digestion** and **chemical digestion** of food begins in the **mouth**. Here, saliva mixes with food to form a food ball or bolus. The **tongue** moves, mixes, and positions food for chewing and swallowing. The **teeth** cut and crush food, increasing surface area and mixing with **saliva**. Every day the **salivary glands** produce about a litre of saliva. Saliva contains salivary amylase, which begins the breakdown of food.

The **pharynx** or throat is the passageway for both the food bolus to the esophagus and for air to enter the trachea. The process of swallowing takes place here. When swallowing takes place, the **epiglottis** meets with the glottis. It covers the opening to the trachea and allows food to move into the esophagus. Smooth, wave-like muscle contractions of the esophagus, also referred to as **peristalsis**, move the food bolus to the stomach.

The **cardiac sphincter** is a ring of muscle located at the entrance to the stomach. It allows food to enter the stomach, but keeps digested food (acid **chyme**) in the stomach, preventing reflux during mechanical digestion.

The **stomach** is a muscular organ that mechanically and chemically digests food. It squeezes and kneads food and drenches it in gastric juices. The mixture of food and gastric juices is called chyme.

The **pyloric sphincter** controls the amount of acid chyme that enters the small intestine by releasing small quantities at regular intervals.

The **small intestine** is important for the chemical digestion and absorption of nutrients. It produces some **enzymes** for digestion, and it also receives enzymes from the pancreas and bile from the liver, via the gall bladder. The inside surface of the small intestine absorbs millions of nutrient molecules. That seems like a big job for a small organ, but the inside wall of the small intestine is covered with tiny folds, called **villi**, that increase the surface area. This allows the small intestine to absorb the maximum amount of nutrients while taking up a minimum of space inside the body. The nutrients are then absorbed by the blood and lymph systems, transported to other parts of the body, and taken out of the blood and absorbed where needed.

The **liver** is one of the most important organs in your body—so important that life without it is almost impossible. The liver:

- converts glucose to glycogen
- helps convert excess amino acids (which we can't store) into urea, which is excreted as urine

- stores and breaks down body fats
- breaks down poisonous substances in the blood (e.g., alcohol)
- gets rid of damaged and dead red blood cells
- stores iron

The liver also secretes bile—a bitter green fluid that helps to break down large fat globules into smaller ones. Bile is stored in the **gall bladder** until it is needed

The **pancreas** makes pancreatic juice that contains numerous digestive enzymes, as well as bicarbonate ions that neutralize acid chime entering the small intestine.

The **large intestine** absorbs water, vitamins, and minerals from the undigestible particles of food (**feces**) left over from the digestive process. Unlike the small intestine, which secretes digestive enzymes, the large intestine only secretes mucus. It also concentrates the feces and stores them while water and minerals and water are extracted. After 18-24 hours, the feces are pushed into a final storage area, the **rectum**, which is located at the very end of the large intestine. The rectum is sealed by a sphincter muscle called the **anus**. This sphincter opens when we eliminate feces, and then closes again.

RJ's Muffin

Let's review what happened to RJ's bite of muffin in *Round the Clock Digestion*. During the digestive process, it was sliced, ground up, lubricated, swallowed, pummeled, drenched with enzymes and acid, drenched with yet more enzymes, stripped of its nutrients, gobbled up by bacteria, and finally pushed out of our bodies—quite a trip! Aside from chewing and swallowing, the whole process is automatic, and takes place without you having to give it a thought.

Activity 1
Digestion: The Journey

Refer back to *Round the Clock Digestion* if you need to!

1. Digestion is the process of:
   a. breaking large pieces of food into smaller particles
   b. breaking complex compounds into simpler ones
   c. absorbing essential nutrients from the food
   d. all of the above

2. Using the following terms, fill in the blanks in the following paragraphs:

   organs, digestion, cells, nutrients, 10 metres, mechanical action, chemical action, eliminated, bloodstream

   _____ is the process by which the body breaks down food into simpler compounds called _____. The digestive system consists of a number of _____ that are in turn made up of different types of tissues. Tissues are made of _____.

   The body uses two methods to break down food: _____ and _____. Once the food has been broken down, the nutrients are absorbed into the _____ and the wastes are _____.

3. Briefly describe what is meant by the mechanical breakdown of food and give at least one example.

   _____

   _____

   _____

4. Briefly describe what is meant by the chemical breakdown of food and how it benefits the body.

   _____

   _____

   _____

5. Match each description on the left with the correct part of the digestive system listed on the right.

	Definition	Term
_____	a narrow tube that moves food to the stomach	A. mucous lining in stomach
_____	an acid secreted by the stomach that assists with the breakdown of protein	B. pepsin
_____	mechanically break down food so we can swallow it	C. amylase
_____	protects the stomach from acids and enzymes	D. esophagus
_____	moistens and begins the chemical breakdown of food	E. hydrochloric acid
_____	an enzyme that converts starch into sugar	F. stomach
_____	involved in the mechanical and chemical breakdown and storage of food	G. epiglottis
_____	closes the opening to the trachea when swallowing	H. saliva
_____	an enzyme that breaks protein in amino acids	I. teeth

6. Fill in the blanks with the correct organ or substance.

   a. Stores bile until it is needed _____

   b. Acts as a storage area for feces _____

   c. Absorbs water, minerals, and vitamins and produces feces _____

   d. Breaks large fat globules into smaller droplets _____

Check your answers using the Solutions at the end of this learning package.

Summary

Completing this lesson has helped you to:

- describe the functions of the digestive system
- describe the components of the digestive system
- describe the process of digestion

Once you have completed this part, move on to Lesson D.

Lesson D
The Excretory System—Taking Care of Wastes

Introduction

The third system you'll be examining in this section is the excretory system—your waste disposal system. In this section, you'll learn all the inner workings of this very efficient system, and about how it gets rid of the body's waste products by a process called excretion. Excretion takes place via the circulatory system.

