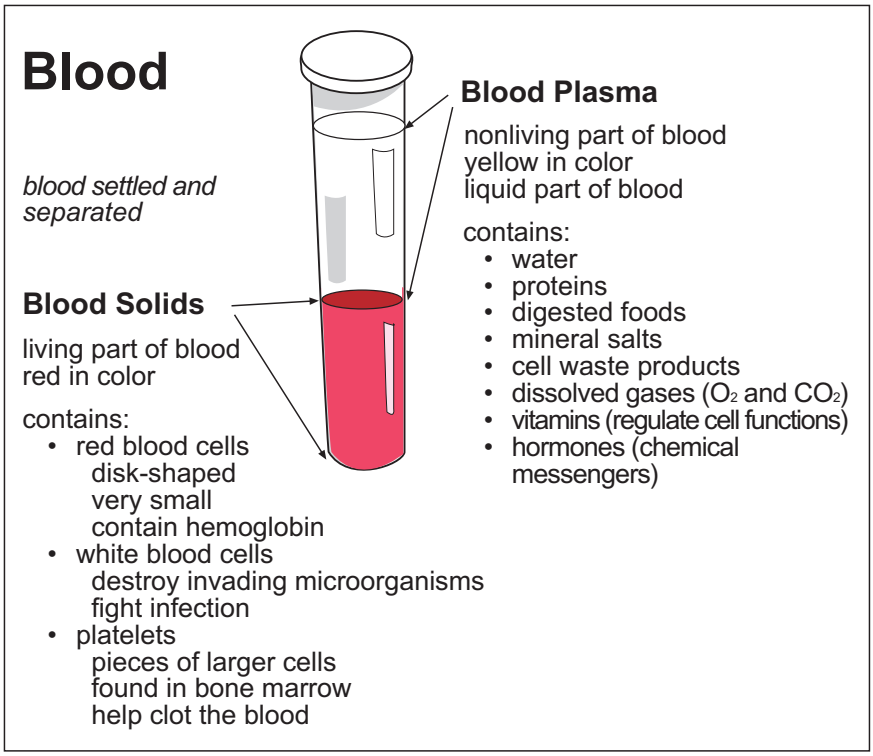
The Structure of Blood

We tend to think of blood as liquid, but in fact blood is made up of a liquid part and a solid part. The liquid part of the blood, called **plasma**, makes up about 55 percent of the total volume. The solid part, blood solids, makes up about 45 percent of the total volume.

Plasma is 90 percent water. Otherwise, it contains the substances listed on the chart below. Proteins in plasma give blood the ability to clot and form scabs, which are necessary to stop bleeding. Proteins also give blood the ability to regulate the amount of fluid contained in cells and the ability to recognize and fight disease. Digested foods float around in the plasma in the form of glucose and fats. Wastes (such as *urea*, which ultimately exits the body in the form of *urine*) are also found in the blood.



Blood solids fall into three categories. **Red blood cells** are disk-shaped and very small. They contain the protein **hemoglobin**, which combines easily with oxygen and carbon dioxide. This is what makes *red blood cells* such good pickup and delivery trucks for these gases throughout the body

and in the lungs. **White blood cells** are larger than red blood cells. Their most important function is to surround and destroy microorganisms that invade the body. Thus, when there is an infection in the body, the number of *white blood cells* increases to fight it off. **Platelets** are not really whole cells. They're pieces of larger cells formed in the bone marrow. They have no nuclei and are even smaller than red blood cells. *Platelets* work with proteins in the plasma to clot the blood.

Practice

Use the list below to complete the following statements.

bronchi	**carbon dioxide**	**epiglottis**	**oxygen**
capillaries	**diaphragm**	**larynx**	

1. As you know, human beings must breathe _____ to survive.

2. The windpipe descends from the back of the throat and is protected by a little flap of tissue called the _____ .

3. The vocal cords of the _____ vibrate with passing air to make sound.

4. The windpipe divides into two branches which are called _____ , one leads to the right lung and one leads to the left lung.

5. The bronchi branch into millions of smaller tubes, each of which leads to a small air sac which is surrounded by tiny blood vessels called _____ through which the blood passes.

