Unit 4.3 Blood and circulation

context

Blood is the river of life. It transports oxygen and nutrients to the cells and takes carbon dioxide and waste away from them for removal. Also, blood transports heat around your body and helps you fight disease. The heart pumps blood around a network of tubing 150 000 kilometres long. This is known as the circulatory system.

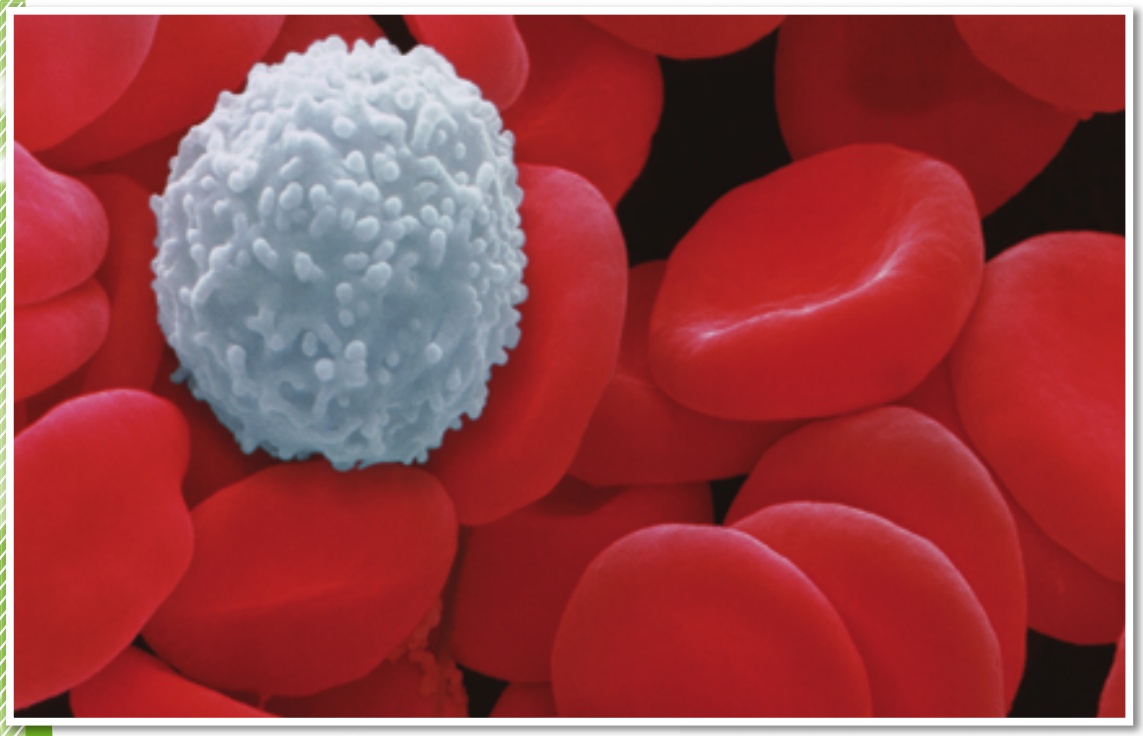

Fig 4.3.1 Red blood cells and a single white blood cell

Blood

Your **blood** has three main jobs:

- It carries oxygen, glucose, water and nutrients from the respiratory and digestive systems to the cells.
- It removes waste material and carbon dioxide from the cells.
- It maintains body temperature by delivering heat produced in the liver.

The human body contains about 5.5 litres of blood, which is made up of red and white blood cells, platelets and plasma.

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The heart

Your heart is about the same size as your clenched fist. Its position and orientation is given roughly by placing your right fist in the centre of your chest and letting it hang.

The heart pumps blood around the body, beating at around 90 to 120 beats per minute for children and 70 beats per minute for adults. Super-fit athletes may have heart rates below 30! Nerve impulses generated within the heart trigger each beat.

The heart is made of a strong type of muscle called **cardiac muscle**. In adults, the heart pumps up to 5 litres of blood every minute and up to 40 litres when beating rapidly during exercise or stress.

The heart is really two pumps joined together that push the blood out to different places in the body.

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Science Clip

Blue blooded!

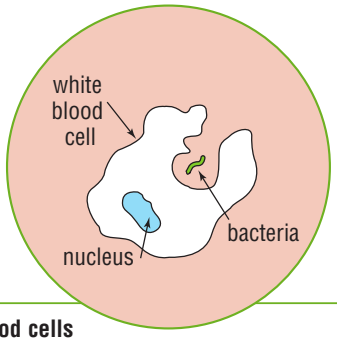
Not all creatures have red blood. A lobster has blue-green blood due to the copper chemicals in it. A starfish has clear, watery blood.