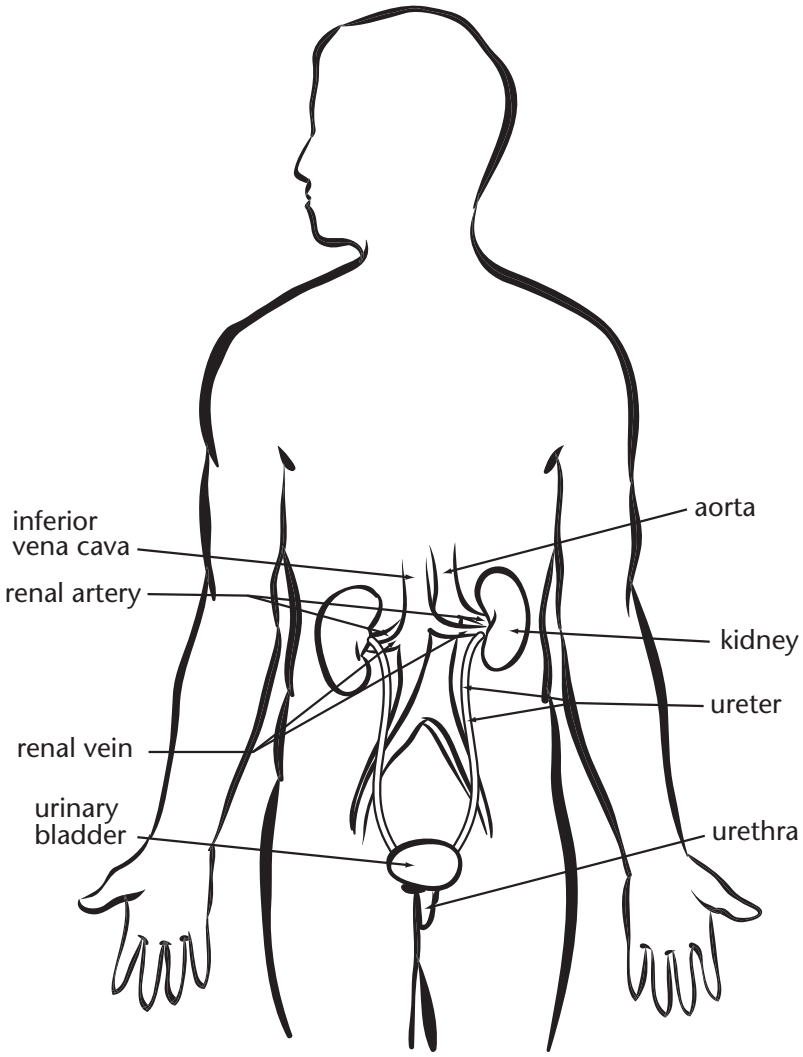
Wastes—the Unusable Products

Hundreds of chemical reactions occur in your body every second. These chemical reactions transmit nerve impulses, make heart cells contract, build new cells out of simple amino acids, and provide the energy for everything we do. These chemical reactions produce compounds that the body can't use. Getting rid of these wastes is as important as producing the things the body does need.

Excretion

The process of getting rid of waste products is called **excretion**. The excretory system includes two bean-shaped organs called **kidneys**. These are the main organs involved in filtering **soluble** wastes from the blood. Each kidney is a compact organ made of a network of blood vessels and collecting tubes. These collecting tubes are called **nephrons**.

A tube called the **ureter** leads from each kidney into the **bladder**, which is a hollow muscular organ that acts as a storage tank for liquid wastes (**urine**) until the body is ready to eliminate them. During urination, the liquid passes from the bladder through a hollow tube called the **urethra** to the outside.



Did You Know?

Some people suffer from kidney failure. When this happens, a process called dialysis can purify the blood. A person needing dialysis will go to a clinic, possibly two or three times a week, and spend several hours connected to a **dialysis machine**. Two needles are inserted into one arm—one to remove blood from the body and carry it to the machine; the other to transport purified blood from the machine back into the body. With the help of dialysis, most patients lead fairly normal, active lives.

Other Ways to Clean Up

Some of the excess compounds secreted by your body are harmless (e.g., water). Others can become toxic if they build up in the body. These products are wastes, and your body has to take out the garbage to stay healthy. Although the excretory system is responsible for removing most of the wastes from the body, several other organs are also involved.

The Lungs

Every time you inhale, your lungs take in the oxygen needed for **cellular respiration**. Carbon dioxide, the by-product of respiration, is toxic and the lungs excrete this gas every time the body exhales. Small amounts of excess water are also excreted with each exhalation, although most water is processed through the kidneys.

The Skin

When the body sweats, it is getting rid of excess water. Sweat, or perspiration, also contains excess salts and other soluble waste products; that's why it tastes salty.

Sweating only gets rid of a small portion of the wastes. Most of the work is done by the excretory system.

The Liver

Although the liver is not an excretory organ, it plays an important role in the process and is one of the most important organs in your body. The liver processes toxic substances that enter the body (e.g., alcohol) and helps to eliminate them.

Summary

Completing this lesson has helped you to:

- explain why waste products must be eliminated from the body
- describe the parts of the excretory system
- describe the functions of the excretory system

Once you have completed this part, move on to Lesson E.

Lesson E
The Respiratory System

Introduction

The fourth system you'll examine in this learning package is the respiratory (breathing) system. Even though you've looking at each organ system separately, it's important to understand that they're all connected. While you learn about this system, pay attention to the way it connects to and depends on the circulatory system.

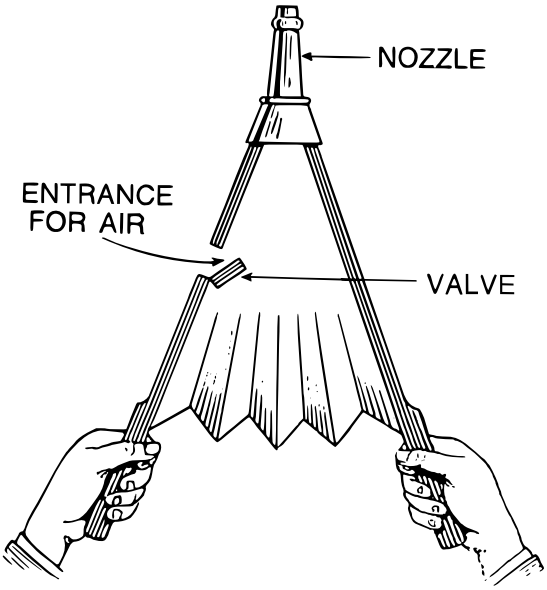
The Respiratory System

The respiratory system is made up of several organs and many types of tissue. Its purpose is to collect the oxygen you need to live and get rid of the carbon dioxide produced by the body.

