Respiration

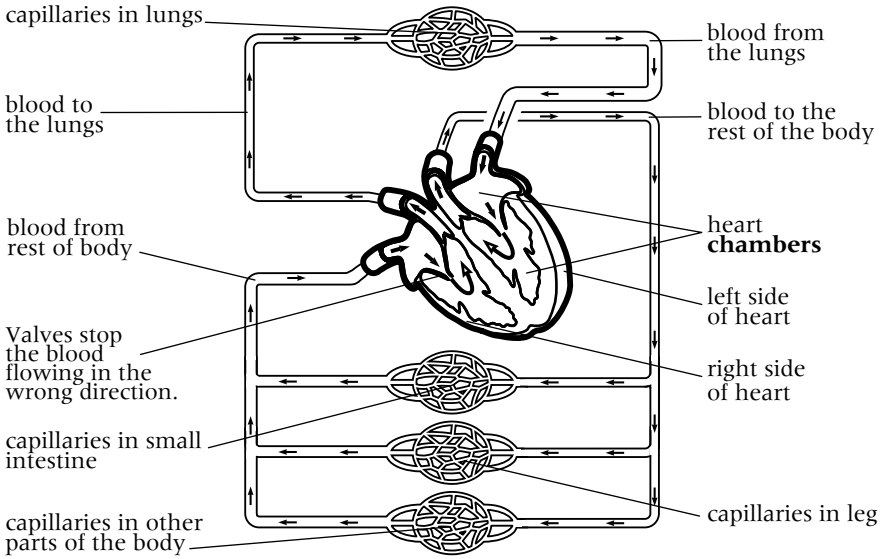
All living cells need to **respire** to release energy. Energy is needed by organisms to help them move, grow and make new substances to help them stay alive.

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

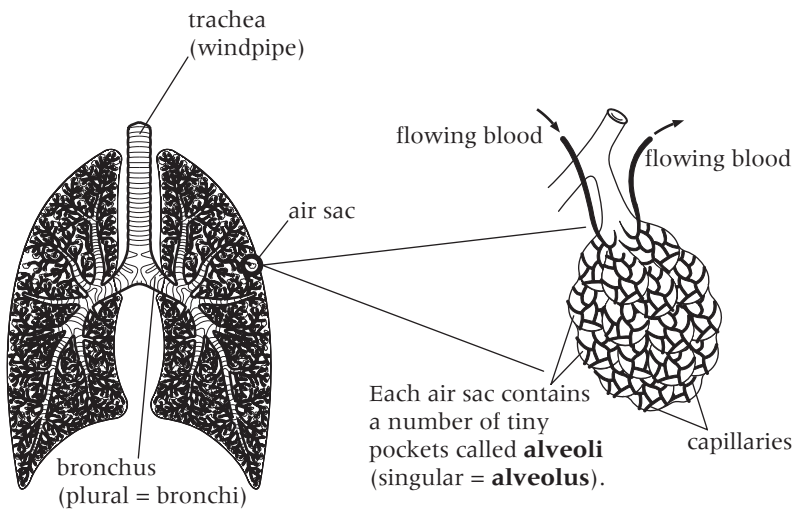
glucose + oxygen → carbon dioxide + water (+ energy)

Glucose and oxygen are the **reactants**. Carbon dioxide and water are the **products**. Energy is released but it is not a chemical substance so we can either miss it out of the equation or put it in brackets.

Glucose is supplied by the **digestion** of carbohydrates. It is 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**.

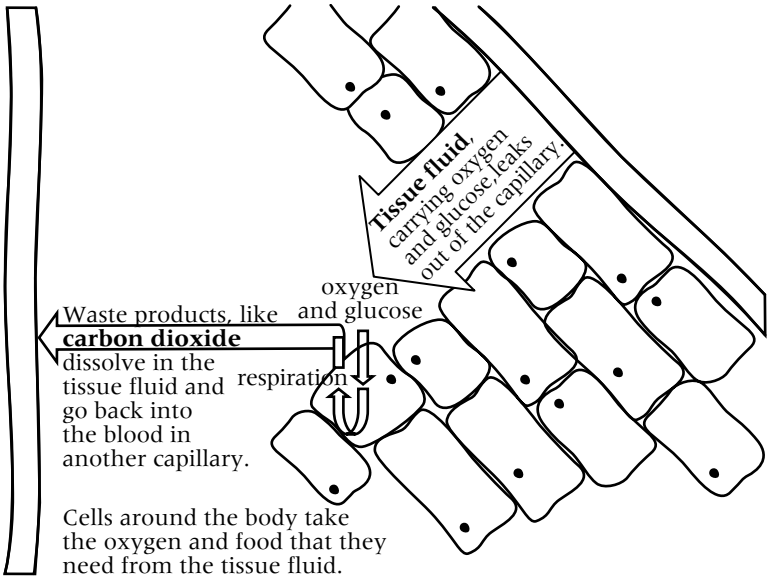


The oxygen is absorbed from the air by the **lungs**. The lungs are part of the **breathing system**.



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 carried by the **red blood cells**.

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**.

	Inhaled air	Exhaled air
nitrogen gas	78%	78%
oxygen gas	21%	16%
carbon dioxide gas	0.03%	4%
water vapour	variable	more

Composition of inhaled and exhaled air.

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

In some diseases 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.