6. By breathing, we draw air containing oxygen into our lungs and push air containing _____ out.

7. As we take in a breath, the muscles of the ribs contract, pulling the ribs up and out. Then the _____ , the dome-shaped muscle at the base of the chest cavity, contracts and lowers.

Practice

Match the following definitions or **descriptions** *with the correct term. Write the letter on the line provided.*

_____ 1. tiny blood vessels where pickup of wastes and delivery of oxygen and food takes place; connect arteries to veins

_____ 2. the protein that colors red blood cells and allows them to carry oxygen to the tissues

_____ 3. blood vessels that contain blood traveling away from the heart

_____ 4. blood vessels that contain blood traveling back to the heart

_____ 5. cells that surround and destroy microorganisms that invade the body; larger than red blood cells

_____ 6. picked up by the red blood cells in the lungs

_____ 7. picked up by the blood cells from body cells

A. arteries

B. capillaries

C. hemoglobin

D. oxygen

E. veins

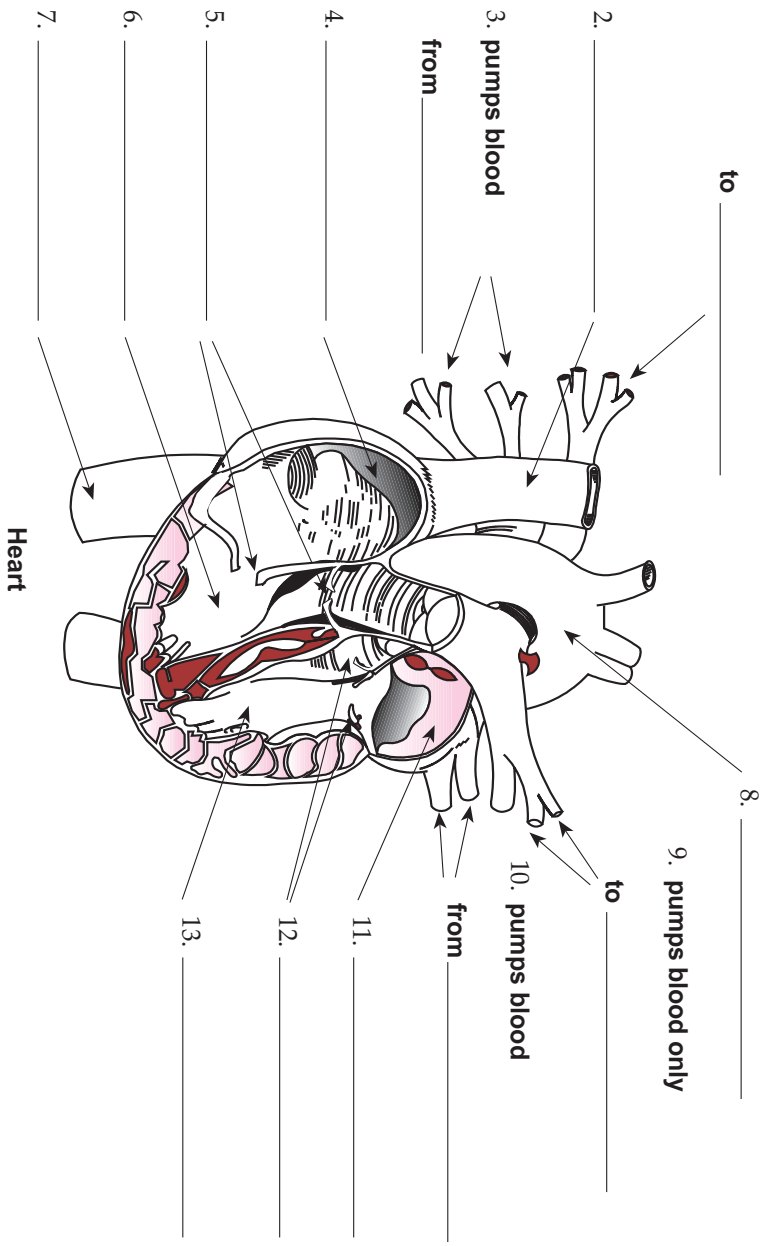
F. wastes

G. white blood cells

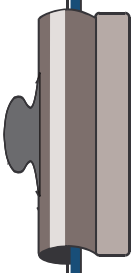
Practice

Use the list below to label the **diagram of the heart**. *Use a* **red pencil to show oxygen-rich blood** *and a* **blue pencil to show oxygen-poor blood**. **One or more terms will be used more than once.**

aorta	**left atrium**	**right atrium**	**valves**
lungs	**left ventricle**	**right ventricle**	**vein**



