Human Body Systems

Energy In Living Things

All living things (including us) need energy. It is needed for many processes, including:

- Cell growth and repair
- Movement
- Keeping us warm (37 °C)

We need to maintain this temperature as that is the optimum temperature for our enzymes. This makes sure our bodies function properly.

Respiration

This is the chemical process which produces energy in all living things.

Word equation for aerobic respiration:

glucose + oxygen → water + carbon dioxide + energy

This process happens in all living cells. Some of the energy is released as heat energy.

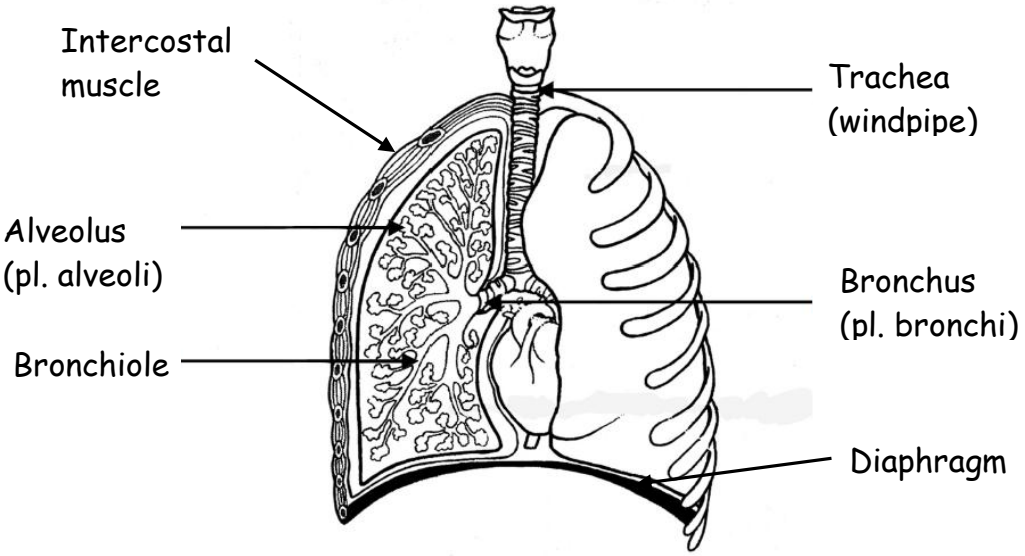
This means the air we breathe in is different from the air we breathe out.

Gas	Inhaled air	Exhaled air
Oxygen	21%	About 15%
Carbon dioxide	0.03%	About 6%

Exhaled air also contains more water vapour.

Breathing

The oxygen we require for respiration gets into our bodies by breathing. The main organs involved in breathing are the lungs.

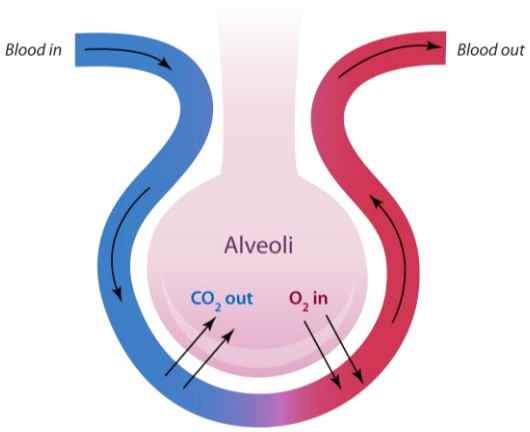


When we breathe in, the following happens:

- The diaphragm contracts, moving down.
- The intercostal muscles contract.
- The rib cage moves up and out.
- The lungs inflate.

When we breathe out, the diaphragm and intercostal muscles relax and the opposite happens.

