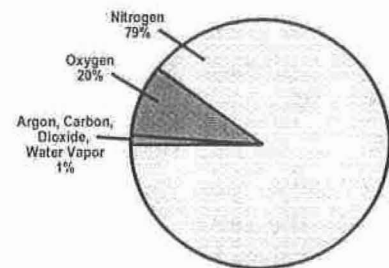


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The Respiratory System

People can survive for a week or more without food. It would not be much fun, and we would become weak, but we could stay alive for a while with what we have stored in our bodies. People can also survive a few days without water; we have some of that stored in our bodies as well. No one can go very long without breathing. Your body cells need oxygen to function and they get that oxygen from the air you breathe. Without oxygen, your body can only survive for a few minutes. We have no way to store oxygen for our bodies. This is why we have our respiratory systems. The respiratory system moves oxygen from the outside environment into the body. It also helps to remove carbon dioxide waste and water from the body.

When you breathe in (inhale), you take in air from the environment. Air is a mixture of gases. 78% of the air that we breathe is actually nitrogen, 21% is oxygen, 0.03% is carbon dioxide, and the remaining 0.97% is a combination of other gases. Your body only needs the oxygen from this air.

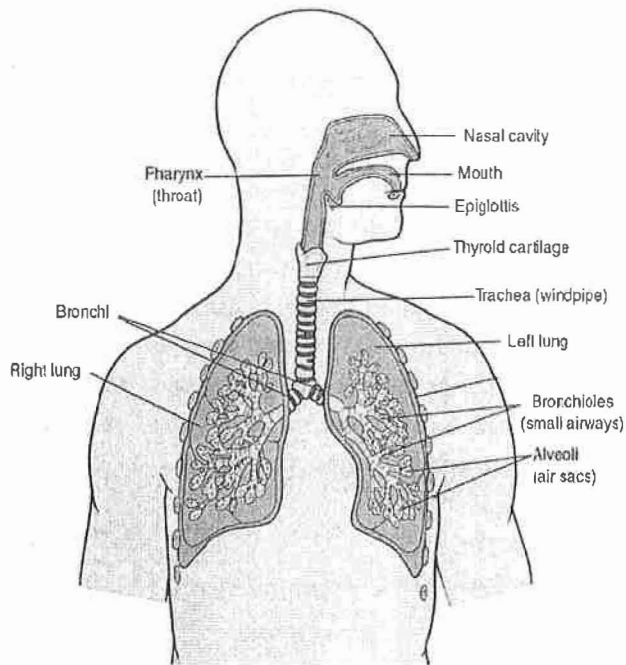


When you exhale (breathe out), most of the unused gases are returned to the air. Oxygen is necessary for your cells to undergo the process of respiration to create energy for you to function. Respiration, which is also called cellular respiration, is different from breathing. Breathing is the movement of air into and out of the lungs. Respiration is the chemical process that occurs in your cells. In addition to releasing energy for you to function, your cells release carbon dioxide and water after undergoing respiration. Your respiratory system helps to eliminate the carbon dioxide and some of the water out of your body through your lungs when you exhale.

Air is not purely made of gases. It also contains tiny particles of dust, pollen and microorganisms. As you breathe in, this also enters your body. Luckily, most of these materials never reach your lungs. As the air enters your respiratory system, it passes through a series of structures that filter and trap these particles. The structures also help to moisten and warm the air. As air travels from the outside towards the lungs, it must pass through these structures: nose or mouth, pharynx, trachea and bronchi. It only takes a few seconds to complete the path from nose to lungs.

Typically, air enters through the nose through spaces called the nasal cavities. Cells that line these cavities are lined with sticky mucus that helps to moisten the air, keeping the lining from drying out, and traps particles from the air. Also lining the nasal cavities are tiny hair-like projections called cilia. Cilia help to move the mucus into the throat where you swallow it. Stomach acid will then destroy the mucus and any particles that were trapped in it. Sometimes these particles irritate the lining of your nose or throat. This can cause you to sneeze; a powerful force of air that can shot the particles out of your nose. If you do breathe in through your mouth, you can still moisten and warm the air, but your throat is not capable of cleaning the air like your nose does.

Next the air enters the pharynx or throat. The pharynx is actually shared with the digestive system. Both the nose and mouth connect to the pharynx. The pharynx is a muscular tube about 5 inches long. It is also lined with cilia to help trap any particles that may have gotten past the filters in the nose.

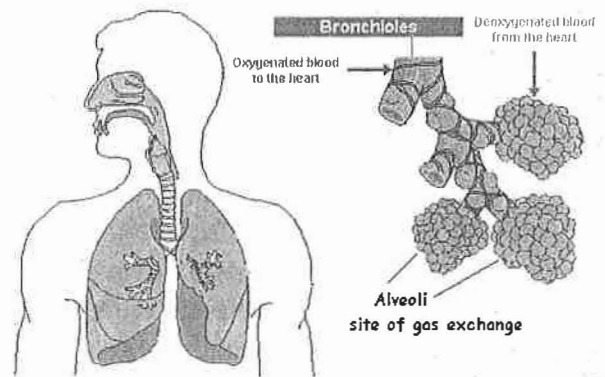


Air moves from your pharynx to the **trachea** or windpipe. You can feel your trachea if you gently run your fingers down the center of your neck. The trachea is about 12 inches long and remains open at all times. It is made of smooth muscle (involuntary) and is held open by rings of cartilage. You can feel these as you run your fingers down your trachea. The trachea is also lined with cilia and mucus to continue cleaning and moistening the air. If irritated here, you cough instead of sneeze in an attempt to remove the particles. Normally, only air is to enter the trachea. Because both food and air enter the pharynx, these must be sent down the correct tubes. A flap of tissue called the **epiglottis** folds over the trachea when you eat to help keep the food out so that it doesn't block the opening and prevent air from getting to the lungs.