Lab Activity 2: Pulse Rates



Fact:

- Every time your ventricles contract, blood is forced suddenly out of your heart and into your arteries. This sudden force makes your arteries jump. This movement of your arteries is called a pulse.

pulse rate = heartbeat

Your heartbeat depends on several things like age, activity, fear, and excitement.

The heart of a rested adult beats 70 to 80 times a minute. A young person's heart beats slightly faster.

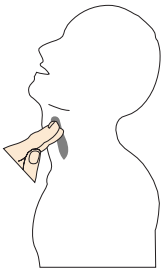
Investigate:

- You will determine your own pulse rate. You will compare your rested pulse rate and pulse rate after exercise.

Materials:

- watch

You can feel a pulse on an artery that is near the skin. Most pulses are taken on the wrist. But you can also take the pulse on the neck. Use your fingers, not your thumb.



1. Take your pulse while you are sitting. Count the number of beats in 15 seconds and multiply by 4 to get the number of pulse beats in one minute. Fill in the Pulse Rate Data Table on the following page.

2. Repeat number 1 two more times.

3. Average all three trials from the Pulse Rate Data Table and record below.

4. Exercise by running in place one minute. Count the number of pulse beats as you did in number 1. Fill in below.

5. Repeat number 4 two more times.

6. Average all three trials from the Pulse Rate Data Table and record below.

Pulse Rate Data Table		
	At Rest	After Exercise
Trial 1		
Trial 2		
Trial 3		
Average		

7. What was your average pulse rate while you were sitting?

   _____

8. What was your average pulse rate after you jogged in place for one minute? _____

9. How does exercise affect the pulse rate? _____

   _____

   _____

   _____

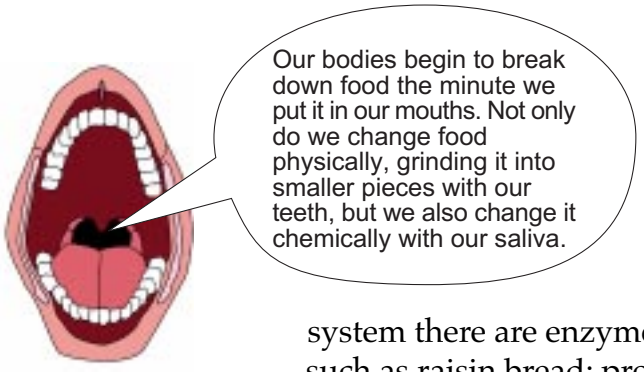
Digestive System

Oxygen and food are the two main things body cells need to carry out their many varied missions, whether they're muscle cells contracting to move bones or white blood cells fighting off invading microorganisms or any other type of cell. We've seen how the respiratory system provides oxygen to cells. But how is raisin bread, beans, or a chocolate bar processed into the tiny molecules that cells need to burn for energy? And how do these molecules reach cells all over the body?

These are the jobs of the digestive system: breaking down food into a form cells can use and aiding or getting this refined food to the cells.

Physical and Chemical Changes That Break Down Food

Our bodies begin to break down food the minute we put it in our mouths. Not only do we change food physically, grinding it into smaller pieces with our teeth, but we also change it chemically with our **saliva**. *Saliva*, a fluid released from glands in the mouth, soaks into the food and helps turn it into a paste. If the food is a carbohydrate, such as raisin bread, saliva begins to change the chemical makeup of the bread with an enzyme. **Enzymes** are proteins that speed up the breakdown of food into molecules. *Enzymes* are very specific to the type of food they affect. In the human digestive system there are enzymes specific to carbohydrates, such as raisin bread; proteins, such as beans or fat.

