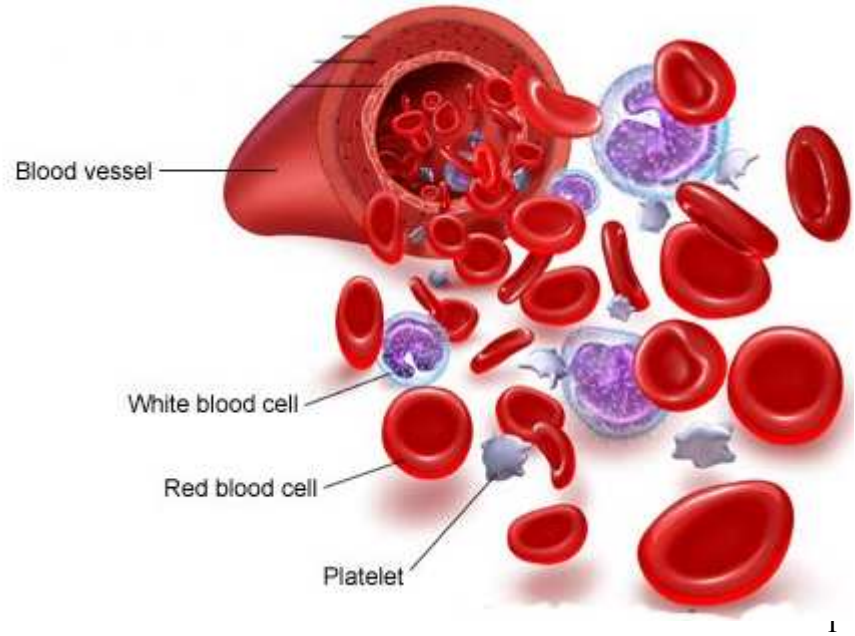
Stage 3- Language support

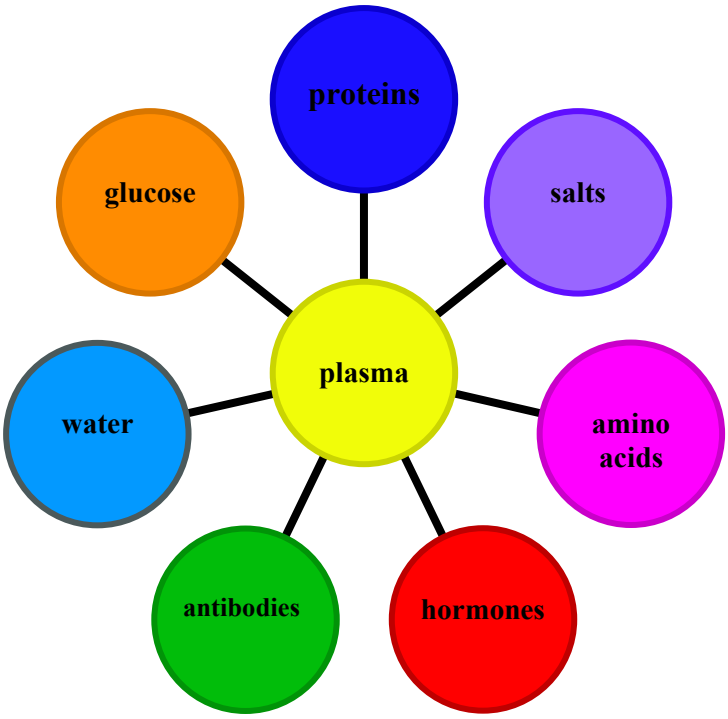
Blood: Components, Blood Types, Functions and Disease

Blood consists chiefly of a liquid called **plasma**, which is made up mostly of **water**, but also contains **proteins**, **glucose**, **amino acids**, **salts**, **hormones**, and **antibodies**. Floating in the **plasma** are three kinds of solid particles: **red blood cells**, **white blood cells**, and **platelets**.

Components of the plasma:

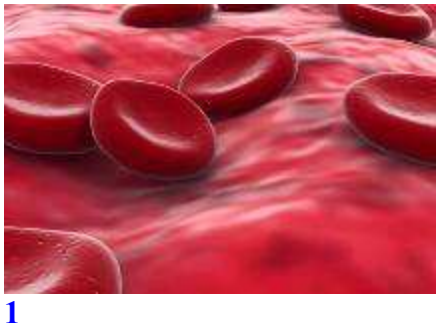
- **water**
- **proteins**
- **glucose**
- **amino acids**
- **salts**
- **hormones**
- **antibodies**





Floating (staying on the surface of) in the plasma are three kinds of solid particles:

1. **red blood cells** (RBC)
2. **white blood cells** (WBC)
3. **platelets**



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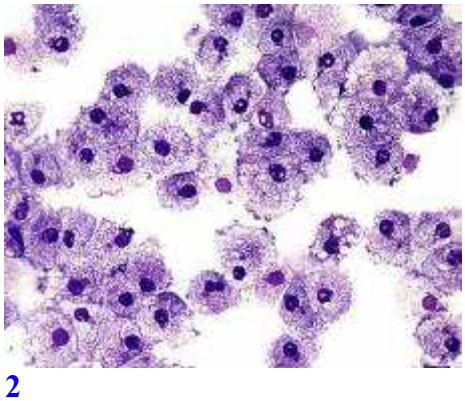

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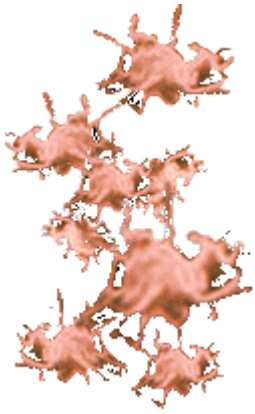