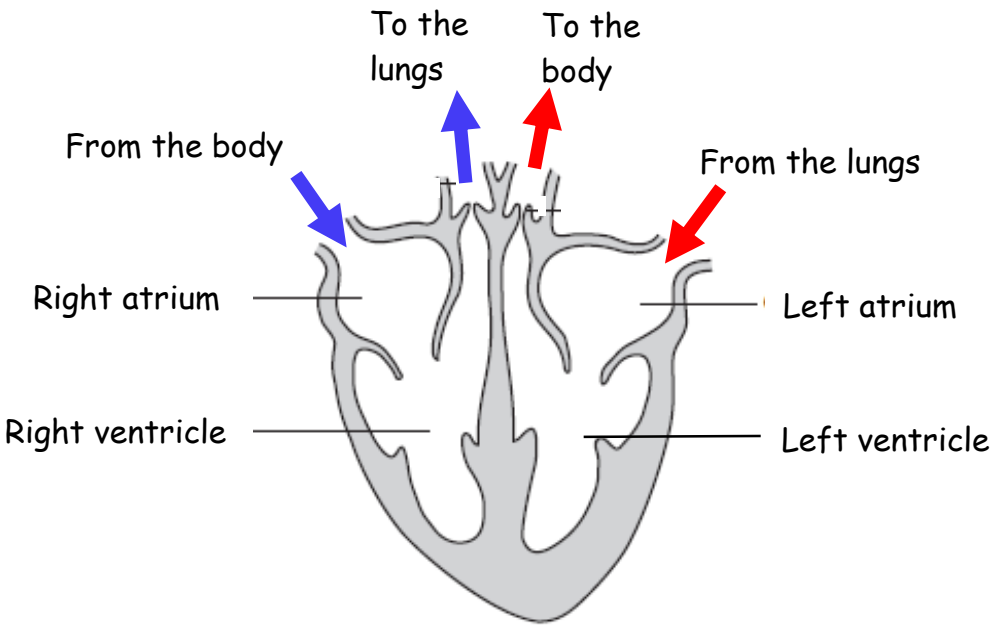
At the alveoli, there is an exchange of the gases carbon dioxide and oxygen. Oxygen moves from a high concentration in the alveolus to a low concentration in the blood. Carbon dioxide moves from a high concentration in the blood to a low concentration in the alveolus.



A peak flow meter measures the force at which air is pushed out of the lungs. Many factors affect peak flow. For example, people with asthma normally have lower peak flow readings.

The Heart

The heart is made of muscle and is responsible for the continual circulation of the blood around the body. There are 4 chambers in the heart. The atria are the top chambers and the ventricles are at the bottom.

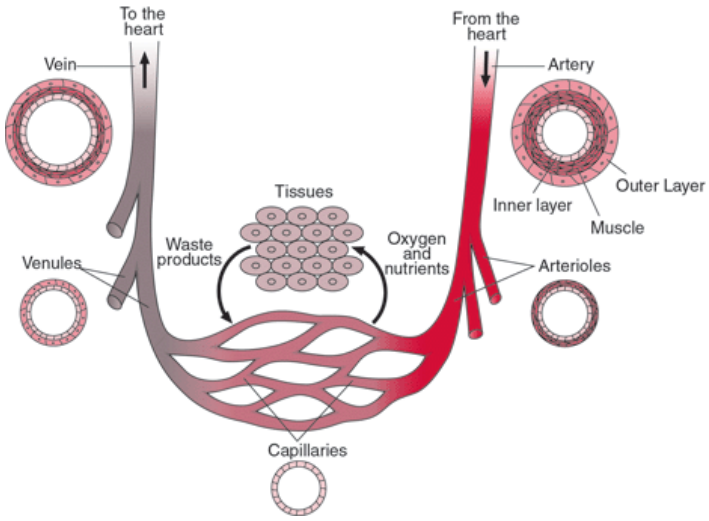


The left ventricle is much thicker than the right ventricle as this pumps the blood around the whole body. The right ventricle only pumps the blood out to the lungs (which are close to the heart).