The organs and tissues that make up the respiratory system include two sponge-like **lungs**, an assortment of tubes, and sets of muscles and bones that act like a pump.

Your Amazing Lungs

The lungs are located in the chest cavity or **thoracic cavity**. These walls are made of strong muscles. The **diaphragm**—a large dome-like sheet of muscle—seals the bottom of this cavity. Think of the thoracic cavity as the bellows you use to start a fire. As the bellows open, the volume inside the bellows increases. The air pressure inside the bellows decreases because fewer air molecules are pushing against the cavity walls. The air pressure becomes lower than that of the outside air. Outside air then rushes in to equalize the pressure.



The lungs work in much the same way. As a person inhales, two things happen. The diaphragm moves down and the rib cage moves up and out, increasing the volume of the thoracic cavity. As the thoracic cavity increases in volume, the lungs, which are attached to the cavity walls by a thin layer of fluid, expand as well. The air pressure in the lungs is lowered, and outside air is drawn in to equalize the pressure.

This action occurs in reverse during exhalation. The diaphragm moves up and the rib cage moves down and in. This reduces the volume of the thoracic cavity and increasing the air pressure inside the lungs. To equalize the pressure, air rushes out of the lungs and into the surrounding atmosphere.

Each lung is enclosed in its own lung sac. If one lung sac is damaged, the other lung is still protected. The bones of the rib cage protect the thoracic cavity. This cavity is flexible and can change its shape and size, making breathing possible.

Did You Know?

The average person breathes about sixteen kilograms of air every day. That's roughly six times the total mass of food and water you consume each day!

Activity 1
Diaphragm and Lungs

Select the best response for questions 1-4. Provide an answer for question 5.

1. As we inhale:
   a. The diaphragm moves up.
   b. The ribs move up and out.
   c. The ribs move down and in.

2. As we inhale:
   a. The volume of the thoracic cavity is increased.
   b. The volume of the thoracic cavity is decreased.
   c. The volume remains the same, but the pressure increases.
   d. The volume remains the same, but the pressure decreases.

3. As we exhale:
   a. The diaphragm moves downwards, increasing the volume of the thoracic cavity.
   b. The diaphragm moves downwards, decreasing the volume of the thoracic cavity.
   c. The diaphragm moves upwards, increasing the volume of the thoracic cavity.
   d. The diaphragm moves upwards, decreasing the volume of the thoracic cavity.

4. As we exhale:
   a. Air is expelled to offset increased air pressure in the lungs.
   b. Air is expelled due to lower pressure in the lungs.
   c. The diaphragm expands, forcing air out of the body.
   d. The diaphragm contracts, forcing air out of the body.

5. What seals the lungs to the chest wall?

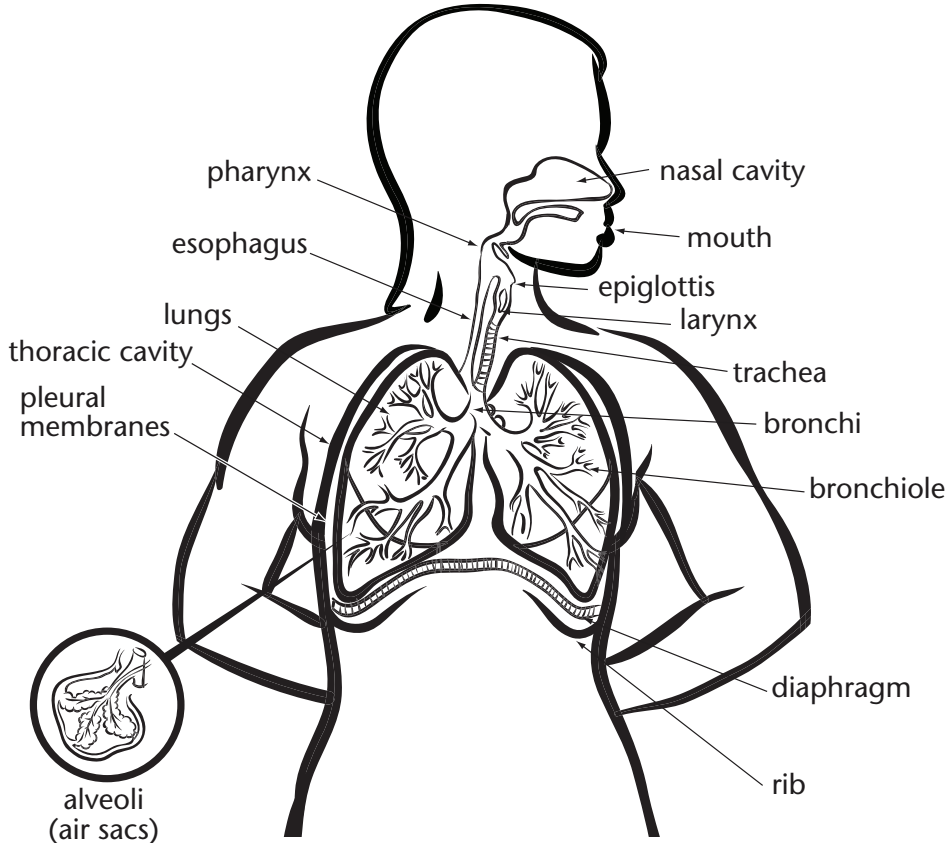
_____

_____

_____

Check your answers using the Solutions at the end of this learning package.

A Single Breath



While exercising, you often breathe through your mouth because you can draw in air more quickly this way than you can through your nose. Mouth breathing is more efficient at delivering large quantities of air. So why do you normally breathe through your nose? There are several good reasons.

