

# What Happens When You Breathe?

## **Breathing In (Inhalation)**

When you breathe in, or inhale, your diaphragm contracts (tightens) and moves downward. This increases the space in your chest cavity, into which your lungs expand. The intercostal muscles between your ribs also help enlarge the chest cavity. They contract to pull your rib cage both upward and outward when you inhale.

As your lungs expand, air is sucked in through your nose or mouth. The air travels down your windpipe and into your lungs. After passing through your bronchial tubes, the air finally reaches and enters the alveoli (air sacs).

Through the very thin walls of the alveoli, oxygen from the air passes to the surrounding capillaries (blood vessels). A red blood cell protein called hemoglobin (HEE-muh-glow-bin) helps move oxygen from the air sacs to the blood.

At the same time, carbon dioxide moves from the capillaries into the air sacs. The gas has traveled in the bloodstream from the right side of the heart through the pulmonary artery.

Oxygen-rich blood from the lungs is carried through a network of capillaries to the pulmonary vein. This vein delivers the oxygen-rich blood to the left side of the heart. The left side of the heart pumps the blood to the rest of the body. There, the oxygen in the blood moves from blood vessels into surrounding tissues.

(For more information on blood flow, go to the Health Topics [How the Heart Works](#) article.)

## **Breathing Out (Exhalation)**

When you breathe out, or exhale, your diaphragm relaxes and moves upward into the chest cavity. The intercostal muscles between the ribs also relax to reduce the space in the chest cavity.

As the space in the chest cavity gets smaller, air rich in carbon dioxide is forced out of your lungs and windpipe, and then out of your nose or mouth.

Breathing out requires no effort from your body unless you have a lung disease or are doing physical activity. When you're physically active, your abdominal muscles contract and push your diaphragm against your lungs even more than usual. This rapidly pushes air out of your lungs.

# What Controls Your Breathing?

A respiratory control center at the base of your brain controls your breathing. This center sends ongoing signals down your spine and to the muscles involved in breathing.

These signals ensure your breathing muscles contract (tighten) and relax regularly. This allows your breathing to happen automatically, without you being aware of it.

To a limited degree, you can change your breathing rate, such as by breathing faster or holding your breath. Your emotions also can change your breathing. For example, being scared or angry can affect your breathing pattern.

Your breathing will change depending on how active you are and the condition of the air around you. For example, you need to breathe more often when you do physical activity. In contrast, your body needs to restrict how much air you breathe if the air contains irritants or toxins.

To adjust your breathing to changing needs, your body has many sensors in your brain, blood vessels, muscles, and lungs.

Sensors in the brain and in two major blood vessels (the carotid (ka-ROT-id) artery and the aorta) detect carbon dioxide or oxygen levels in your blood and change your breathing rate as needed.

Sensors in the airways detect lung irritants. The sensors can trigger sneezing or [coughing](#). In people who have [asthma](#), the sensors may cause the muscles around the airways in the lungs to contract. This makes the airways smaller.

Sensors in the alveoli (air sacs) can detect fluid buildup in the lung tissues. These sensors are thought to trigger rapid, shallow breathing.

Sensors in your joints and muscles detect movement of your arms or legs. These sensors may play a role in increasing your breathing rate when you're physically active.

## Lung Diseases and Conditions

Breathing is a complex process. If injury, disease, or other factors affect any part of the process, you may have trouble breathing.

For example, the fine hairs (cilia) that line your upper airways may not trap all of the germs you breathe in. These germs can cause an infection in your bronchial tubes ([bronchitis](#)) or deep in your lungs ([pneumonia](#)). These infections cause a buildup of mucus or fluid that narrows the airways and limits airflow in and out of your lungs.

If you have [asthma](#), breathing in certain substances that you're sensitive to can trigger your airways to narrow. This makes it hard for air to flow in and out of your lungs.

Over a long period, breathing in cigarette smoke or air pollutants can damage the airways and air sacs. This can lead to a disease called [COPD](#) (chronic obstructive pulmonary disease). COPD prevents proper airflow in and out of your lungs and can hinder gas exchange in the air sacs.

An important step to breathing is the movement of your diaphragm and other muscles in your chest, neck, and abdomen. This movement lets you inhale and exhale. Nerves that run from your brain to these muscles control their movement. Damage to these nerves in your upper spinal cord can cause breathing to stop, unless a machine is used to help you breathe. (This machine is called a [ventilator](#) or a respirator.)

A steady flow of blood in the small blood vessels that surround your air sacs is vital for gas exchange. Long periods of inactivity or surgery can cause a blood clot called a [pulmonary embolism](#) (PE) to block a lung artery. A PE can reduce or block the flow of blood in the small blood vessels and hinder gas exchange.