At the top of the trachea is your **larynx** or vocal cords. As the air passes through the series of folds, sounds are made. By controlling the amount of air that passes through, you can control the amount of sound you make - from a whisper to a shout.

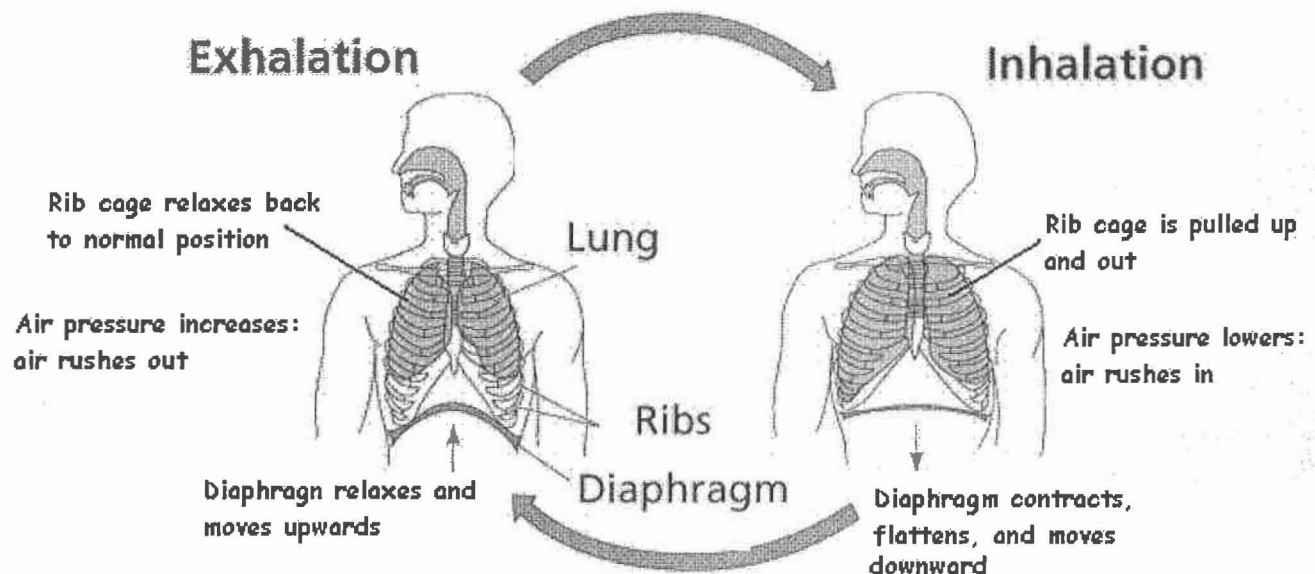
After moving down the trachea, the air moves into the bronchi. The **bronchi** are two passages that direct the air into the lungs. As you are aware, the lungs are the main organs of the respiratory system. The left bronchus (singular for bronchi) leads to the left lung, the right bronchus to the right lung. Inside the lungs, each bronchus branches and divides into smaller and smaller tubes in a pattern much like the branches of a tree. These branches are called **bronchioles**.

At the end of the bronchioles there are structures that look like bunches of grapes. These small sacs are called **alveoli**, and are tiny specialized structures that are responsible for moving the gases between the air and blood. Each alveolus (singular for alveoli) is surrounded by tiny capillaries. Here blood is able to pick up the oxygen from the air and deliver it to the cells. Likewise, carbon dioxide can be dropped off to be removed by the respiratory system. The exchange of gases between the respiratory and circulatory system is called **gas exchange**.



Your lungs can take in large amounts of oxygen because the surface area of all the alveoli is quite large. An adult's lungs can have about 300 million alveoli. If you were to flatten these all out, they would cover the surface of an area about 70 square meters. On the average, people breathe 10 to 14 times per minute (more than 20,000 times per day); when exercising, this can increase as much as 50 to 60 times per minute. You breathe in and out about 1 pint of air when resting and up to a gallon when exercising.

The process of breathing is controlled by muscles. The lungs are surrounded by the protective ribs, which have muscles attached to them. At the base of the lungs is the **diaphragm**, a large dome shaped muscle that plays a very important role in helping you breathe. When you breathe, your rib muscles and diaphragm expand or contract to allow air to flow in or out. **Inspiration or inhalation** is the process by which air and oxygen enter the respiratory system. First the diaphragm contracts, flattens, and moves downward. The muscles in the chest contract and pull the ribs up and out. As a result, the chest cavity is larger. As the chest area increases, the air pressure inside the lungs lowers. Because it is now lower, air naturally moves from an area of higher pressure to lower pressure, and enters your lungs to try to equalize the pressure. **Expiration or exhalation** is the process by which air and carbon dioxide can leave the respiratory system. The steps are the opposite of inhalation. The diaphragm must first relax and move upwards. The chest muscles can also relax, and will return the rib cage to its normal position. This process makes the chest area decrease, and the air pressure inside the lungs increases. Now the air will flow from an area of higher pressure (in your lungs) to an area of lower pressure (the environment) to equalize the pressure.



The Respiratory System: A Concept Map