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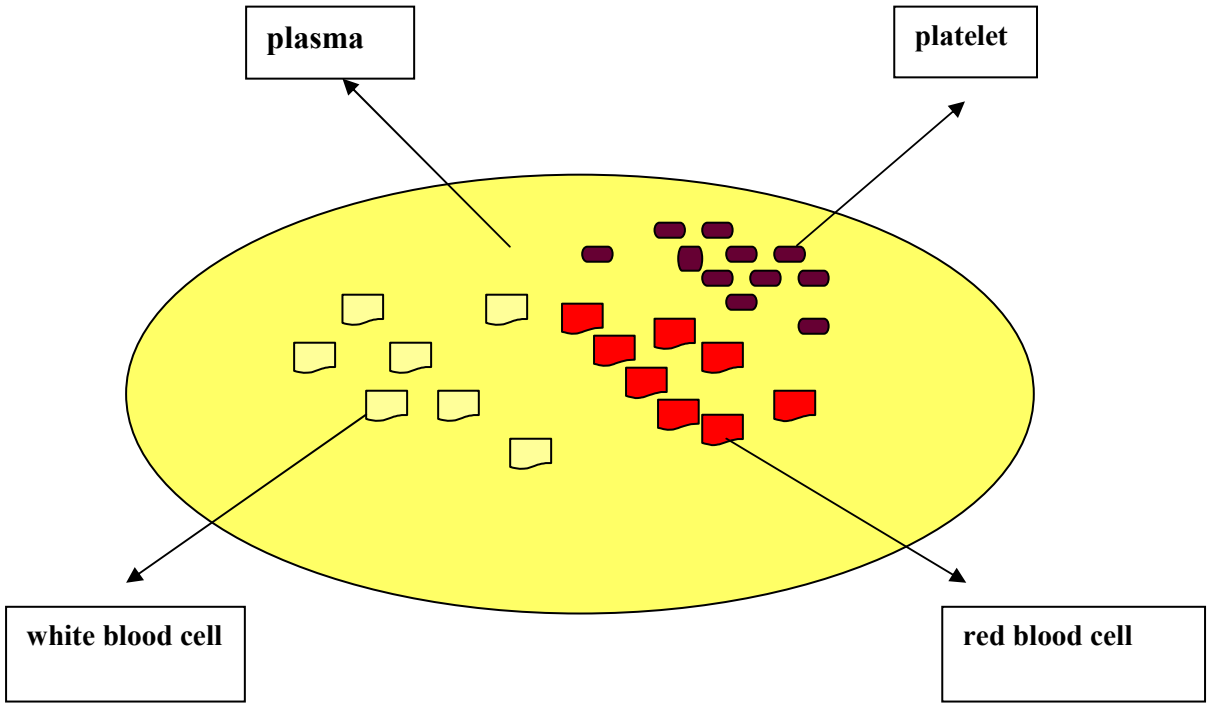
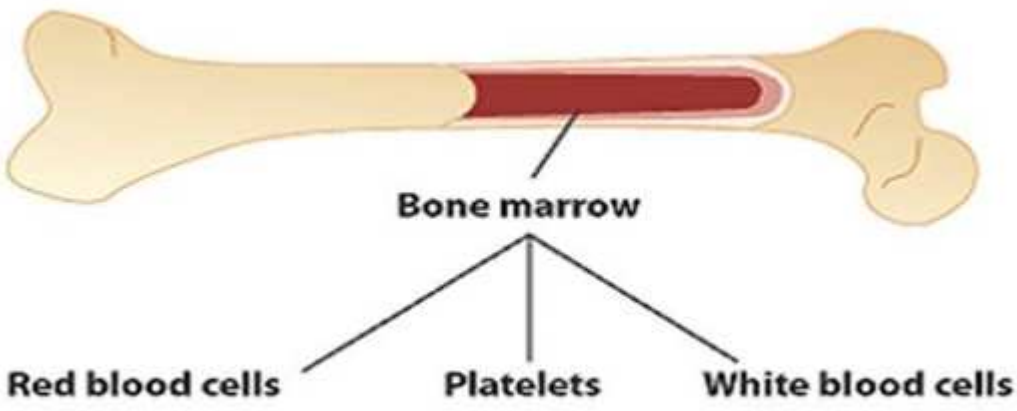


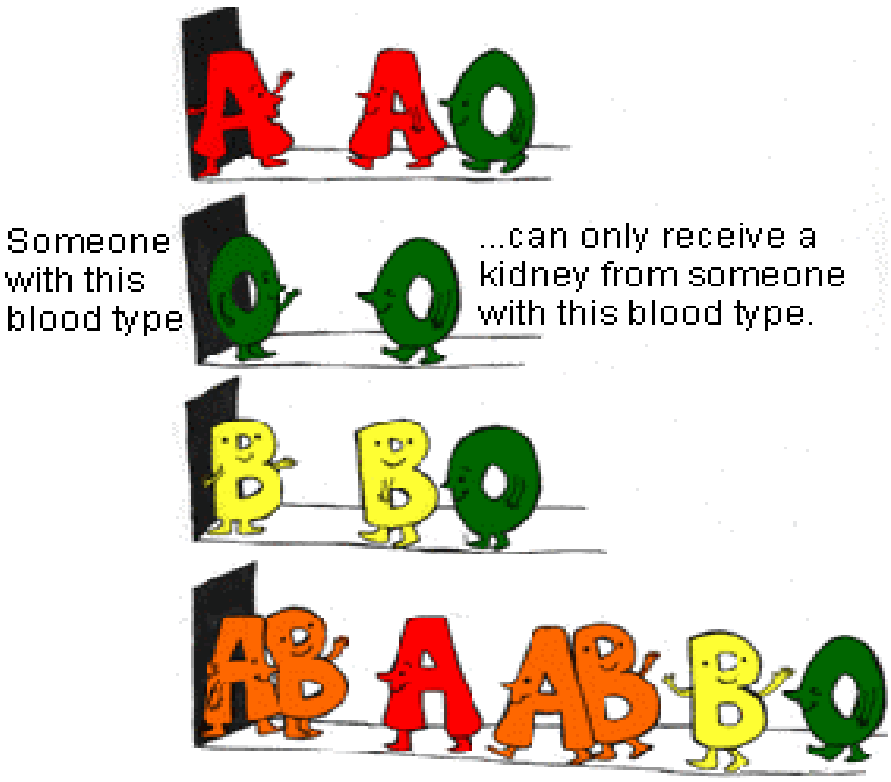
The **red blood cells** (RBC) are formed in **bone marrow** (soft substance inside human and animal bones) - mainly in the ribs (the twelve parts of curved bones extending from the spine to or towards the sternum in humans, and similar bones in most vertebrates), vertebrae, and limbs (arms and legs); they contain **haemoglobin** and **carry oxygen and carbon dioxide** (CO_2) **throughout the body**. The red blood cells, which have no nucleus, have a relatively short life of about four months.
White blood cells are also made in the **bone marrow**, as well as in the lymph nodes. They have a nucleus, often quite large, and they are able to move around and pass through the walls of capillaries into all parts of the body. **Their main function is to fight infection and help protect the body from disease** (illnesses). This is done by the production of **antibodies** which counteract (neutralize) the effects of invading bacteria or viruses.