The lining of the respiratory system organs—the **trachea**, the **bronchi**, and the **alveoli**—is very thin and delicate. This tissue is susceptible to wounds, chemical damage, and infection. To protect the body from those dangers, the respiratory system has evolved an air-conditioning system that begins right at the nostrils. This system:

- filters out dirt, dust, pollen, bacteria, and other tiny particles by capturing them in a sticky layer of mucus
- moistens the air to prevent the delicate lining of the alveoli from drying out
- warms the air as it enters the body

Movement of Air

The tubes (**bronchioles**) leading to the lung's alveoli are lined with mucus-secreting cells that have tiny hair-like projections called **cilia**. These cilia are constantly moving and are covered by a fine layer of mucus. The movement of the cilia pushes the mucus away from the lungs, along with dust, bacteria, and other matter caught in the mucus. The dust-bearing mucus is moved towards the pharynx where it can be coughed or sneezed out of the body, or swallowed.

Once the air has been filtered and conditioned, it is drawn through a series of branching tubes—the trachea and bronchi—that lead to the lungs.

Inhaled air moves through the **pharynx** towards the opening of the trachea. The **epiglottis** opens and allows this air to pass into the trachea. The trachea is a tube that is permanently held open by a set of rings made of **cartilage**. These rings prevent the tube from collapsing and cutting off the air supply.

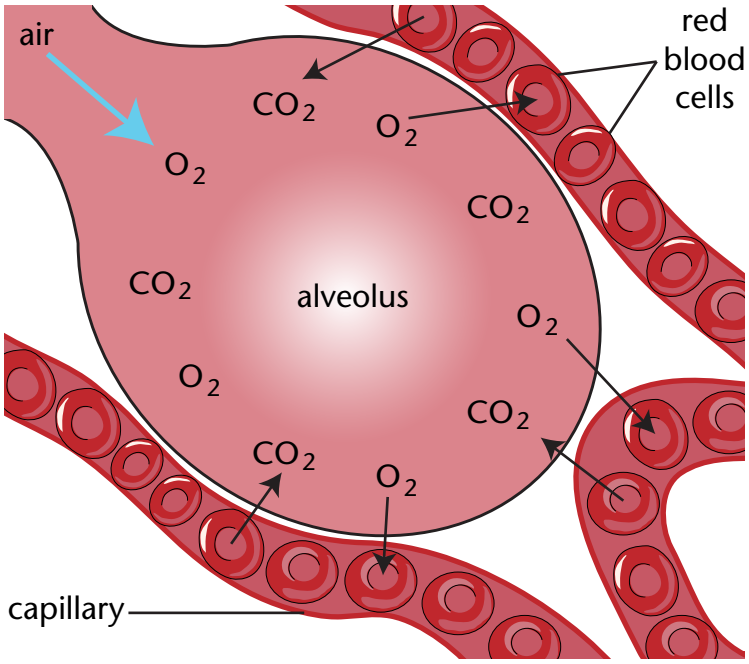
The trachea branches into two cartilage-ringed tubes called the bronchi (singular, bronchus) or bronchial tubes. Each bronchus leads to a lung, where it divides into a series of ever-smaller branches called **bronchioles**.

Did You Know?

You can't breathe through your nose and swallow at the same time. Try it. When you swallow, the epiglottis covers the trachea, preventing food from entering it. When you breathe, the epiglottis is drawn back, allowing air to enter the trachea. So you can either breathe or swallow, but you can't do both at the same time.

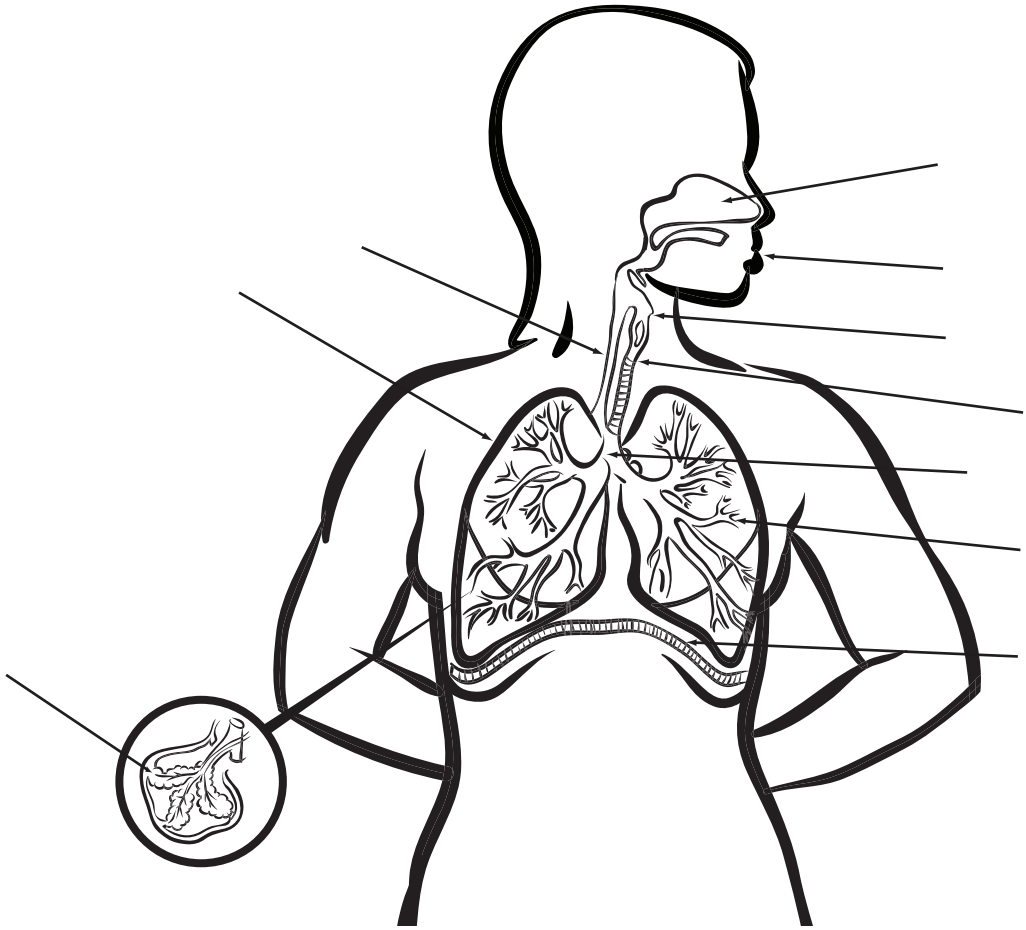
Alveoli—the Final Destination

Each of the smallest bronchioles dead-ends into a cluster of small balloon-like hollow sacs called alveoli. They have thin walls and are surrounded by blood capillaries. Gas exchange occurs in the **alveoli**. Oxygen gas is in higher concentration in the alveoli than in the blood and so it diffuses into the blood through this thin layer of cells. Carbon dioxide is in higher concentration in the blood than in the alveoli, so it diffuses into the alveoli and can be exhaled.