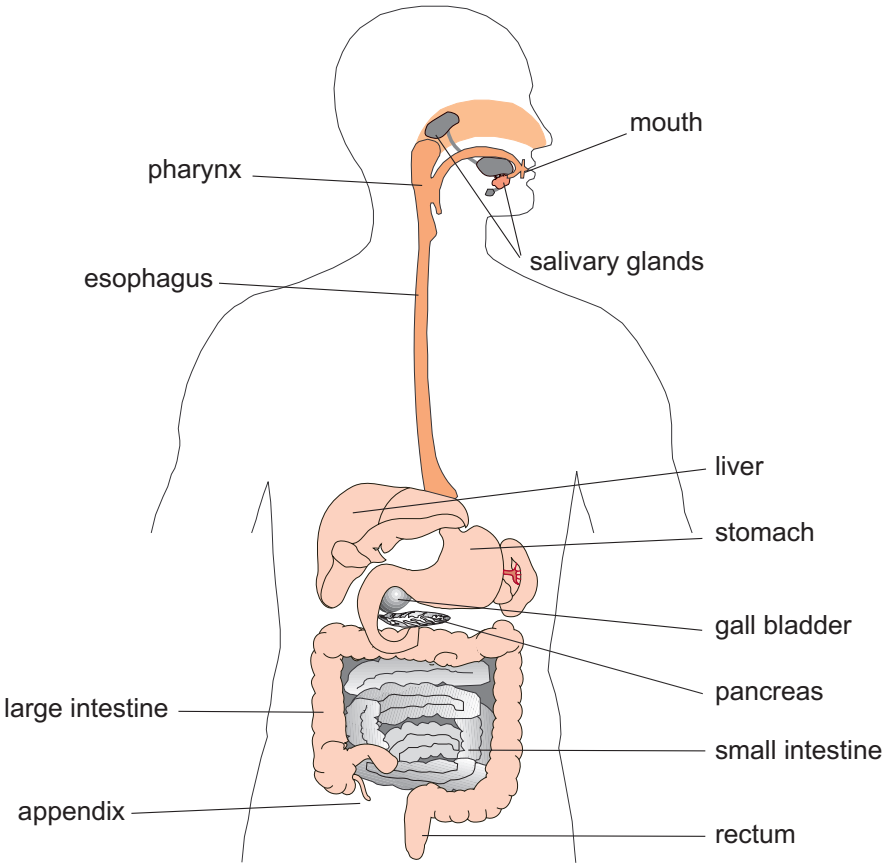


When we swallow, muscles in the throat push the bite of food into the **esophagus**. This is the tube that carries food to the stomach. The *esophagus* also has muscles that push the food down toward the stomach.

The stomach is a muscular bag that holds and works on food for about four hours. Cells inside the stomach make chemicals which include hydrochloric acid and enzymes. After the stomach is finished with the food, it pushes it into the small intestine.

The stomach is a muscular bag that holds and works on food for about four hours.

The small intestine is a tube-shaped organ that's about seven meters long. This is where most of the food processing known as *digestion* occurs. Enzymes from the liver and pancreas work with enzymes produced by the small intestine to break down foods from all three food groups—carbohydrates, proteins, and fat. **Bile**, a substance produced in the liver and stored in the gall bladder, works specifically on fat. The small intestine may handle food for as long as 10 hours before the remnants of what's left pass through.



digestive system

The large intestine is a larger tube whose main job is to remove water from the undigested remains of the food that entered the mouth. By this point, all of the usable nutrients in the food have been removed. Undigested food and wastes pass from the large intestine out of the body through the rectum.

How the Body Absorbs Food

The small intestine breaks food down into molecules that cells can use. But how do these molecules get from the small intestine to the cells?

seven meters worth of small intestine

Food molecules are absorbed through the very thin lining of the small intestine into blood passing through underlying capillaries. From there the blood travels to the liver for filtering before it circulates throughout the body. But even seven meters worth of small intestine would not provide enough space to absorb all of the available food molecules if the lining of the intestine were not constructed in a way that maximizes absorption area. The inside of the small intestine is not smooth. It is puckered up into millions of fingerlike knobs called *villi*. This puckering or knobby wrinkling of the small intestine lining increases the amount of area with which food comes into contact.

