

All **organisms** carry out **seven life processes** (movement, reproduction, sensitivity, growth, respiration, excretion, nutrition).

All living cells **respire** to release energy. Organisms need energy for everything they do (for example, making new substances, moving).

**Aerobic respiration** is a series of **chemical reactions** that can be summarised as:



## Breathing

The **breathing system** allows air to enter and leave the lungs, so that oxygen can get into the blood and carbon dioxide can leave the blood. Oxygen for respiration leaves the lungs and enters the blood. Carbon dioxide (a waste product from respiration) leaves the blood and enters the air in the lungs. Carbon dioxide is **excreted** when you **exhale**.

**Breathing** is the movement of the muscles in your **diaphragm** and between the ribs, which cause the changes in the volume of the lungs.

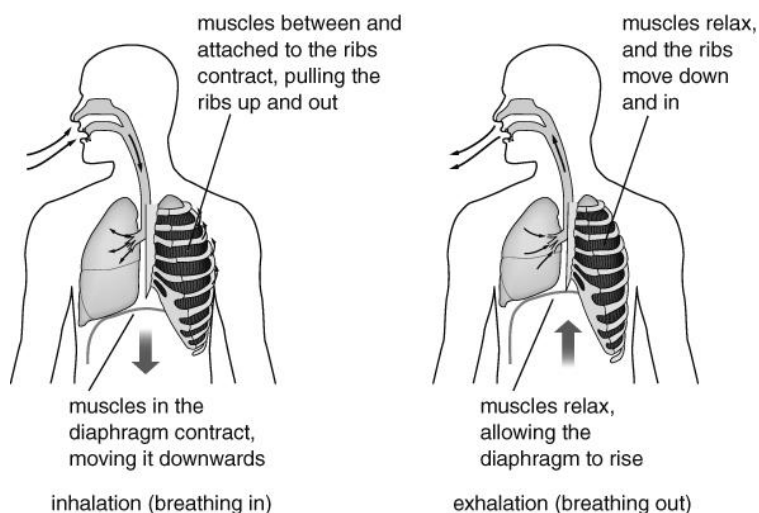


Diagram showing breathing.

## Circulation

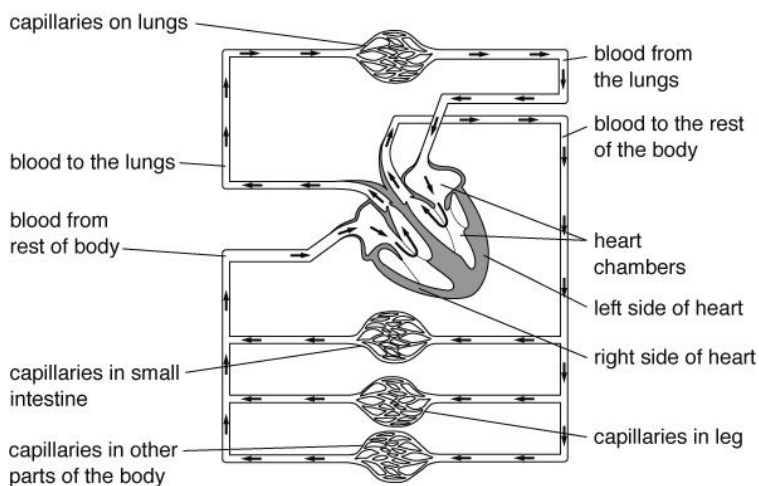
Blood is carried to the heart by veins, where it enters the chambers of the heart. The blood is then forced back out when the heart muscle tissue contracts. The pumping of the heart can be felt in arteries as a pulse.

You can measure your pulse either at your wrist or the side of your neck. Press two fingers firmly onto your wrist, the pumping you can feel is your pulse.

**Arteries** are connected to **veins** by **capillaries**, which are **blood vessels** with very thin walls that allow oxygen and nutrients to leave the blood to get to the cells in tissues. Carbon dioxide from the cells can easily get into the capillaries.

**Arteries** have a thick outer wall to withstand the high pressure created by the heart pumping.

**Veins** have a thin layer of muscle and pushes the blood back to the heart.



Some of the circulatory system.