Activity 2
Parts of the Respiratory System

1. Label the following diagram of the respiratory system by writing the correct word by the line.



2. Describe the two main differences in the composition of inhaled and exhaled air.

_____

_____

_____

_____

3. List one advantage and two disadvantages of breathing through the mouth instead of the nose.

_____

_____

_____

_____


Check your answers using the Solutions at the end of this learning package.

Summary

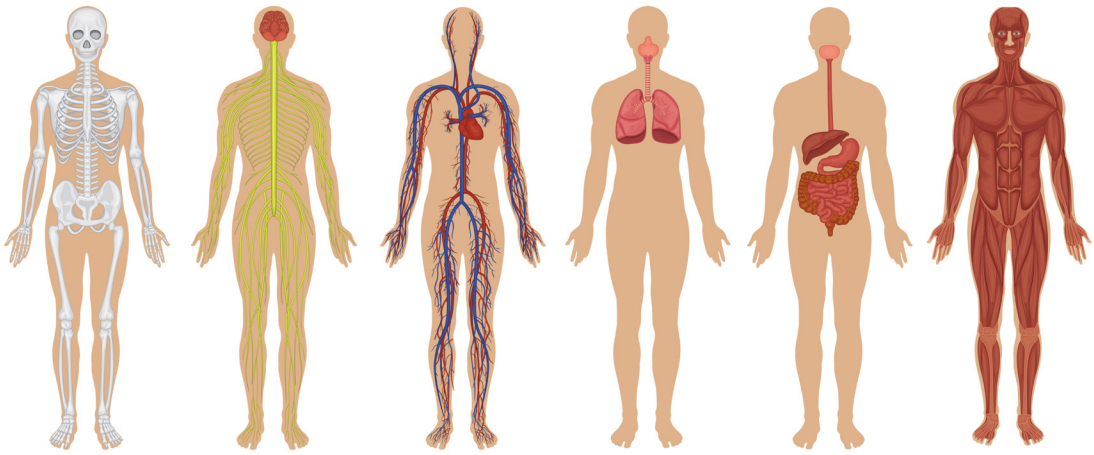
Completing this lesson has helped you to:

- describe the parts of the respiratory system
- describe the functions of the respiratory system

Once you have completed this part, move on to Lesson F.

Lesson F
Relationships and Interactions of the Systems

Introduction



You are an amazing multi-tasking machine. You can carry on, at any given moment, many different tasks. As you sit and read this, your heart is beating, your digestive track is breaking down your food, your eyes are blinking to protect them, and your muscles are keeping you upright and balanced and so on. These important activities are all necessary for a healthy body and are all related to our body systems and how they coordinate with one another. Cells of multicellular organisms must demonstrate teamwork and co-operation in order for us to function. Read on to learn how all the systems interact.

Systems Working Together!

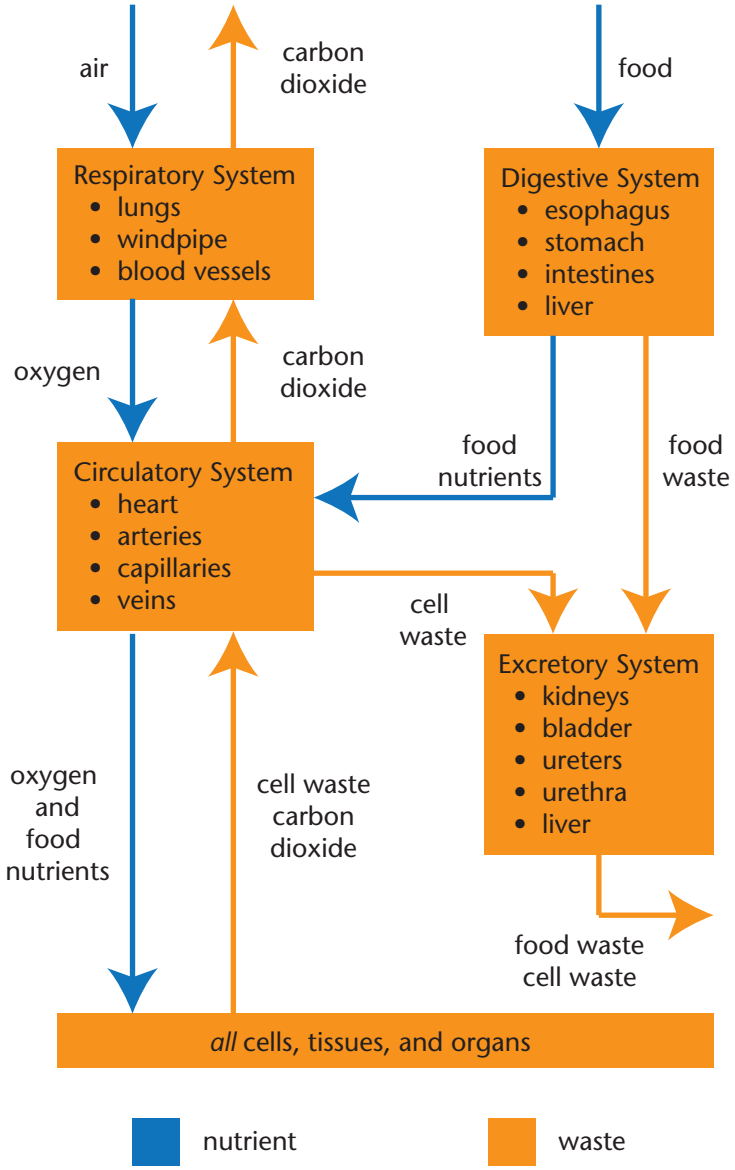
In the previous lessons, you've looked closely at the circulatory, respiratory, digestive, and excretory systems. These systems are summarized in the following table.

