# Organs of the body

## The Heart

Did you give your friends valentines and little heart-shaped candies on Valentine's Day? Do you ever cross your heart when making a promise that you really, really mean? Or turn on the radio to hear a guy singing about his broken heart?

We see and hear about hearts everywhere. A long time ago, people even thought that their emotions came from their hearts, maybe because the heart beats faster when a person is scared or excited. Now we know that emotions come from the brain, and in this case, the brain tells the heart to speed up. So what's the heart up to, then? How does it keep busy? What does it look like? Let's find out……

**Working That Muscle**

Your heart is really a muscle. It's located a little to the left of the middle of your chest, and it's about the size of your fist. There are lots of muscles all over your body, in your arms, in your legs, in your back, even in your behind.

But the heart muscle is special because of what it does. The heart sends blood around your body. The blood provides your body with the oxygen and nutrients it needs. It also carries away waste.

Your heart is sort of like a pump, or two pumps in one. The right side of your heart receives blood from the body and pumps it to the lungs. The left side of the heart does the exact opposite: It receives blood from the lungs and pumps it out to the body.

**We Got the Beat**

How does the heart beat? Before each beat, your heart fills with blood. Then its muscle contracts to squirt the blood along. When the heart contracts, it squeezes, try squeezing your hand into a fist. That's sort of like what your heart does so it can squirt out the blood. Your heart does this all day and all night, all the time. The heart is one hard worker!

**Heart Parts**

The heart is made up of four different blood-filled areas, and each of these areas is called a chamber. There are two chambers on each side of the heart. One chamber is on the top and one chamber is on the bottom. The two chambers on top are called the atria (say: ay-tree-uh). If you're talking only about one, call it an atrium. The atria are the chambers that



fill with the blood returning to the heart from the body and lungs. The heart has a left atrium and a right atrium.

The two chambers on the bottom are called the ventricles (say: ven-trih-kulz). The heart has a left ventricle and a right ventricle. Their job is to squirt out the blood to the body and lungs. Running down the middle of the heart is a thick wall of muscle called the septum (say: sep-tum). The septum's job is to separate the left side and the right side of the heart.

The atria and ventricles work as a team, the atria fill with blood, then dump it into the ventricles. The ventricles then squeeze, pumping blood out of the heart. While the ventricles are squeezing, the atria refill and get ready for the next contraction. So when the blood gets pumped, how does it know which way to go?

Well, your blood relies on four special valves inside the heart. A valve lets something in and keeps it there by closing, think of walking through a door. The door shuts behind you and keeps you from going backward.

Two of the heart valves are the mitral (say: my-trul) valve and the tricuspid (say: try-kus-pid) valve. They let blood flow from the atria to the ventricles. The other two are called the aortic (say: ay-or-tik) valve and pulmonary (say: pul-muh-ner-ee) valve, and they're in charge of controlling the flow as the blood leaves the heart. These valves all work to keep the blood flowing forward. They open up to let the blood move ahead, then they close quickly to keep the blood from flowing backward.

**It's Great to Circulate**

You probably guessed that the blood just doesn't slosh around your body once it leaves the heart. It moves through many tubes called arteries and veins, which together are called blood vessels. These blood vessels are attached to the heart. The blood vessels that carry blood away from the heart are called arteries. The ones that carry blood back to the heart are called veins.

The movement of the blood through the heart and around the body is called circulation (say: sur-kyoo-lay-shun), and your heart is really good at it, it takes less than 60 seconds to pump blood to every cell in your body.

Your body needs this steady supply of blood to keep it working right. Blood delivers oxygen to all the body's cells. To stay alive, a person needs healthy, living cells. Without oxygen, these cells would die. If that oxygen-rich blood doesn't circulate as it should, a person could die.

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The left side of your heart sends that oxygen-rich blood out to the body. The body takes the oxygen out of the blood and uses it in your body's cells. When the cells use the oxygen, they make carbon dioxide and other stuff that gets carried away by the blood. It's like the blood delivers lunch to the cells and then has to pick up the trash!