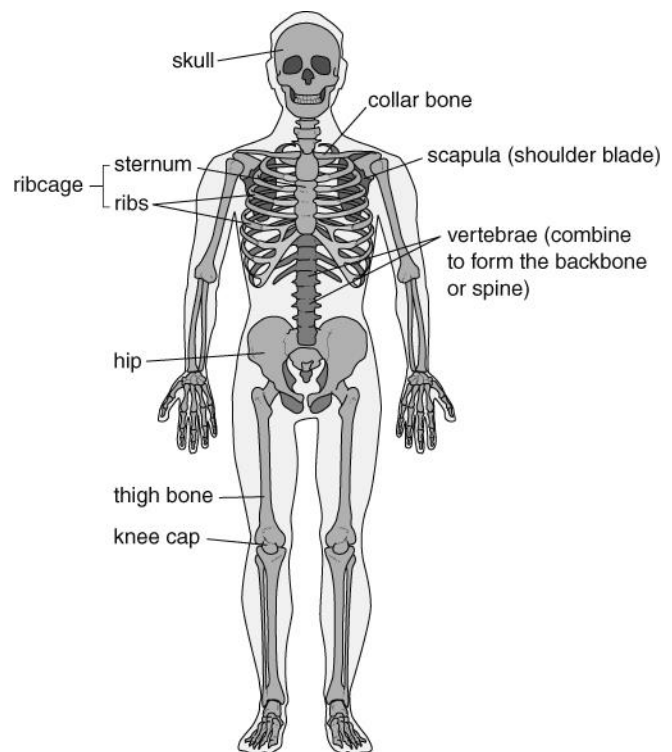
## Locomotor (skeletal) system

The **locomotor (skeletal) system** consists of bones and muscles and lets you move.

Bones are organs that form the **skeleton**, which:

- protects some organs (e.g. the **ribs** and **sternum** protect the lungs; the **skull** protects the brain)
- supports your body (e.g. the **vertebrae** in your '**backbone**' hold you up straight)
- allows you to move (using muscles at your **joints**).

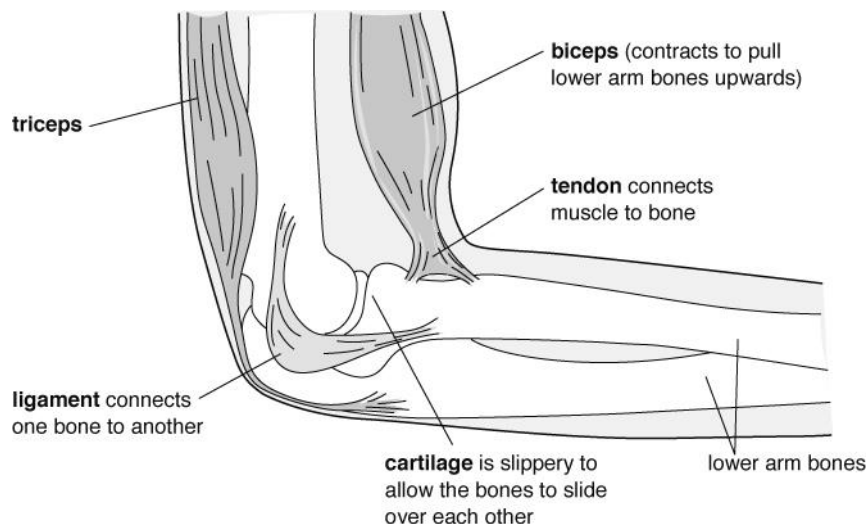
Bones are hard (to withstand knocks and pressure) and light (so they are easy to move). Many have a hollow centre containing **bone marrow**, where **blood cells** are made.



The human skeleton.

## Muscle action

Muscles cannot push and so bones need pairs of muscles (**antagonistic pairs**) to pull them in opposite directions. One muscle **contracts** (gets shorter and fatter) to pull a bone. At the same time, the other muscle in the pair **relaxes**.



The elbow joint is a flexible joint (whereas the bones in the skull meet at fixed joints).

Muscles are controlled by the **nervous system**. Impulses from the brain travel down the **spinal cord** and along **nerves** to muscles.

Muscle cells are adapted to their function by containing strands that can shorten to produce a pulling force. This requires energy from **respiration**.

The oxygen and nutrients (from food) required for respiration are carried to the muscles in the blood. Nutrients are carried in the **plasma**, while oxygen is carried on **red blood cells**. Blood also contains **white blood cells**, which attack micro-organisms.

## Drugs

**Drugs** are chemicals that affect how the body works. Some can damage your organs (e.g. the liver), particularly if they are abused. Some drugs are **addictive**.

**Medicines** (e.g. **antibiotics**) are drugs that can help people who are suffering from diseases.

**Recreational drugs** are drugs that people take because they like the effect that they have on their bodies (e.g. **caffeine** in coffee and **alcohol**, which are both **legal** drugs). Some are **illegal drugs** (e.g. **heroin** and **ecstasy**) because they have very harmful **side-effects**.

Drugs that slow down the **nervous system** are called **depressants**. Alcohol is a depressant. It alters behaviour and slows reaction times. Drugs that speed up the nervous system are called **stimulants** (e.g. caffeine).