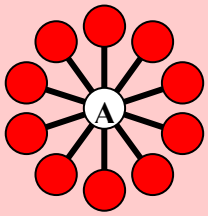
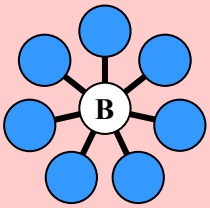
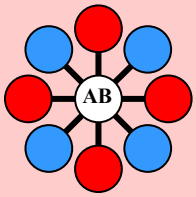
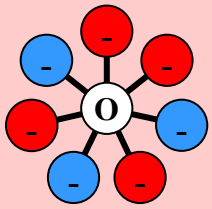
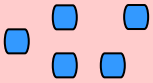
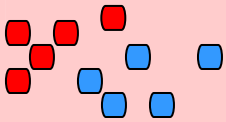
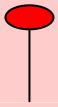
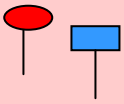
Platelets are small fragments of cells with no nucleus. They too are produced in the **bone marrow** and **their function is to release** (to liberate) **substances which enable blood to clot** (coagulate)**. Thus they help to prevent the loss of blood from damaged vessels.**



Types of blood

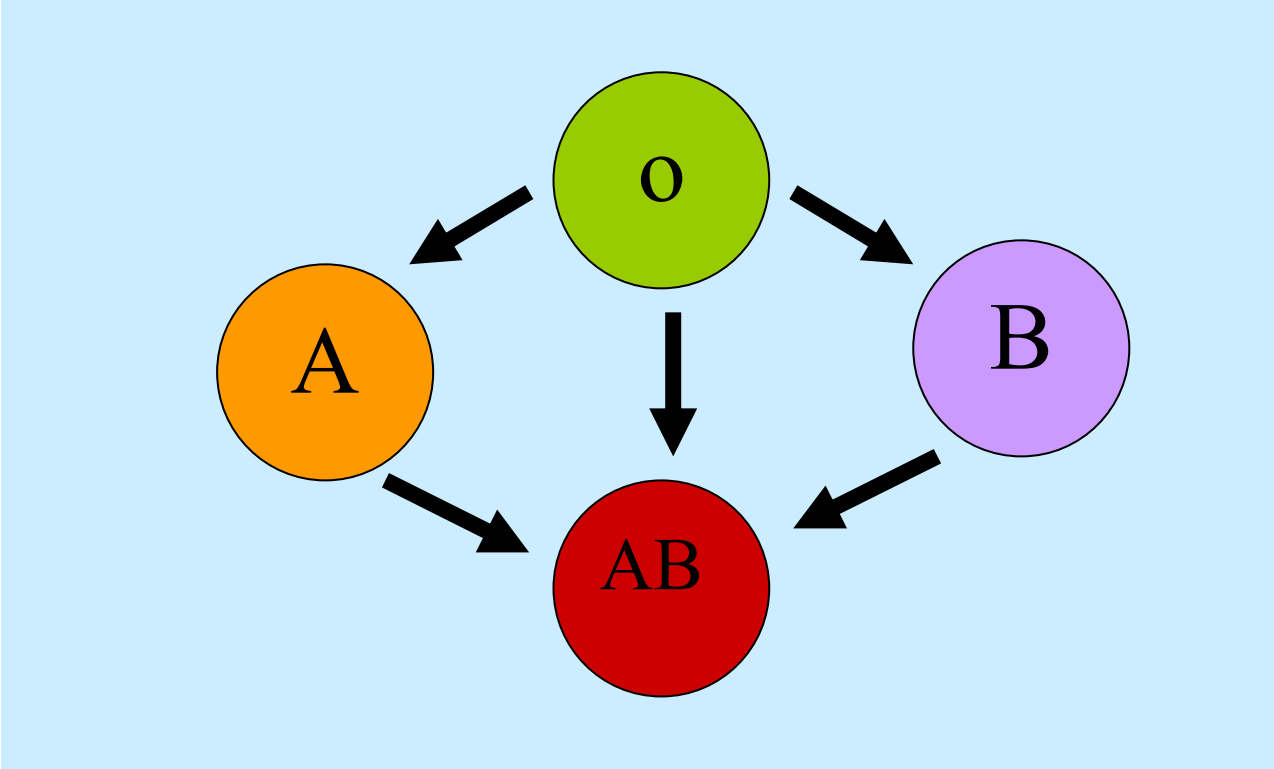
Red blood cells commonly have immune-stimulating polysaccharides (a class of carbohydrates whose molecules contain chain of monosaccharide molecules) called **antigens** on the surface of their cells. Individuals having the **A antigen** have **blood type A** (as well as **anti-B antibodies**); individuals having the **B antigen** have **blood type B** (as well as **anti-A antibodies**); individuals having the **A and B antigens** have **blood type AB** (but **no anti-A or anti-B antibodies**); and individuals having **no antigens** have **blood type O** (as well as **anti-A and anti-B antibodies**).