Blood Vessels

There are 3 types:

- Arteries
- Capillaries
- Veins

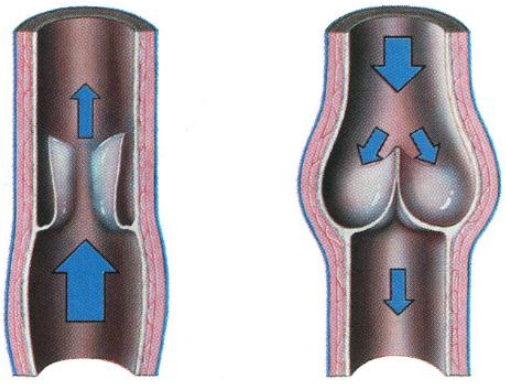


Arteries take blood away from the heart. They have thick muscular walls as the blood is at high pressure.

Capillaries have very thin walls. Gas exchange occurs here as oxygen passes into the cells and carbon dioxide and other waste products pass into the blood.

Veins return the blood to the heart. They have thinner walls than arteries as the blood is at low pressure.

Veins have valves to prevent the blood flowing backwards which could lead to blood with and without oxygen mixing. Valves are also found in the heart where the blood leaves the atria and ventricles.



Valve open Valve closed

Heart Rate

This is the number of times the heart beats in a minute. It is the same as pulse rate.

When we exercise, the heart rate increases as the cells need more oxygen and nutrients.

The recovery time is the time it takes the heart rate to return to normal following exercise. The fitter a person is, the shorter their recovery time.

Food Groups

There are five main food groups.

Food groups	Role in the body
Carbohydrates	To provide energy
Proteins	For growth and repair
Fats	To provide energy
Vitamins	To maintain a healthy body
Minerals	To maintain a healthy body

A lack of vitamins C or D, leads to the diseases scurvy or rickets, respectively.

Calcium is a mineral needed for strong teeth and bones.

Chemical Tests for Foods

Food Group	Test	Result
Starch	Iodine	Turns brown → blue/black
Glucose	Benedict's	Turns blue → brick-red
Protein	Biuret	Turns blue → violet
Fat	Filter paper	Translucent mark is left

Energy From Food

Different foods contain different amounts of energy. This can be measured by burning them and measuring the increase in temperature of a volume of water.

Foods with a lot of **fat** contain the **most** energy.

Fats contain **double** the energy of carbohydrates and proteins for the same mass.

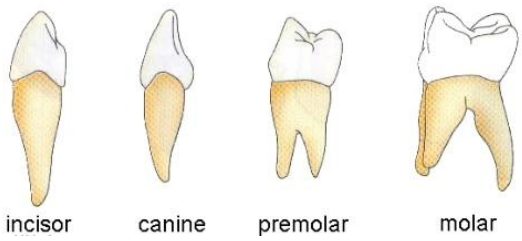
Digestion

This is the breakdown of large food particles into smaller particles. This is needed to allow them to be absorbed through the wall of the small intestine into the blood.

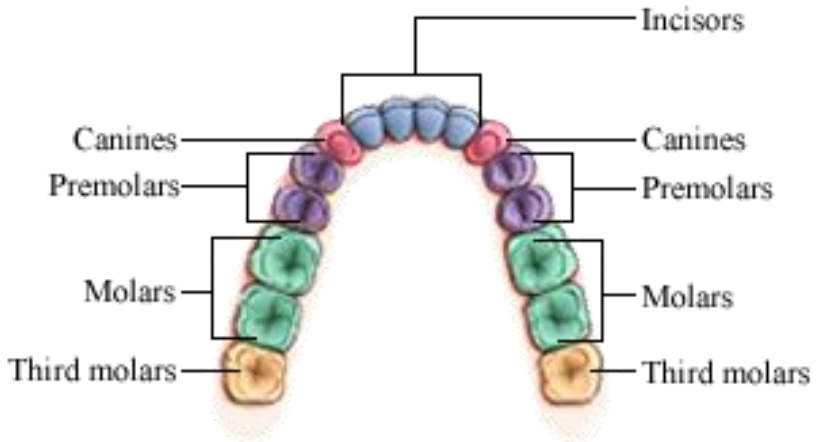
This breakdown starts with the teeth and is continued by enzymes, which break the food down chemically.