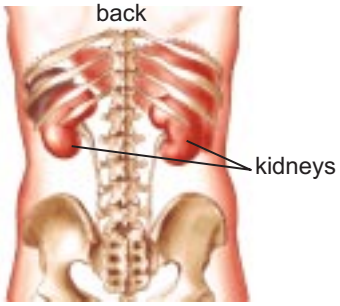
Excretory System

The excretory system is the body's garbage service. Through the excretory organs, the human body gets rid of waste products that could slow down and even poison its other systems. One of these waste products is **urea**, a substance that is made up of leftover parts of used proteins and is high in nitrogen. Another waste product is carbon dioxide.

Though we think of lungs as part of the respiratory system, they're an excretory organ in that they remove carbon dioxide from the body. The skin also excretes some *urea* with water and salt when we perspire, although the main purpose of perspiration is to cool the body.

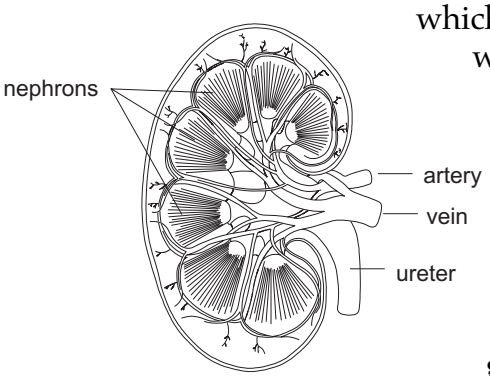
Kidneys—The Major Excretory Organs

The kidneys are the major excretory organs. They are found on either side of the spine in the small of the back, looking like a pair of giant kidney beans.



The kidneys are found on either side of the spine in the small of the back.

Each kidney is made up of many tiny filtering units called **nephrons**. Each *nephron* is made up of a cuplike structure mounted on a tube that leads out of the kidney. The cup holds a tightly coiled capillary. Pressure inside this capillary is very high because the heart pumps blood directly into the arteries that lead to the kidney. Because of this pressure, everything is forced out of the blood except the blood cells. This includes water, mineral salts, food, and urea—much of which the blood needs to keep. But not to worry: all of these things run down into the nephron tube, which the capillary wraps around. The capillary reabsorbs the food as well as the proper amounts of water and mineral salts. The urea and everything else continues down the nephron tube. Eventually they leave the kidney, are gathered in the bladder as **urine**, and leave the body through the **urethra**.



Kidney

Summary

The human body depends on many biological systems to function and survive. All of these systems interact and overlap with one another.

Major organs include the brain, heart, lungs, liver, stomach, intestines, and kidneys. All of these organs play central roles in the systems that run the human body.

The skeleton provides a framework for the body and also accomplishes other important jobs. The muscles move the bones of the skeleton and contribute to the make up and function of most major organs.

The respiratory system provides a place for blood to take up oxygen and give off carbon dioxide: the lungs. The circulatory system allows blood to deliver oxygen and food molecules to body cells and to pick up waste products. The heart pushes blood through the body so that it can accomplish these tasks.

The digestive system breaks down food into molecules that cells can use. The liver and pancreas contribute enzymes to this process. The small intestine is the place where the blood absorbs these molecules.

The excretory system is the human body's garbage service. The kidneys are the main excretory organs. They remove waste products from the blood and regulate the amount of water and mineral salts that blood contains.

Practice

Use the list below to write the correct term for each definition on the line provided.

bile	**nephrons**	**urethra**
enzymes	**saliva**	**urine**
esophagus	**urea**	

_____ 1. the tube that carries food to the stomach

_____ 2. a waste product that is made up of leftover parts of used proteins and is high in nitrogen

_____ 3. a fluid released from glands in the mouth that soaks into food and helps in chewing, swallowing, and digesting

_____ 4. a substance produced in the liver and stored in the gall bladder that works specifically to dissolve fat in the small intestine

_____ 5. the passageway out of the body for urine

_____ 6. urea and other waste substances that are collected in the bladder

_____ 7. tiny filtering units in the kidneys

_____ 8. proteins that speed up the breakdown of food into molecules in the digestive system

Practice

Complete the following outline.