	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies present	**Anti-B** 	**Anti-A** 	**None**	**Anti-A Anti-B** 
Antigens present	A antigen 	B antigen 	A and B antigens 	None

Red blood cells compatibility chart

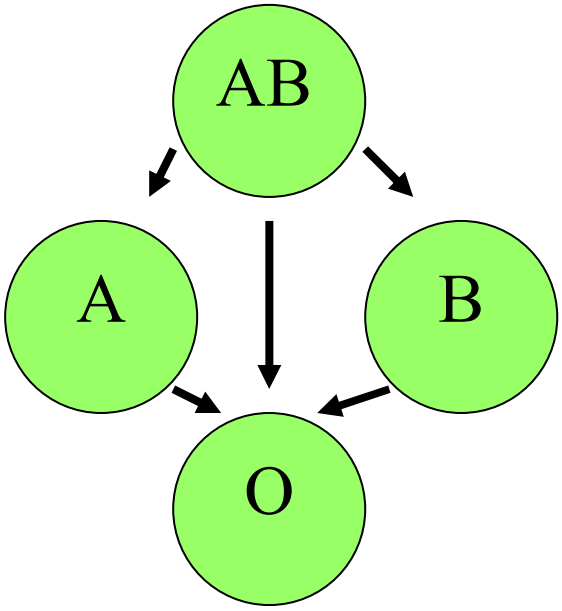
In addition to donating to the same blood group; type **O** blood donors can give to **A**, **B** and **AB**; blood donors of types **A** and **B** can give to **AB**.



RBC compatibility chart

Plasma compatibility

In addition to donating to the same blood group; plasma from type **AB** can be given to **A**, **B** and **O**; plasma from types **A** and **B** can be given to **O**.



Plasma compatibility chart

Functions of the system

The circulatory system plays an important role in many of the body's processes including **respiration**, **nutrition**, and the **removal of wastes** (materials that are no longer needed and are to be thrown away) **and poisons**.

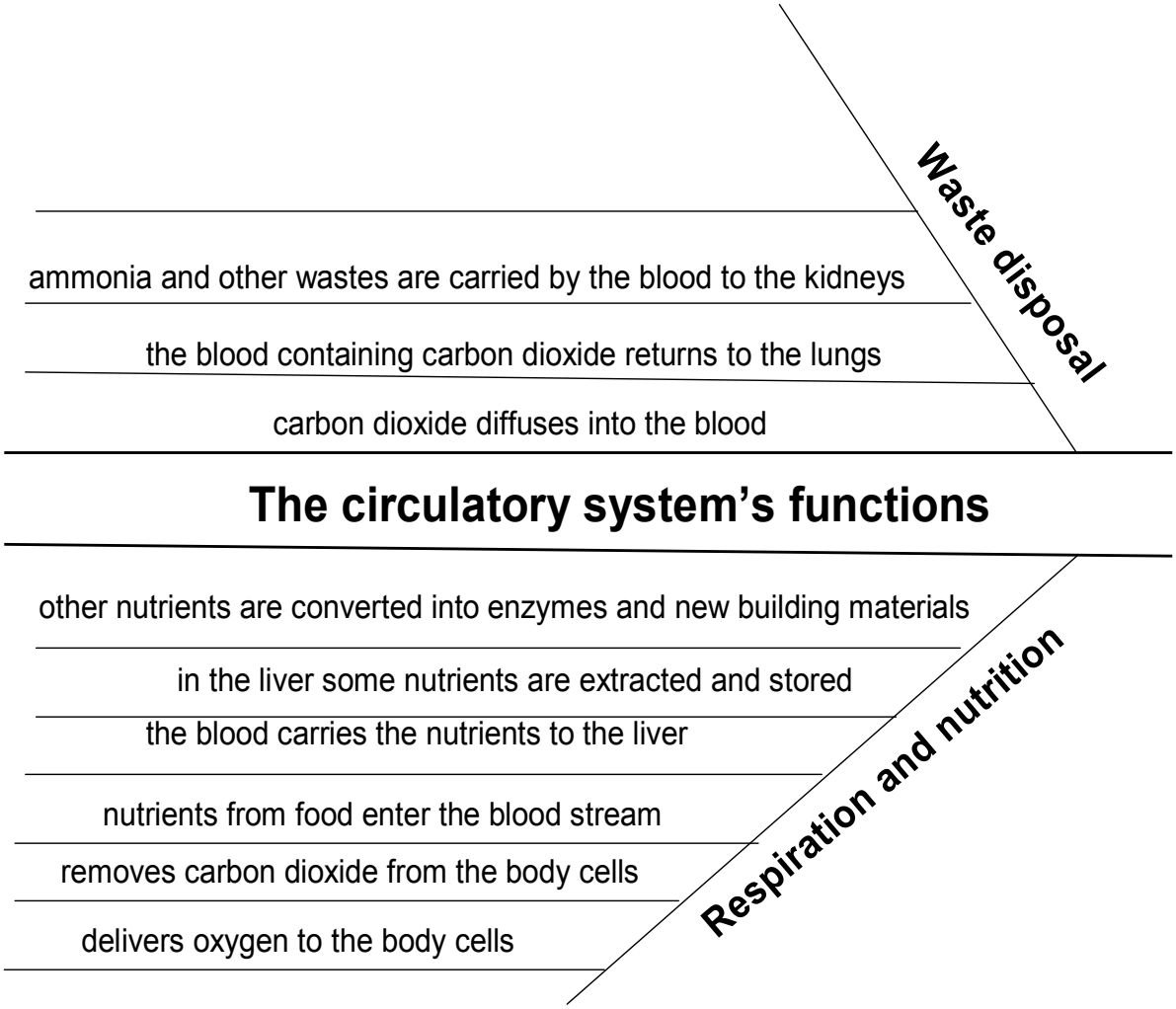
In respiration it delivers oxygen to the body's cells and removes (takes away) carbon dioxide from them.