The returning blood enters the right side of the heart. The right ventricle pumps the blood to the lungs for a little freshening up. In the lungs, carbon dioxide is removed from the blood and sent out of the body when we exhale. What's next? An inhale, of course, and a fresh breath of oxygen that can enter the blood to start the process again. And remember, it all happens in about a minute!

**Listen to the Lub-Dub**

When you go for a checkup, your doctor uses a stethoscope to listen carefully to your heart. A healthy heart makes a lub-dub sound with each beat. This sound comes from the valves shutting on the blood inside the heart.

The first sound (the lub) happens when the mitral and tricuspid valves close. The next sound (the dub) happens when the aortic and pulmonary valves close after the blood has been squeezed out of the heart. Next time you go to the doctor, ask if you can listen to the lub-dub, too.

**Pretty Cool — It's My Pulse!**

Even though your heart is inside you, there is a cool way to know it's working from the outside. It's your pulse. You can find your pulse by lightly pressing on the skin anywhere there's a large artery running just beneath your skin. Two good places to find it are on the side of your neck and the inside of your wrist, just below the thumb.

You'll know that you've found your pulse when you can feel a small beat under your skin. Each beat is caused by the contraction (squeezing) of your heart. If you want to find out what your heart rate is, use a watch with a second hand and count how many beats you feel in 1 minute. When you are resting, you will probably feel between 70 and 100 beats per minute.

When you run around a lot, your body needs a lot more oxygen-filled blood. Your heart pumps faster to supply the oxygen-filled blood that your body needs. You may even feel your heart pounding in your chest. Try running in place or jumping rope for a few minutes and taking your pulse again, now how many beats do you count in 1 minute?

**Keep Your Heart Happy**

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Most kids are born with a healthy heart and it's important to keep yours in good shape. Here are some things that you can do to help keep your heart happy:

- Remember that your heart is a muscle. If you want it to be strong, you need to exercise it. How do you do it? By being active in a way that gets you huffing and puffing, like jumping rope, dancing, or playing basketball. Try to be active every day for at least 30 minutes! An hour would be even better for your heart!
- Eat a variety of healthy foods and avoid foods high in unhealthy fats, such as saturated fats and trans fats (reading the labels on foods can help you figure out if your favorite snacks contain these unhealthy ingredients).
- Try to eat at least five servings of fruits and vegetables each day.
- Avoid sugary soft drinks and fruit drinks.
- Don't smoke. It can damage the heart and blood vessels.

So now you know that your heart doesn't look like a valentine, but it sure deserves to be loved for all the work it does. It started pumping blood before you were born and will continue pumping throughout your whole life.

## The Lungs

The lung is a magnificent organ that performs a multitude of vital functions every second of our lives. Breathing is the most essential of these functions. With each breath, the lungs take in oxygen and remove carbon dioxide.

The air (oxygen) we breathe enters the lungs via the main windpipe (trachea), which branches into two main tubes supplying the right and left lung, respectively. These tubes progressively branch 22 additional times to form more than 100,000 smaller tubes (bronchi, bronchioles) and more than 300 million air sacs (alveoli), which are only about 0.3 mm in diameter.

Thus, the surface area of the lungs is huge, larger than the surface of a person's skin. In fact, if all the airways and air sacs of a person's lungs were laid flat on the ground, they would cover more than 100 square yards, which is larger than the size of a tennis court. Because the walls of these air sacs are 1/50th the thickness of tissue paper and are bathed with millions of tiny blood vessels called capillaries, there is an easy and efficient exchange of oxygen and carbon dioxide between the body and the environment.

The lungs are also important in the body's defense against infection and other harmful environmental factors. While the nose is the first line of defense against inhaled harmful materials, the lungs provide the second line of defense. Inhaled particles (smoke,



pollution) or infectious agents (bacteria, viruses) pass through the mouth or nose and lodge in the lungs.

Mucus, a sticky fluid produced in the lungs, can trap these inhaled agents and aid the lungs' protective white blood cells (macrophages, neutrophils) in the engulfment and destruction of bacteria and other harmful materials. Coughing is the best way to clear mucus and other materials from the lungs; however, the larger airways have tiny hair like cells called cilia that aid in this process. The cilia beat with a rhythm fast enough, and a force sufficient enough, to propel mucus and cells up the airways to be coughed out or swallowed. When a person smokes, the cilia are inactivated or destroyed, allowing thick mucus to accumulate and compromise lung defense.

