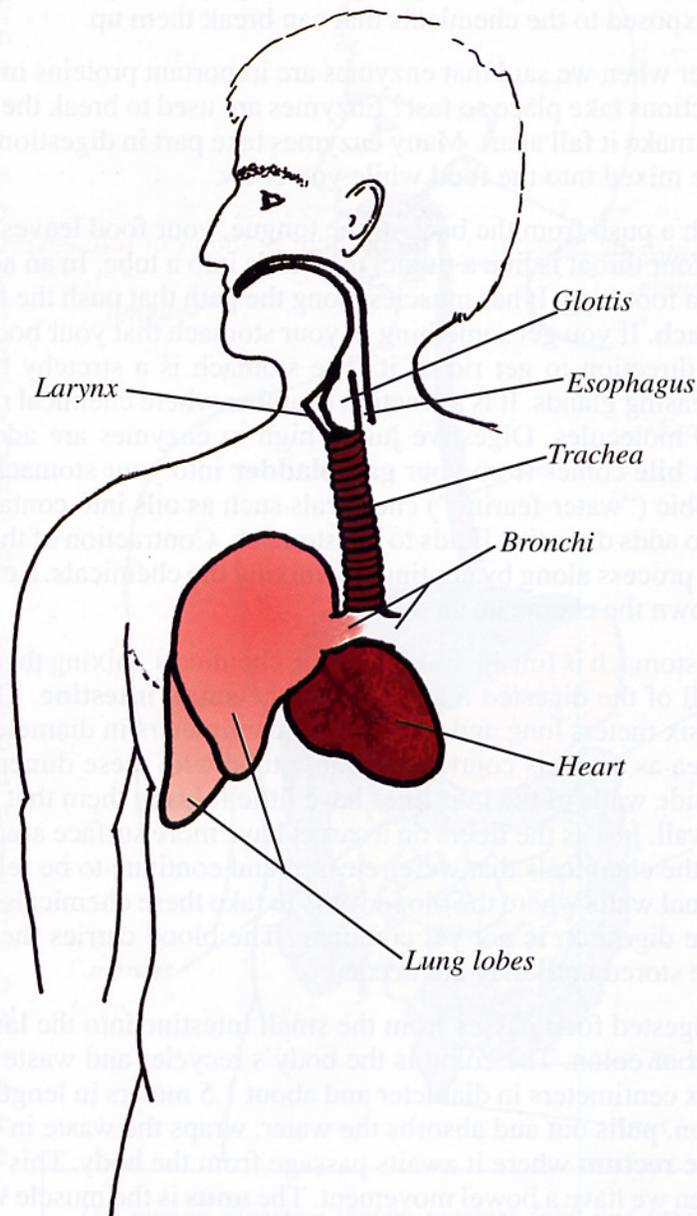


34: Respiratory System

One thing that humans need a lot of is **oxygen**. We use oxygen to oxidize organic molecules for energy. Our cells store that energy in a few special chemical bonds and then use it as needed to fuel their activities. We take oxygen right out of the air using our **respiratory system**. Our respiratory system begins with the mouth and nose because through them air enters our bodies. The air entering the mouth goes to the throat. Air entering at the nose has a more twisted path through the **nasal passages**, which empty into the space right above the throat. The throat is the place where those two air streams come back together. From the throat they pass through the voice box (also called the **larynx**) [LĀR-ingks]. The voice box has two folds of flesh that come together and vibrate against each other to produce sounds, the sounds we make when we talk, sing or hum.

From the voice box the air travels into a tube that looks something like a vacuum cleaner hose. That tube is called the **trachea**. A vacuum cleaner hose is made of a series of plastic rings that give it strength and keep it from



The human respiratory system delivers oxygen to the blood so that it can be distributed to the rest of the body. It also accepts waste carbon dioxide from the blood to remove it from the body. Air enters the mouth and nose and travels through the airways to the lungs. The cells of the lungs form tiny sacs, called alveoli, that have thin walls to exchange oxygen and carbon dioxide with the blood. Oxygen passes from the lungs to the bloodstream while carbon dioxide does the reverse.

collapsing, while also giving it some flexibility. The trachea is made of a series of rings of cartilage joined together. Because of this ring structure it is both flexible and strong. It is situated right in front of the esophagus, and both tubes (the trachea and the esophagus) originate in the throat. When we swallow food we have to close off the trachea so we don't get food "down the windpipe." The trachea is that windpipe.

The trachea divides into two smaller but similar tubes called **bronchi** [BRON-kī]. The bronchi split the flow of air between the two lungs. When we have a severe infection in the air passage, these tubes become **inflamed** (or irritated and swollen). We call such a condition bronchitis (meaning "inflammation of the bronchi"). The bronchi branch out into several **bronchioles** as they enter the lungs. These bronchioles break up the air flow into smaller and smaller streams which then enter the **alveoli** [al-VĒ-ō-lī]. The alveoli are small sacs from which oxygen crosses a thin layer of tissue and enters the blood. At the same time oxygen is passing into the blood vessels, carbon dioxide from the blood leaves through the wall of the blood vessels and passes into those little sacs so that it can be sent out of the body when we exhale.

Blood cells contain a special complex chemical compound called **hemoglobin**, which likes oxygen. Hemoglobin can hold loads of oxygen until it can be delivered to the cells that need it. If hemoglobin liked oxygen too much, it wouldn't let go when it came close to the cells needing some. On the other hand, if it didn't like oxygen well enough, it would let go too soon, before reaching those cells. For these reasons, the exact design of the hemoglobin molecule is extremely important. Carbon monoxide poisoning offers an example of how disastrous a problem with hemoglobin can be. Cars produce a small amount of carbon monoxide (CO) in their exhaust. These molecules have a tremendous liking for hemoglobin. Once they combine with hemoglobin, they will not let go; as a result, the hemoglobin can't accept oxygen molecules as it normally would. People who have been exposed to enough CO to fill a large portion of their hemoglobin will die of suffocation, even if they are given plenty of oxygen, because their hemoglobin can't get rid of the CO to accept the oxygen.

Lungs are like stretchy bags. They are enclosed inside the chest cavity. When the chest cavity is made bigger, it creates a vacuum on the outside surfaces of the lungs. As the lungs expand to fill the vacuum, air is drawn down the trachea from the mouth and nostrils. When the chest cavity relaxes, the stretchiness of the lungs makes them go back to their original shapes, forcing the extra air out. Take in a deep breath and notice how the expansion of your chest brings in air through your mouth and/or nose.