In nutrition, **it carries digested food substances to the cells**. Nutrients from food enter the bloodstream (the blood flowing through the circulatory system) by passing through the walls of the small intestine into the capillaries. The blood then carries most of the nutrients to the liver (a large organ in the body that produces bile), where some of these are extracted and stored (accumulated) to be liberated into the blood as and when the body needs them. Other nutrients are transformed by the liver into substances which are required in the production of energy, enzymes, and new building materials for

the body. Hormones, which affect (have an effect on) or control the activities of various organs and tissues, are produced by the endocrine glands - including the thyroid, pituitary (the master gland of the endocrine system, located at the base of the brain), adrenal (close to the kidney), and sex glands (secretor organ) - and they too are transported by the blood through the body.

Waste disposal

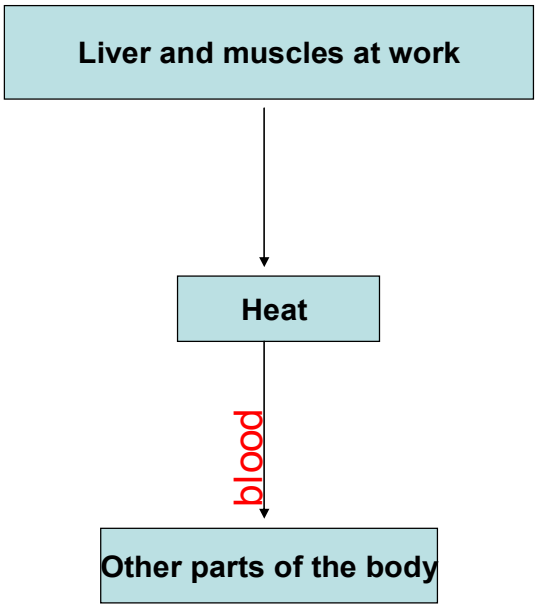
In addition to nourishing the body, **the circulatory system also helps to dispose of waste** (materials that are no more needed and are to thrown away) **products and poisons which would prove dangerous if allowed to accumulate**. Carbon dioxide (CO_2), produced by the body's cells as they respire (breath), diffuses through the walls of the capillaries into the blood. **The blood containing carbon dioxide** (CO_2) **is returned via** (through) **the heart to the lungs and passed out of the body on expiration**. In processing (digesting) food, the liver removes (takes away) ammonia (pungent substance) and other wastes (materials that are no more needed and are to thrown away), together with various poisons that enter the body through the digestive system. These are converted (transformed) into water-soluble (that can melt into water) substances, which are carried by the blood to the kidneys (excretory organs that filter wastes, especially urea, from the blood and excrete them and water in urine). **The kidneys then filter out** (remove by passing through a filter) **these wastes and expel them from the body in urine.**

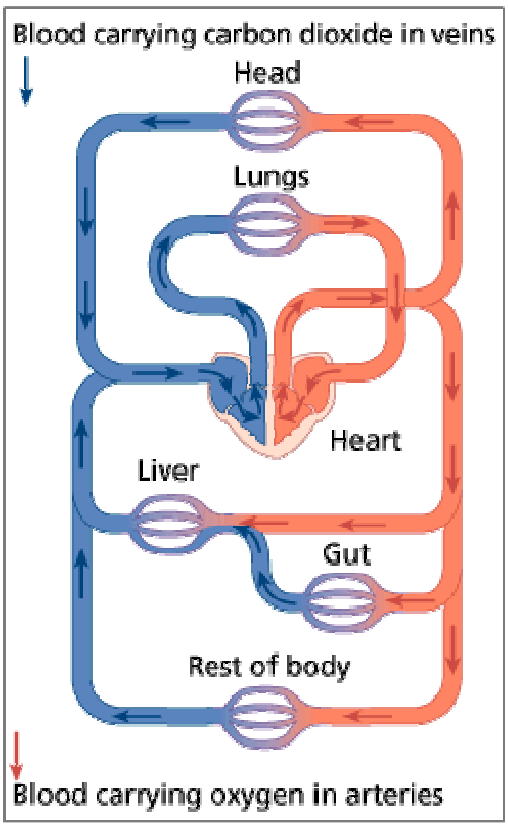


Temperature control

As well as the heat produced generally by cells during respiration, some parts of the body, such as the liver and muscles, produce heat in the course of their activities. This **heat is transported by the blood to warm other parts of the body**. **As the temperature of the body rises, the flow** (continuous movements) **of blood into vessels in the skin increases as a result of small arteries expanding, and excess** (extra) **heat is conveyed to the surface where it is lost. When the temperature of the body drops** (falls down) **the flow of blood to the skin is restricted**. Thus, the circulatory

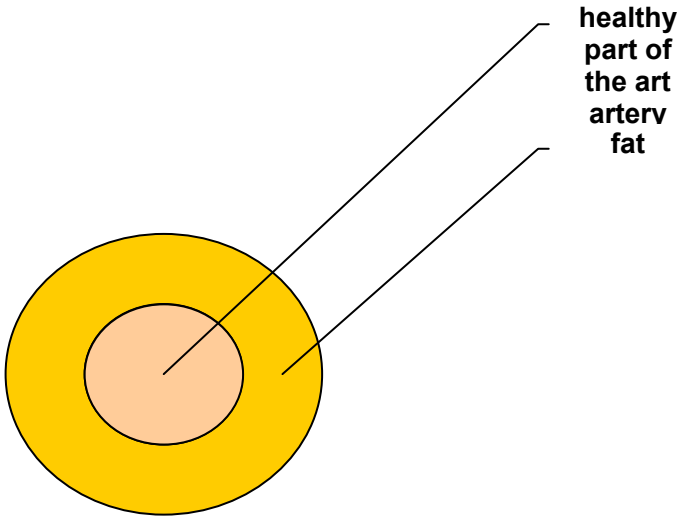
system acts as a natural thermostat allowing the body to maintain an optimum and stable (unchanging) temperature.