Body System	Major Organs Involved	Major System Functions
Circulatory System	heart, arteries, capillaries, veins	transports nutrients, gasses, and wastes through the body via the blood
Digestive System	esophagus, stomach, intestines, liver	breaks down food into nutrients that the body can use and removes solid waste
Excretory System	kidneys, bladder, ureters, urethra	eliminates waste from the body
Respiratory System	lungs, trachea, bronchi, blood vessels	brings air into the body and is responsible for gas exchange in the lungs

The body has many other systems including the ones listed below:

- The *immune system* defends the body against infections and diseases.
- The *skeletal system* contains bones, ligaments, and tendons and provides the body's support and structure.
- The *reproductive system* includes the organs that allow us to produce offspring.
- The *muscular system* works with the skeletal system to control the body's movements.
- The *nervous system* is the body's central control system—sending messages between the brain and body and reacting to the external environment.
- The *endocrine system* produces hormones that control many body functions.

These systems work closely together to ensure that your body is functioning effectively and efficiently. The diagram below shows how the four systems you studied in detail work together to supply the body's cells with nutrients and remove wastes.



You can see that the organ systems in your body are highly interconnected. For example, the respiratory system wouldn't function properly without help from the circulatory system. The respiratory system needs the circulatory system to transport oxygen through the body and to collect carbon dioxide waste from cells. In a similar way, the digestive system is dependent on the circulatory system to transport nutrients around the body. There are countless connections between the body's many systems. Can you think of others?

Summary

Completing this lesson has helped you to:

- describe how the body's systems work together

YOUR BODY'S SYSTEMS—APPENDIX

Activity Solutions

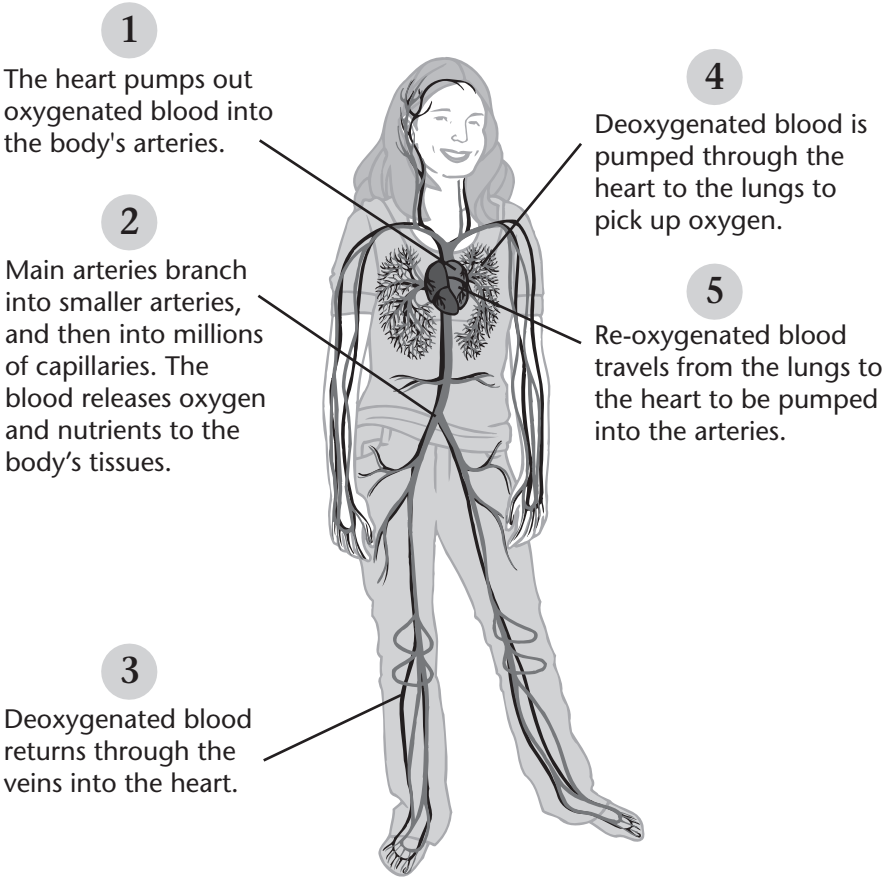
Lesson A: Levels of Organization in Organisms

Lesson A: Activity 1: Organization

Answers will vary.
Example: Dog > central nervous system > brain > nerve/nervous tissue > nerve cells