We have different types of teeth and they have different roles relating to their shape and size.

Name	Role
Incisor	Biting
Canine	Gripping
Premolar and Molar	Grinding and crushing

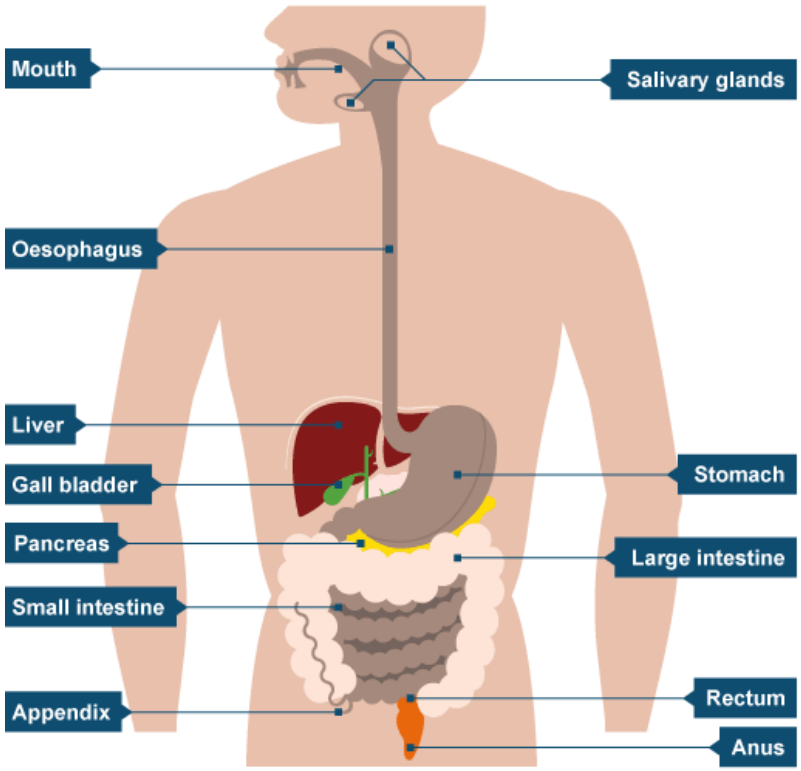


These are arranged in the mouth in the following way.

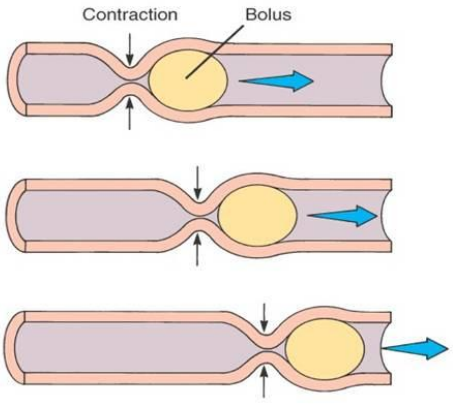


The Alimentary Canal

This is the pathway by which food enters the body and waste products leave the body. There are several organs associated with this.



The food is pushed along the oesophagus and intestines by a mechanism called peristalsis. The muscles behind the food contract while the muscles in front relax.



The stomach wall is also made of muscle and the contraction and relaxation of the muscle helps food to mix with the digestive enzymes.

Enzymes are produced at various points along the alimentary canal and different enzymes are responsible for the breakdown of each of the food groups.

Food	Enzyme
Starch (carbohydrate)	Amylase, maltase
Protein	Proteases including pepsin
Fat	Lipases

The Small Intestine

The structure of the small intestine is related to its function of absorbing as much food through its wall into the blood as possible.

The small intestine;

- is long
- is folded
- has many finger-like projections called **villi**

These features provide a large surface area.

The Large Intestine

The main roles of the large intestine are:

- To absorb most of the water from undigested food.
- To store the remains of the undigested food (faeces) in the part called the rectum until it is expelled from the body through the anus.