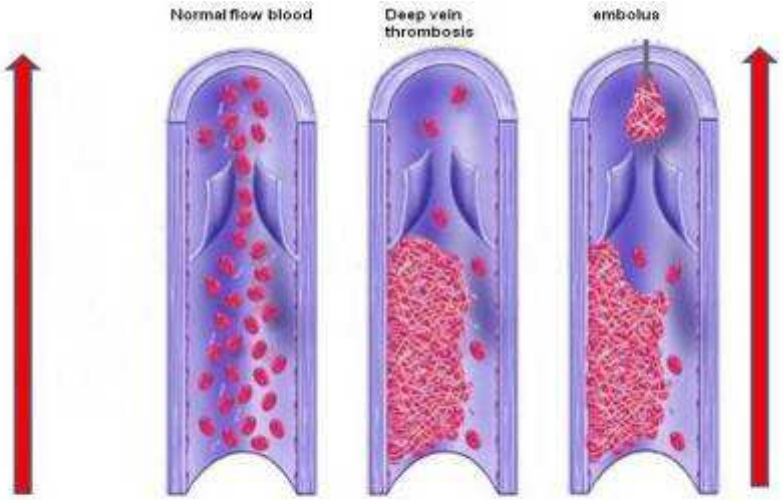
Disease and disorders

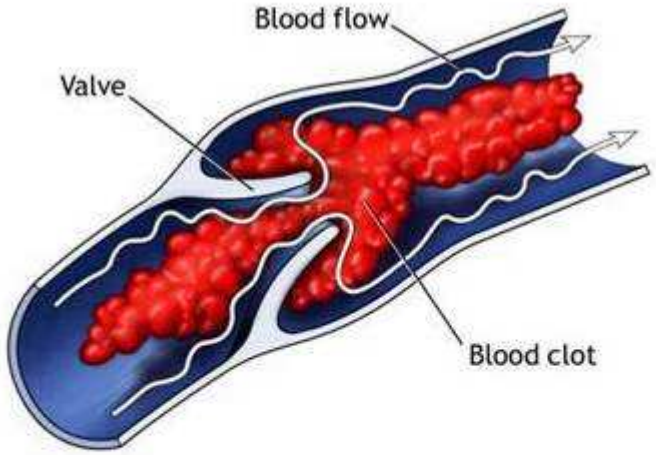
One of the most **common diseases** (illnesses) of the circulatory system is **arteriosclerosis**, a slow deterioration of arteries that results from the **accumulation of fatty deposits** (deposits of fat) **in the arteries**.



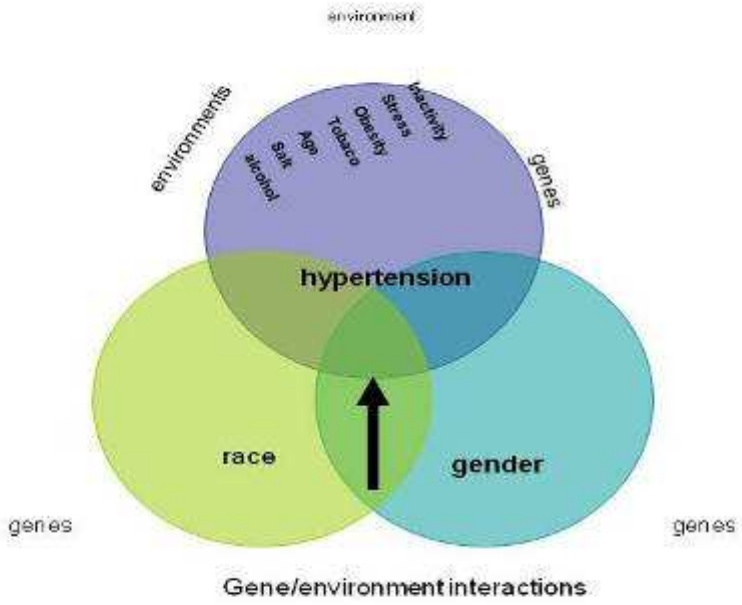
If it affects (attacks) **the arteries supplying blood to the walls of the heart, it is called heart disease**. The deposits thicken (make become bigger) the walls of the arteries and reduce their elasticity, thus restricting the flow of blood. **If a blood clot** (coagulum) **then develops in the affected vessels (thrombosis), this can further inhibit** (render difficult) **the circulation and lead to a heart attack or, if it affects** (attacks) **the brain, a stroke** (the rupture or occlusion of a blood vessel that leads to oxygen lack in the brain) **- where the brain does not receive enough blood**.