Plasma

Plasma is a clear, yellow liquid, 90% of which is water. In the body, white and red blood cells and platelets are suspended in plasma and are transported with it.

Platelets

Platelets are broken-up blood cells. They trigger the formation of fibrin strands, shown here trapping red blood cells, a single white blood cell and smaller platelets, to form a clot.



White blood cells

White blood cells help rid the body of bacteria and viruses by surrounding and destroying them, or by producing chemicals to kill them. Here, a white blood cell engulfs bacteria.

Red blood cells

Red blood cells carry an iron-containing substance called haemoglobin. Haemoglobin carries oxygen and is what gives blood its red colour.

Fig 4.3.2 Blood settles readily into its different parts—55% plasma and 45% red cells, with small amounts of white blood cells and platelets.

Go to Science Focus 1, Unit 5.3

Science Fact File

Blood types

Blood transfusions can be deadly if blood is not matched between the donor and the recipient.

There are several types of human blood. Blood can be classified in two ways:

- **blood type**—Blood contains no more than two types of **antigen** (i.e. antigens A or B). Type A blood contains antigen A, type B blood contains antigen B, type AB blood contains both, and type O blood contains neither antigen A nor B. The most common type of blood is type O.
- **Rhesus factor**—Rhesus is another type of antigen. Blood that contains the Rhesus antigen is classified as Rhesus positive (Rh+). Blood without the Rhesus antigen is classified as Rhesus negative (Rh–).

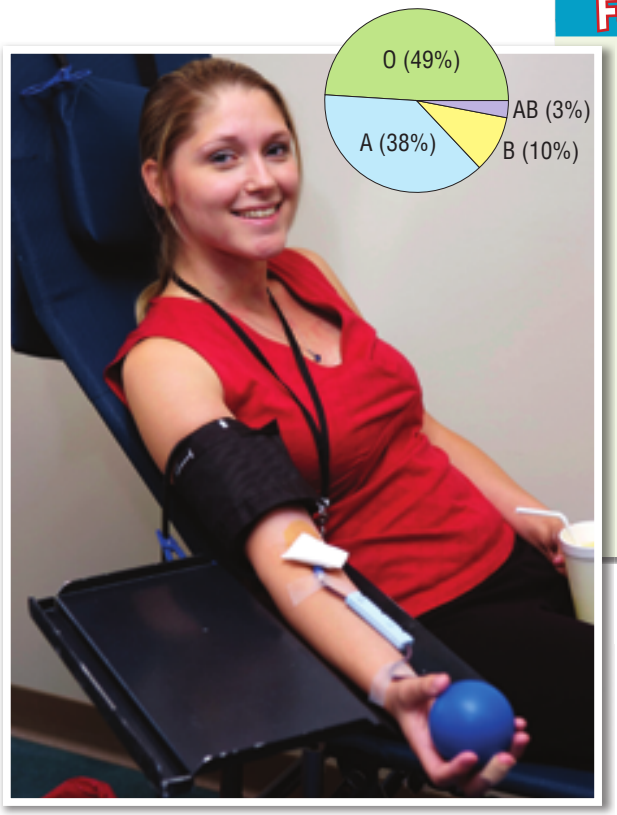


Fig 4.3.3 For a blood transfusion to be safe, the donor blood must not contain any antigens that are not already in the recipient's blood. Otherwise blood cells are likely to clump together and form deadly blockages. **Inset:** This pie chart shows the percentages of each blood type in the Australian population.

The 'right' pump draws blood from the body and sends it to the lungs to pick up oxygen. Blood that has had most of its oxygen removed is said to be deoxygenated. Deoxygenated blood is a dull red-blue colour.

The pulmonary artery carries deoxygenated blood to the lungs for removal of carbon dioxide and to receive a new load of oxygen.

The 'left' pump receives the oxygen-rich blood from the lungs and then pushes it out to the head and the body. Blood that is rich in oxygen is said to be oxygenated. Oxygenated blood is bright red.

The walls of the left side of the heart are thicker than those on the right side as they must withstand greater pressure. For the same reason, the walls of each ventricle are thicker than those of the corresponding atrium.

The vena cava is the main vein from the body, carrying deoxygenated blood back to the heart.