## Stomach

When you eat, food from your mouth goes down a tube called the esophagus and into your stomach, where it is stored temporarily, then later digested. As the food arrives, the stomach wall starts its glands working. One type of gland gives off a mucus that lubricates the food. Other glands give off acids which kill any bacteria in the food; while still others give off special chemicals, called enzymes, to break down the food into tiny particles.

The stomach's strong muscles break down all this food and all these chemicals into a liquid. This breaking down is done in peristaltic waves, wavy movements by the muscles. These waves work on a regular schedule every two seconds. The waves then squeeze that liquid toward the other end your stomach by contractions of the stomach muscles. A special ring-like muscle guards that bottom opening, first allowing only the liquid to pass through, then allowing some of the pulpy food to enter your small intestines, where digestion continues.

Because the stomach is a muscular organ, it can change its shape depending on the amount of food in it. However, it has been found that tall, thin people usually have long, narrow stomachs, while short, stocky people have short, wide stomachs. Regardless of the shape, most adults' stomachs hold about one **quart** of liquid and food.

Although the stomach is a useful organ, people can, and have lived without a stomach if it has been removed because of disease!

### Intestine

The intestine is the portion of the digestive tract between the stomach and the anus. It is divided into two major sections: small intestine and large intestine.

The small intestine is about 6 meters (20 feet) long. It is coiled in the center of the abdominal cavity (see picture). The small intestine is divided into 3 sections: upper, jejunum, and ileum. The lining of the small intestine secretes a hormone called secretin, which stimulates the pancreas to produce digestive enzymes.

The large intestine has a larger width but is only 1.5 meters (5 feet) long. The large intestine is divided into 6 parts: cecum, ascending colon, transverse colon, descending colon, sigmoid colon, and rectum.

**Major function of Intestines**

The small and large intestines perform different functions. The small intestine is where the most extensive part of digestion occurs. Most food products are absorbed in the small intestine. The large intestine is responsible for absorption of water and excretion of solid waste material. Food and waste material are moved along the length of the intestine by rhythmic contractions of intestinal muscles; these contractions are called peristaltic movements. Waste is solid because most of the water has been removed by the intestines as it travels through them.

## Liver

If you place your right hand over the area under the ribs on the right side of your body it will just about cover the area of your liver. The liver is the largest gland, and the largest solid organ in the body, weighing some 1.8 kgs in men and 1.3 kgs in women. It holds approximately 13% (about one pint or 0.57 litres) of your total blood supply at any given moment and is estimated to have over 500 functions.

The liver is dark reddish brown in colour and is divided into two main lobes (the much larger right and the smaller left) which are further subdivided into approximately 100,000 small lobes, or lobules. About 60% of the liver is made up of liver cells called hepatocytes which absorb nutrients and detoxify and remove harmful substances from the blood. A hepatocyte has an average lifespan of 150 days. There are approximately 202,000 in every milligram of your liver tissue. Two-thirds of the body of your liver is the parenchyma, which contains the hepatocytes, and the remainder is the biliary tract. It receives its blood supply via the hepatic artery and portal vein (which transports nutrients from your intestine, or gut).

A brief summary of the liver's functions follows, but remember there are more than 500 functions:

- processing digested food from the intestine



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- controlling levels of fats, amino acids and glucose in the blood
- combating infections in the body
- clearing the blood of particles and infections including bacteria
- neutralising and destroying drugs and toxins
- manufacturing bile
- storing iron, vitamins and other essential chemicals
- breaking down food and turning it into energy
- manufacturing, breaking down and regulating numerous hormones including sex hormones
- making enzymes and proteins which are responsible for most chemical reactions in the body, for example those involved in blood clotting and repair of damaged tissues.