Sections of veins affected by thrombosis

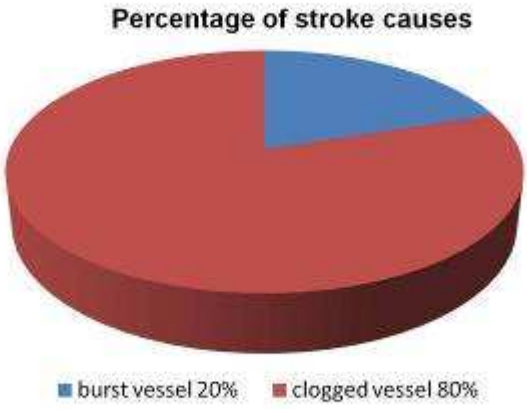


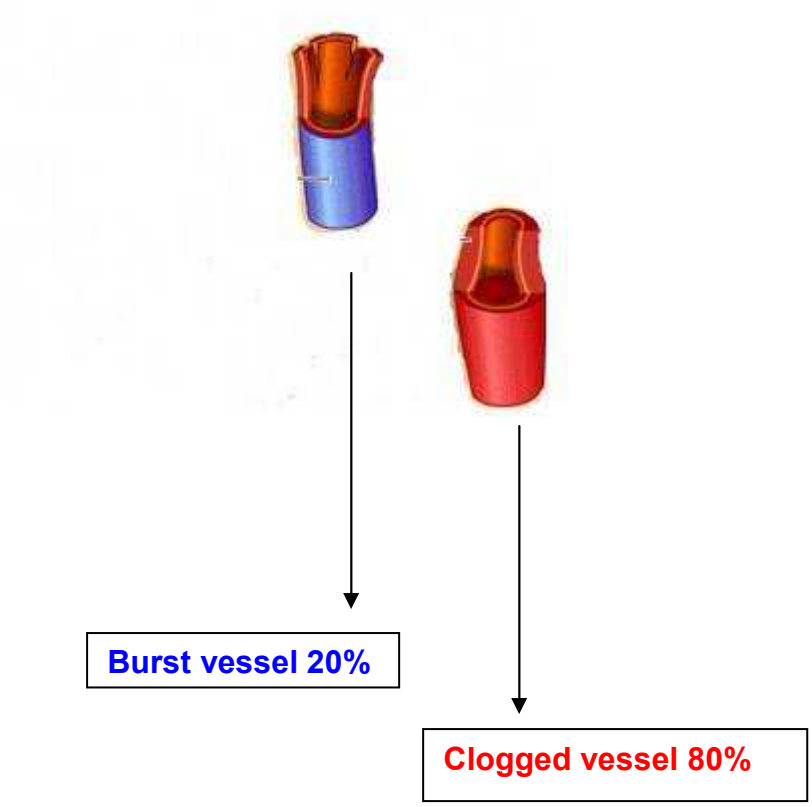


Arteriosclerosis can also lead to increased blood pressure, or hypertension (high blood pressure), as the heart is forced to work harder to force the blood through the arteries. This too can result in a heart attack or stroke, or in kidney (excretory organs that filter wastes, especially urea, from the blood and excrete them and water in urine) failure (malfunction).



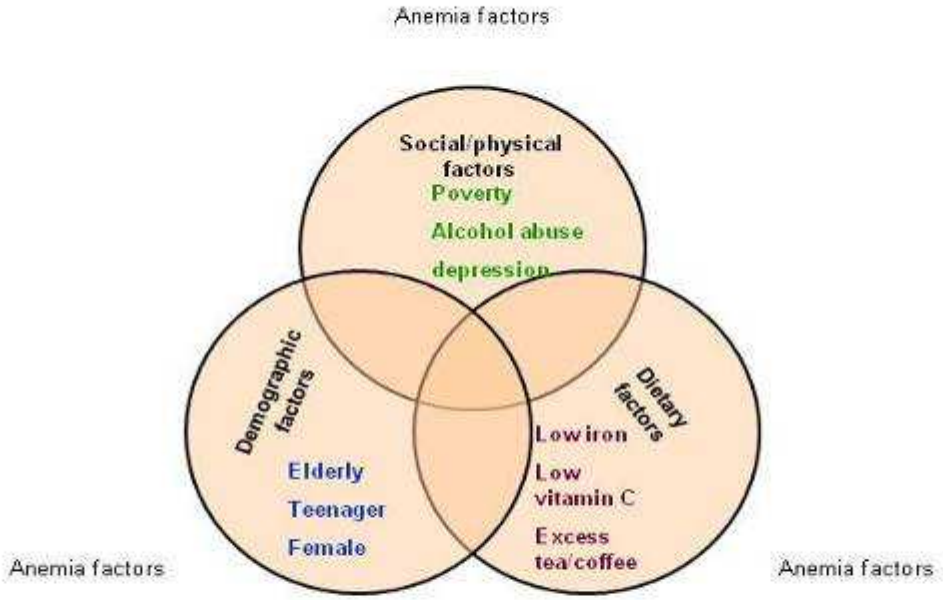
Gene/environment interactions

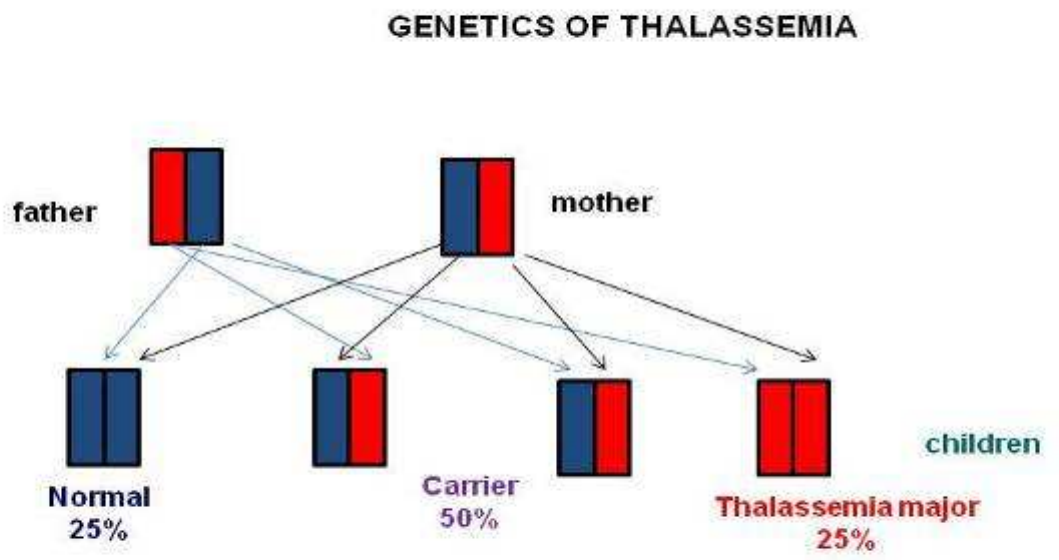




There are **other disorders** which can result from damage or defects in the heart or blood vessels. For example**, bacteria may harm or destroy the valves that control the flow of blood through the heart**. Incomplete development of the heart or its blood vessels before birth may produce congenital (present at birth) heart disorders.