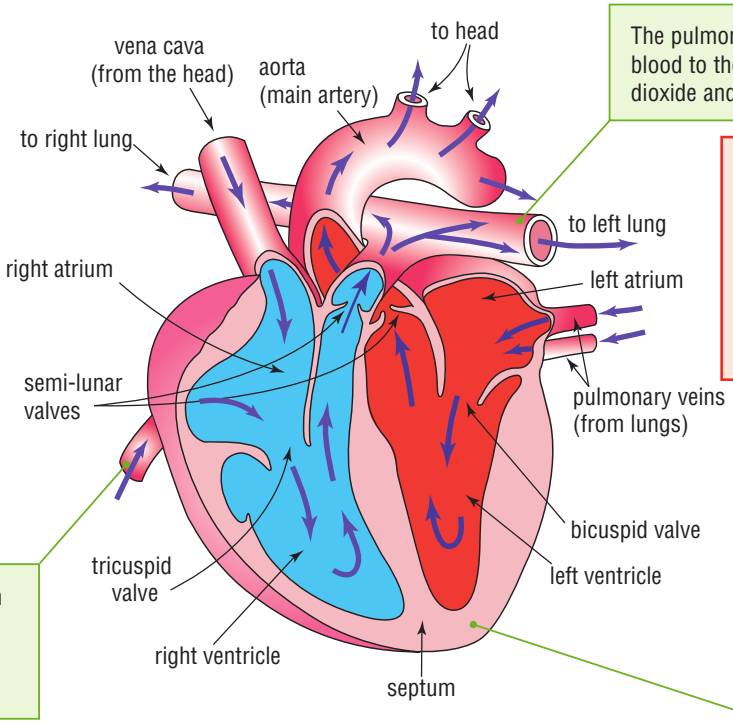


Fig 4.3.4 A cross-section of the human heart. Imagine placing the heart inside the chest of its owner. Although the 'left' and 'right' labels seem opposite to you, they make sense to the owner.

Science Clip

Super pump

Your heart is really a super pump—it could fill a petrol tanker in one day!

Worksheet 4.3 The heart

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Blood vessels

Blood travels along tubes called **blood vessels**, and the adult body contains over 150 000 kilometres of them. There are three types of blood vessels—**arteries**, **capillaries** and **veins**.

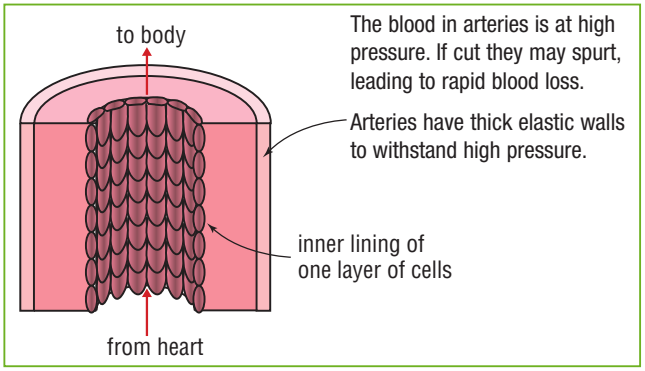

Fig 4.3.5 Arteries carry oxygenated blood away from the heart to the organs and tissues. A regular surge, or 'pulse', can be felt at several pressure points around the body where blood passes through arteries close to bones.

PP Drag-and-drop

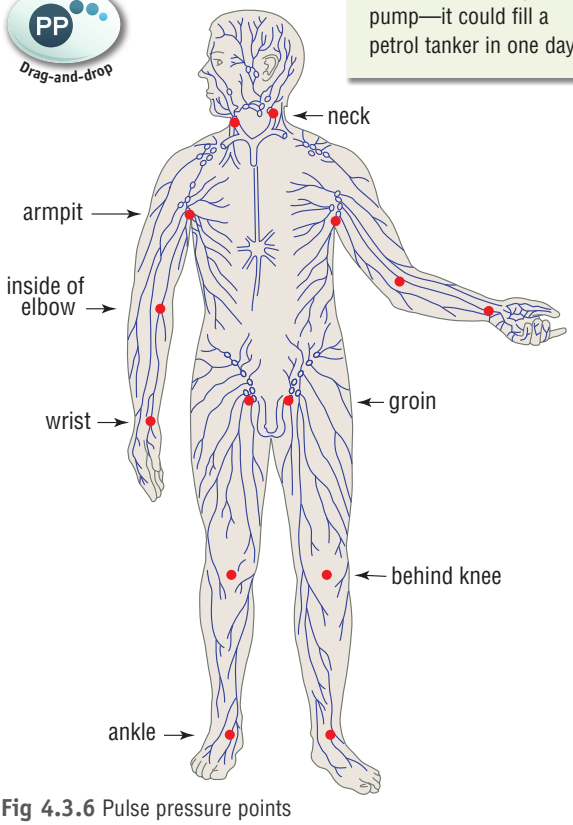

Fig 4.3.6 Pulse pressure points