Some of the most important functions include:

**Producing quick energy**

One of your liver's most important functions is to break down food and convert it into energy when you need it. Carbohydrates such as bread and potatoes from our diet are broken down to glucose and stored mainly in the liver and muscles as glycogen. When energy is required in an emergency the liver rapidly converts its store of glycogen back into glucose ready for the body to use.

You need food to power your body, giving it energy and the material it needs to grow and repair itself. When you eat food it is broken down in your stomach and intestine (gut) and three main nutrients are extracted:

- carbohydrates
- fat
- protein

These nutrients are then absorbed into the bloodstream and carried to your liver. Here they are either stored or changed in such a way that your body can use them at once. At the same time your liver is also working to stop poisons and toxins from harming the body. If you have a liver problem then your liver may not be able to do these jobs as efficiently as it should.

Your liver also helps the body to get rid of waste products. Waste products which are not excreted by your kidneys are removed from the blood by the liver. Some of them pass into the duodenum and then into the bowel via the bile ducts.

People with liver damage may sometimes lose the ability to control glucose concentration in the blood and need a regular supply of sugar.

**Fighting infections**

Your liver plays a vital role in fighting infections, particularly infections arising in the bowel. It does this by mobilising part of your body's defence mechanism called the macrophage system. The liver contains over half of the body's supply of macrophages, known as Kuppfer cells, which literally destroy any bacteria that they come into contact with.

If the liver is damaged in any way its ability to fight infections is impaired.

## Kidneys

Your two kidneys are vital organs that perform many functions to keep your blood clean and chemically balanced. Understanding how your kidneys work can help you to keep them healthy.

**What do my kidneys do?**

The kidneys remove wastes and extra water from the blood to form urine. Urine flows from the kidneys to the bladder through the ureters.

Your kidneys are bean-shaped organs, each about the size of your fist. They are located near the middle of your back, just below the rib cage. The kidneys are sophisticated reprocessing machines. Every day, your kidneys process about 200 **quarts** of blood to sift out about 2 **quarts** of waste products and extra water. The waste and extra water become urine, which flows to your bladder through tubes called ureters. Your bladder stores urine until you go to the bathroom.

The wastes in your blood come from the normal breakdown of active tissues and from the food you eat. Your body uses the food for energy and self-repair. After your body has taken what it needs from the food, waste is sent to the blood. If your kidneys did not remove these wastes, the wastes would build up in the blood and damage your body.

The actual filtering occurs in tiny units inside your kidneys called nephrons. Every kidney has about a million nephrons. In the nephron, a glomerulus, which is a tiny blood vessel, or capillary, intertwines with a tiny urine-collecting tube called a tubule. A complicated chemical exchange takes place, as waste materials and water leave your blood and enter your urinary system.

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At first, the tubules receive a combination of waste materials and chemicals that your body can still use. Your kidneys measure out chemicals like sodium, phosphorus, and potassium and release them back to the blood to return to the body. In this way, your kidneys regulate the body's level of these substances. The right balance is necessary for life, but excess levels can be harmful.

In addition to removing wastes, your kidneys release three important hormones:

1. erythropoietin (eh-RITH-ro-POY-eh-tin), or EPO, which stimulates the bone marrow to make red blood cells

2. renin (REE-nin), which regulates blood pressure

3. calcitriol (kal-suh-TRY-ul), the active form of vitamin D, which helps maintain calcium for bones and for normal chemical balance in the body

## Pancreas

The pancreas is part of the digestive system. It lies in the upper half of the abdomen, well above the tummy button (navel), on a level with the V where the ribs meet at the front. It's deep inside the abdomen, lying just in front of the spine. It is about 15cm (6 inches) long.

The large rounded section on the right-hand side of the body is called the head of the pancreas, the middle part is known as the body of the pancreas and the narrow part on the left-hand side of the body is called the tail of the pancreas. The head of the pancreas lies next to the first part of the small intestine, which is called the duodenum.

**The position of the pancreas**

The pancreas produces a fluid which helps to digest food (pancreatic juice) and a hormone which enables the body to use sugars and store fats (insulin). The digestive juices produced by the pancreas flow down a tube (the pancreatic duct) into the duodenum.

**Nothing is sufficient for the person who finds sufficiency too little.** ***Epicurus***