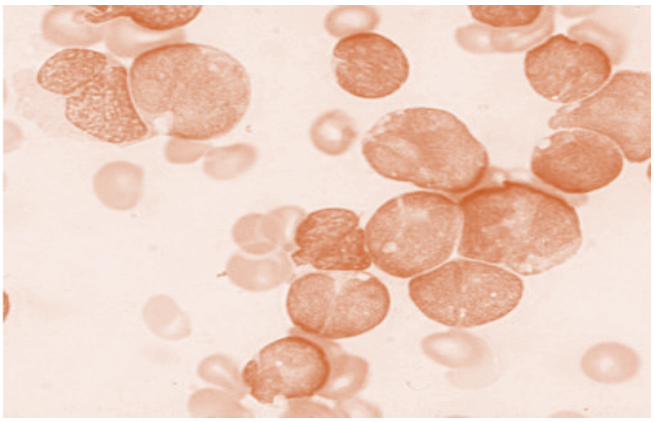
Disorders of the blood itself**,** such as **anaemia** (a deficiency of red blood cells), **can happen when the quantity of haemoglobin** (a protein of blood composed of globin and heme that gives red blood cells there characteristic colour) **- the oxygen-carrying pigment in the blood - is insufficient and the blood cannot carry enough oxygen**. This can lead to excessive fatigue (tiredness), breathlessness (shortness of breath), and reduced immunity to infections. **Iron-deficiency** (insufficiency) **anaemia results from lack of iron necessary for the production of haemoglobin**.

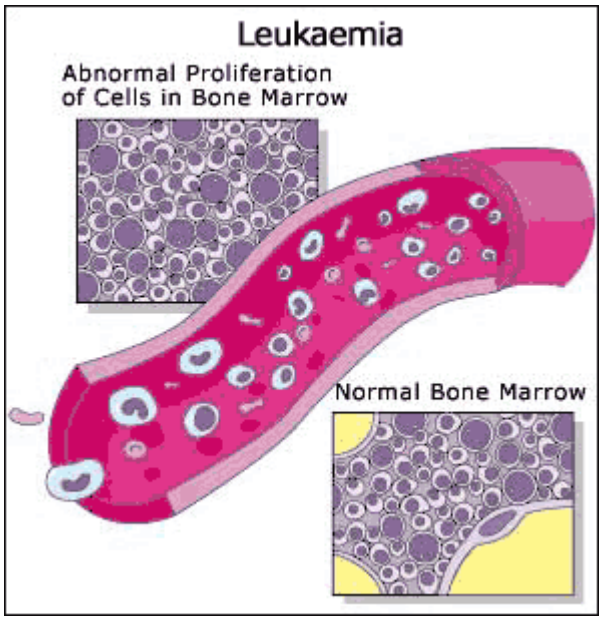


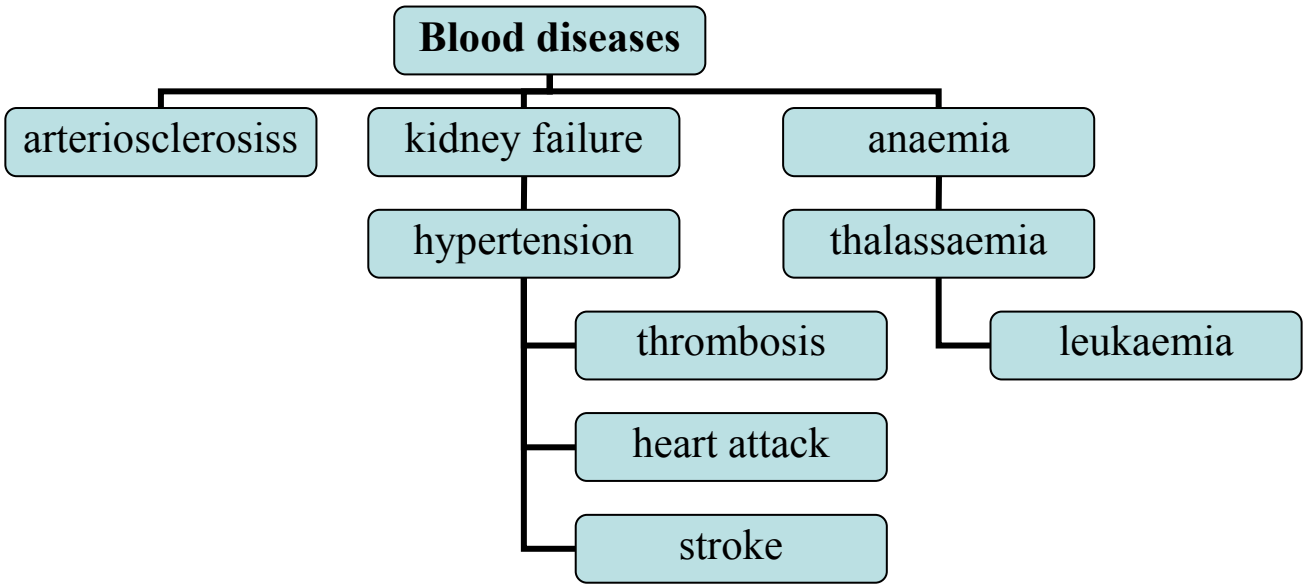


Conditions such as sickle-cell (red blood corpuscle) anaemia and **thalassaemia** are **associated with abnormal forms of haemoglobin**. **Impaired** (damaged) **production of red blood cells** in the bone marrow (soft substance inside human and animal bones) can result in pernicious (dangerous) **anaemia or leukaemia**, while **problems affecting the production of white blood cells can impair** (damage) **the body's immune system**.

Blood affected by leukaemia




Leukaemia
Abnormal Proliferation
of Cells in Bone Marrow
Normal Bone Marrow


Blood diseases
arteriosclerosiss
kidney failure
anaemia
hypertension
thalassaemia
thrombosis
leukaemia
heart attack
stroke

REVISION CORNER