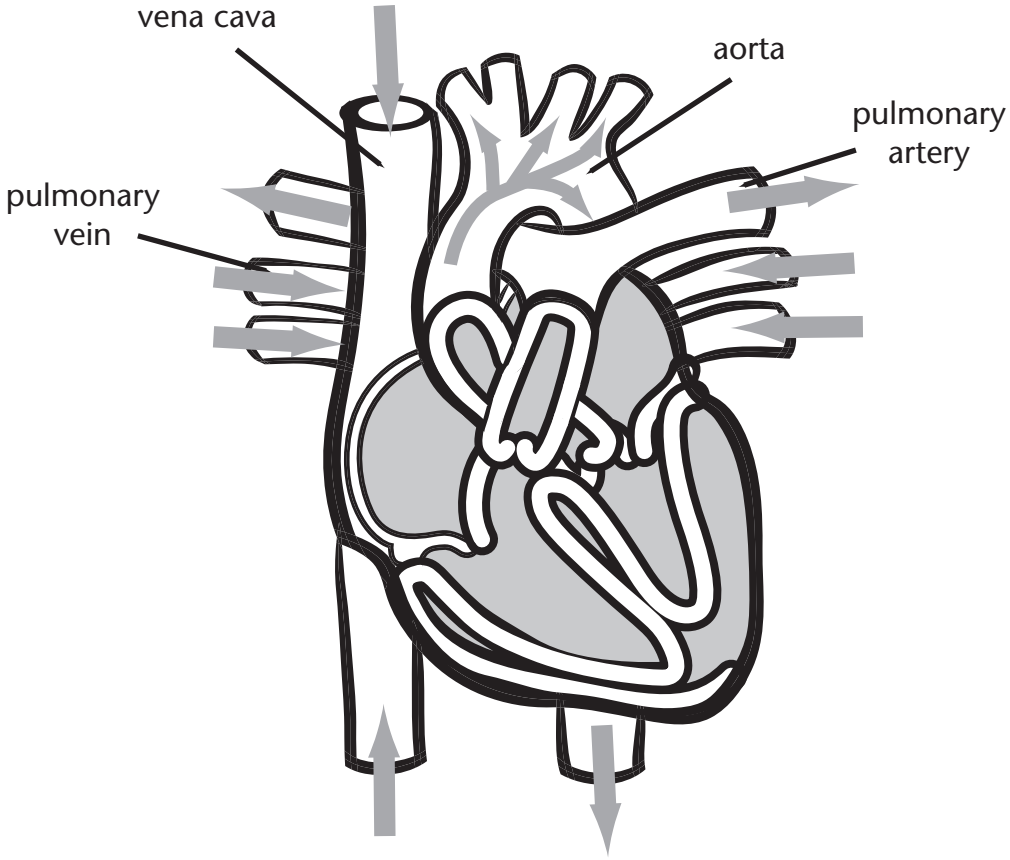
Lesson B: The Circulatory System

Lesson B: Activity 1: Circulation Sequence



Lesson B: Activity 2: The Heart

1 and 2. See diagram below:



3. The wall between the two sides of the heart keeps oxygenated and deoxygenated blood separate.

4. Valves prevent blood from flowing backwards.

Lesson C: The Digestive System

Lesson C: Activity 1: Digestion: The Journey

1. d

2. **Digestion** is the process by which the body breaks down food into simpler compounds called **nutrients**. The digestive system consists of a number of **organs** that are in turn made up of different types of tissues. Tissues are made of **cells**.

The body uses two methods to break down food: **mechanical action** and **chemical action**. Once the food has been broken down, the nutrients are absorbed into the **bloodstream** and the wastes are **eliminated**.

3. Mechanical breakdown of food uses physical action, e.g., chewing in the mouth and kneading in the stomach to break food into smaller pieces.

4. Chemical breakdown of food uses chemical reactions to turn large, complex food molecules into smaller, simpler molecules that can be absorbed into the cells.

5.

	Definition	Term
D	a narrow tube that moves food to the stomach	A. mucous lining in stomach
E	an acid secreted by the stomach that assists with the breakdown of protein	B. pepsin
I	mechanically break down food so we can swallow it	C. amylase
A	protects the stomach from acids and enzymes	D. esophagus
H	moistens and begins the chemical breakdown of food	E. hydrochloric acid
C	an enzyme that converts starch into sugar	F. stomach
F	involved in the mechanical and chemical breakdown and storage of food	G. epiglottis
G	closes the opening to the trachea when swallowing	H. saliva
B	an enzyme that breaks protein in amino acids	I. teeth

6.

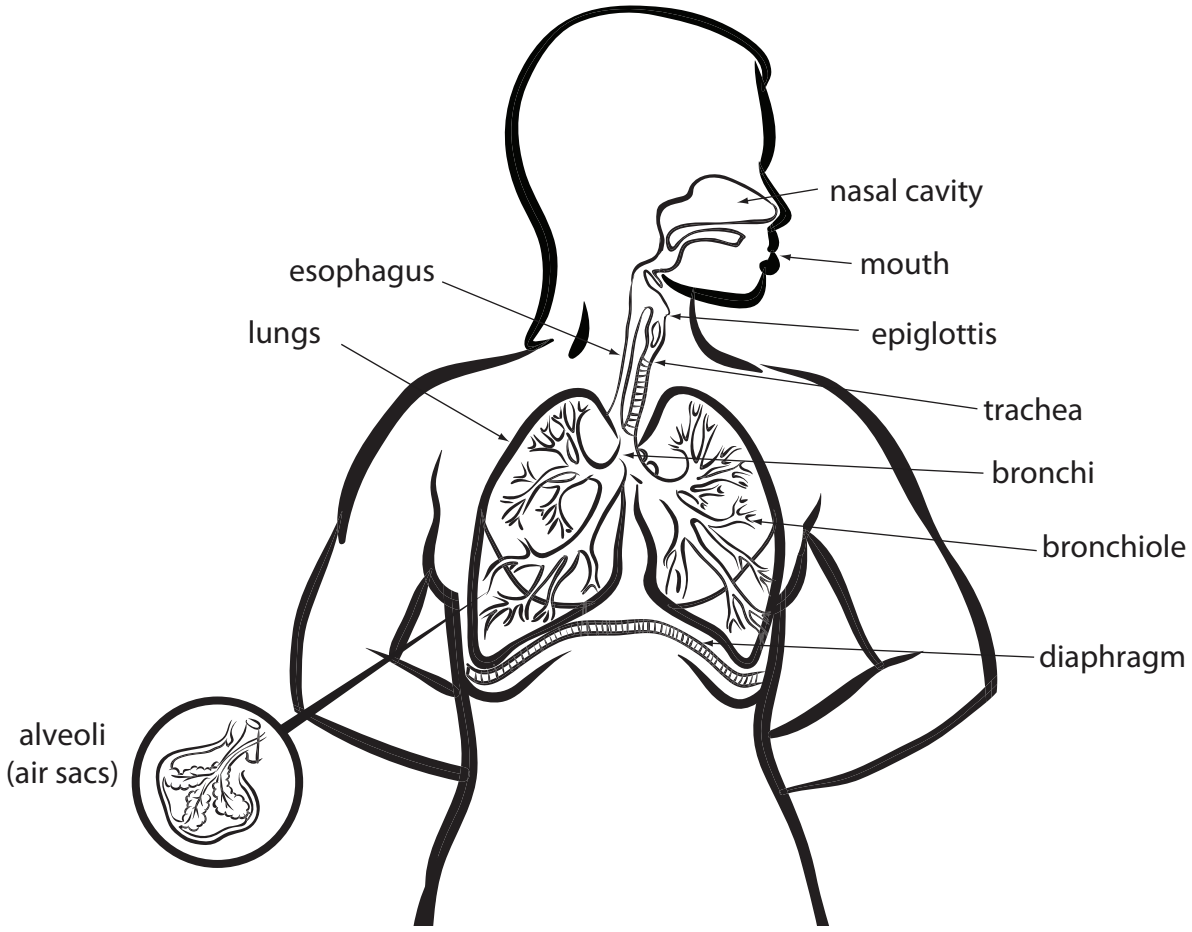
a. gall bladder
b. rectum
c. large intestine
d. liver