A. Skeletal system

1. Functions of the skeleton
   a. _____
   b. _____
   c. Makes blood cells
   d. Stores calcium
2. Bone structure
   a. _____ —soft, flexible substance
   b. _____ —holds bones together
   c. Periosteum—covers outside of bone

B. Muscular system

1. Two types of muscles
   a. Voluntary—*examples:* _____ and _____
   b. _____ —heart, stomach, and intestines

2. Three kinds of muscle

   a. Skeletal
   b. _____ —*examples:* stomach and intestines

   c. Cardiac

3. How muscles work

   a. Move by _____

   b. Move the _____ which are attached by _____

C. Respiratory system

1. Function: _____

   _____

2. Parts of the system:

   a. _____ —filters and warms the air

   b. Windpipe covered by the _____

   c. Voice box or _____

   d. _____ or branches of the windpipe

   e. Red blood cells—pick up _____ and give up carbon dioxide

   f. _____ —a large muscle that helps us breathe

D. Circulatory system

1. Power supply: _____

2. Function of red blood cells

   a. Pick up wastes; take to kidneys

   b. Pick up food energy to deliver to _____

3. Three types of blood vessels

   a. _____ —lead away from the heart

   b. _____ —where pickup and delivery takes place

   c. _____ —take blood back to the heart

4. The heart—a two-sided pump

   a. Structure

      (1) _____ —top chamber

      (2) Ventricle— _____ chamber

   b. Function

      (1) Right side—pumps blood to the _____

      (2) _____ side—receives blood from the lungs and sends it out to the _____

5. Blood

   a. Liquid part— _____

   b. Solids

      (1) Red blood cells contain _____

      (2) _____ help fight off infection

      (3) _____ help clot the blood

E. Digestive system

1. Jobs of the system

   a. _____

   b. Getting the food to the cells

2. Breakdown of food

   a. Mouth—teeth and _____ (enzymes)

   b. Esophagus—carries food to the _____

   c. Stomach chemicals: _____ and _____

d. Small intestine

(1) Structure

(a) Length: _____ meters

(b) Lining composed of _____

to increase absorption area

(2) Description

(a) Uses enzymes from the liver,

_____ , and small intestine

(b) Process time: _____ hours

e. _____ intestine—sends

undigested food out of the body

F. Excretory system

1. Function: _____
2. Waste products— _____

and _____

3. _____ —central organs located in

the small of the back on either side of the spine

4. Nephrons filter _____ from the

blood

5. Urea goes to the bladder as urine, leaves the body

through the _____

Practice

Use the list above each section to complete the statements in that section.

206	**cardiac**	**ligaments**	**skeleton**	**tendons**
arteries	**diaphragm**	**muscles**	**smooth**	**veins**
capillaries	**involuntary**	**skeletal**		

1. The circulatory system is made up of the heart plus all of the _____ , _____ , and _____ .

2. The human skeleton has _____ bones in all.

3. Our _____ is the framework for our body.

4. Our _____ are attached to our skeleton.

5. _____ help hold our bones together.

6. _____ muscles run the heart, stomach, and intestines.

7. The three kinds of muscle are _____ , _____ , and _____ .

8. Muscles are attached to the bones by strong fibers called _____ .

9. When we breathe, a large muscle called the _____ helps us draw oxygen into our lungs.

One term will be used more than once.

atria	**excretory**	**lungs**	**saliva**
bile	**four**	**mouth**	**ventricles**
digestive	**kidneys**	**plasma**	

10. The _____ filter our blood.

11. The right side of the heart pumps blood only to the _____ .

12. The human heart has _____ chambers.

13. The top chambers of the heart are each called the _____ .

14. The bottom chambers of the heart are each called the _____ .

15. The liquid part of the blood is called _____ .

16. The _____ system breaks down food for the body's cells.

17. Digestion begins in the _____ with the teeth and _____ .

18. The liver produces _____ , which acts on fat.

19. The _____ system is the body's garbage service.

20. The _____ are the main excretory organs.