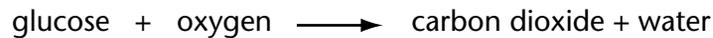


## Going for gold!

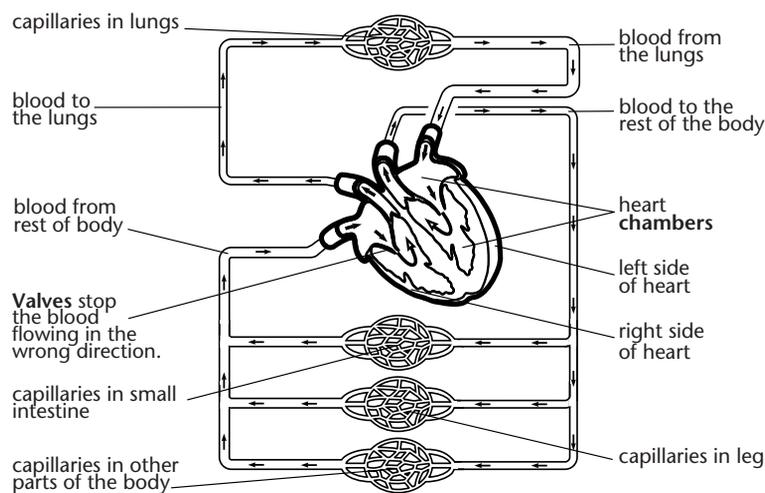
All living cells need to respire to release energy. Energy is needed by organisms to stay alive, to make new substances and to help them move.

**Respiration** normally requires oxygen and so it is called **aerobic** (with air) **respiration**. It is a series of **chemical reactions** that can be shown by a **word equation**:

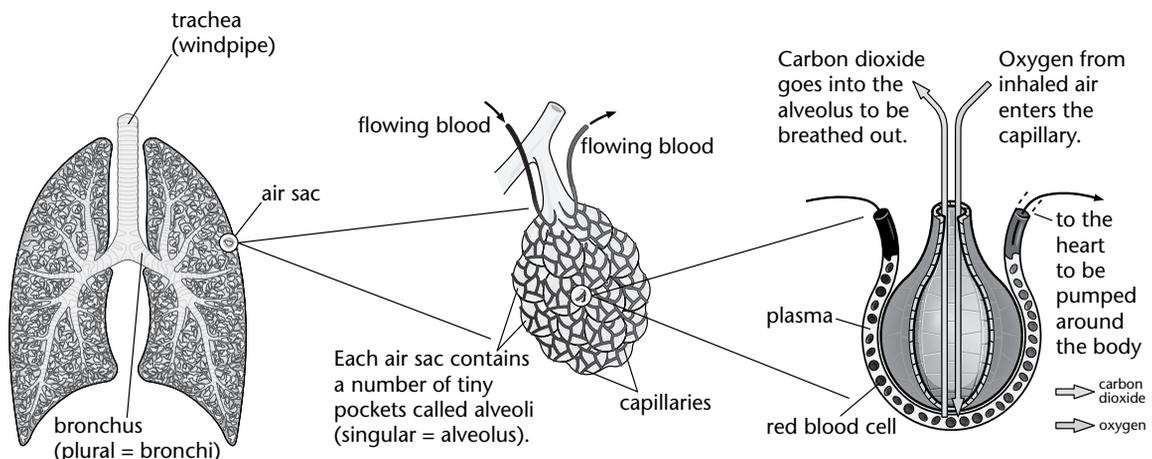


Glucose and oxygen are the **reactants**. Carbon dioxide and water are the **products**. Energy is released but this is not a chemical substance.

Glucose is supplied by the **digestion** of carbohydrates. It is **absorbed** into the blood by the small intestine and carried around the body dissolved in the **plasma** of the blood. The blood travels through **blood vessels** and is pumped by the heart. The **heart** and the blood vessels form the **circulatory system**.



The oxygen is absorbed from the air by the **lungs**. The lungs are part of the **breathing system** (or **respiratory system**).

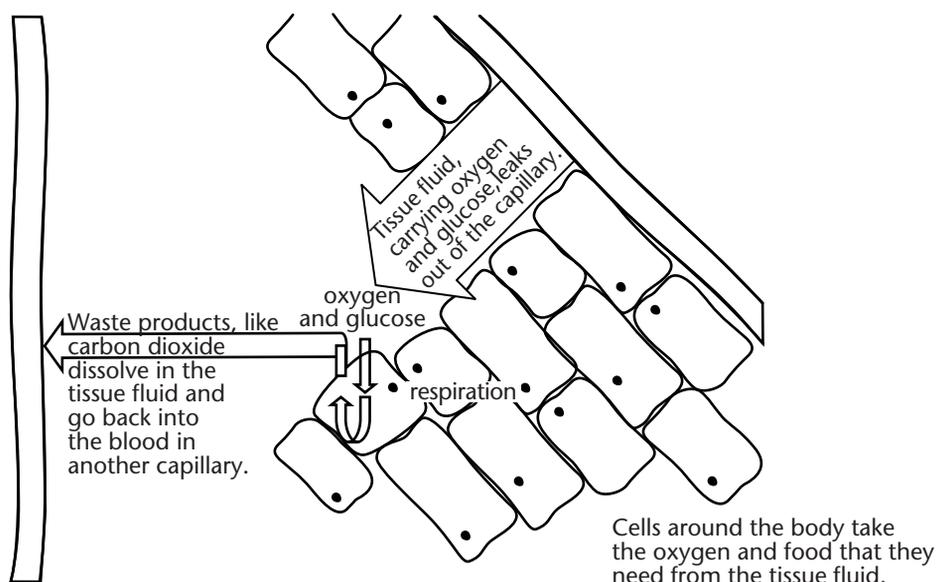


The **alveoli** give the lungs a large surface area so that oxygen can quickly **diffuse** from the air inside the lungs into the blood contained in **capillaries**. The walls of the alveoli and the walls of the capillaries are only one cell thick, which also makes it easy for oxygen to diffuse into the blood. The oxygen is then carried by the **red blood cells** to capillaries around the body.

**Tissue fluid** comes out of other capillaries around the body and bathes the tissues in the body. Tissue fluid contains oxygen and glucose. The cells take the oxygen and glucose that they need from the tissue fluid and put the carbon dioxide that is produced back into the tissue fluid. The tissue fluid soaks back into other capillaries and the carbon dioxide dissolves in the blood plasma.

In the lungs the dissolved carbon dioxide diffuses out of the blood and into the air in the lungs. That is why we breathe out (**exhale**) more carbon dioxide than we breathe in (**inhale**). The carbon dioxide is **excreted** by the lungs. Carbon

dioxide can be tested for by using limewater, which turns from clear to cloudy. Oxygen diffusing into the blood and carbon dioxide diffusing out of the blood is called **gas exchange**.



Composition of inhaled and exhaled air.			
	Inhaled air	Exhaled air	
nitrogen gas	78%	78%	
oxygen gas	21%	16%	
carbon dioxide gas	0.03%	4%	
water vapour	variable	more	

When you exercise, your **breathing rate** (number of breaths in one minute) and your **pulse rate** (number of heart beats in one minute) increase. This is because your cells need more oxygen and glucose for respiration.

In some diseases (e.g. **emphysema**) or when there is little air (e.g. at the top of a mountain) the body cannot get enough oxygen. People in these situations often feel short of breath and tired. If too little oxygen gets to cells, the cells cannot release energy from food and so they die.

Most organisms respire using oxygen. Fish and many water organisms have **gills** to take oxygen out of the water. Oxygen from the water diffuses into the leaves of underwater plants.