Lesson E: The Respiratory System

Lesson E: Activity 1: Diaphragm and Lungs

1. b
2. a
3. d
4. a
5. A thin layer of fluid between the lungs and the chest wall.

Lesson E: Activity 2: Parts of the Respiratory System



Glossary

alveoli
tiny air sacs involved in gas exchange between the blood and the air; the alveoli transfer respiratory gases (oxygen and carbon dioxide) to and from the blood

anus
a sphincter involved in the elimination of feces

arteries
blood vessels that carry oxygenated blood away from the heart

bile
a bitter green fluid that helps to break down fat globules

bladder
an organ that stores urine

blood
the liquid that circulates through the body delivering nutrients and removing waste materials; made up of plasma, red blood cells, white blood cells, and platelets

blood vessels
the network of arteries, veins, and capillaries that transport blood through the body

bronchi
bronchial tubes; two tubes that lead from the trachea to the lungs

bronchioles
tubes that lead from the two bronchi to the alveoli

capillaries
tiny blood vessels that connect arteries to veins by passing close to individual cells

cardiac sphincter
a ring of muscle located at the entrance to the stomach; keeps digested food (acid chyme) in the stomach

cartilage
a tissue that covers the ends of bones

cell
the basic unit of life

cellular respiration
the process by which chemical energy from food is converted into energy that the body's cells can use

chemical digestion
the breakdown of food molecules into simpler components by digestive enzymes; each chemical reaction is catalyzed by a specific enzyme protein

chyme
a liquid created in the stomach during digestion; composed of food particles and gastric juices

cilia
small hairs that line the trachea and bronchial tubes and act as filters

dialysis machine
used to purify blood for those whose kidneys do not function properly

diaphragm
a thin but strong muscular wall that separates your chest from your abdomen

digestion
the process that allows organisms to take in, break down, and absorb nutrients

digestive system
responsible for the breakdown of food into molecules small enough to pass into cells

enzyme
a protein that helps speed up chemical reactions, such as the break down of food

epiglottis
a small flap of skin that covers the entrance to the trachea during the swallowing of food; is open when breathing

esophagus
a tube that connects the throat to the stomach; moves the food bolus to the stomach by peristalsis

excretion
removal of wastes

feces
solid waste; consists of bacteria, fibre, and other indigestible solids as well as water

gall bladder
stores bile until it is needed

heart
a muscle about the size of your fist that is divided into four chambers and pumps blood throughout your body

kidney
removes waste from the blood; controls the amount of water and minerals in the blood

large intestine
connected to the small intestine at one end and the rectum at the other; this organ is a tube about 5 centimetres wide and 1.5 metres long; it absorbs water, minerals, and vitamins, and produces feces

larynx
acts as a passageway for air between the pharynx and trachea; contains the vocal cords

levels of organization
the arrangement of structures from simple to complex

liver
an organ located above the stomach; has many important functions, one of which is to store and break down fats

lungs
a major organ that contains many tiny air sacs (alveoli) through which gases are exchanged between the air and the blood; consists of two lobes

mechanical digestion
the mechanical processes that break down food into smaller particles; increases the surface area of food particles and the effectiveness of enzymes that chemically digest food molecules; the main sites of mechanical digestion are the mouth and stomach

mouth
responsible for the mechanical and chemical digestion of food; food is mixed with saliva in the mouth forming a food ball or bolus

nephron
a small tubule that filters wastes from the blood

organ
a group of tissues that work together to perform a specific function

organ system
an organ or organs and other body structures that work together to perform a specific function

pancreas
produces and secretes insulin and various enzymes

peristalsis
a series of wave-like contractions of the esophagus to move food

pharynx
a common passage for the food bolus to the esophagus and air to the trachea; swallowing is the process that occurs in the pharynx

platelet
a specialized cell found in blood; responsible for clotting

pulse
the rhythmic beat that can be felt in the arteries, created by the beating of the heart

pyloric sphincter
releases small quantities of chyme into the small intestine at regular intervals

rectum
a storage area for feces

red blood cell
a specialized cell found in blood; responsible for carrying oxygen from the lungs to the body's cells and carbon dioxide from the body's cells to the lungs

saliva
moistens and begins the chemical breakdown of food

salivary glands
produce saliva

small intestine
connected to the stomach at one end and the large intestine at the other; this organ is a tube about 2.5 centimetres in wide and about 6 metres long; it breaks down nutrients into useable molecules

soluble
a substance that dissolves in water

stomach
a muscular organ that mechanically and chemically digests food

teeth
cut and crush food increasing surface area and mixing with saliva

thoracic cavity
inside of the chest; sometimes referred to as the thorax

tissue
a group of cells with the same structure and function that work together

tongue
involved in taste; moves, mixes, and positions food for chewing and swallowing

trachea
a windpipe that leads from the larynx, or voice box, to the lungs

ureter
carries waste from the kidney to the bladder

urethra
a tube leading from the bladder to the outside of the body

urine
filtered wastes and water from the kidneys that is excreted from the body

veins
blood vessels that carry deoxygenated blood to the heart

villi
tiny folds in the inside wall of the small intestine which increase the surface area available for absorption of nutrients

white blood cell
a specialized cell found in blood; responsible for fighting infections