

# Blood and the Circulation

## You must be able to:

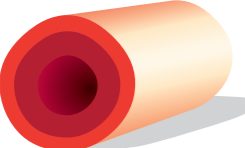
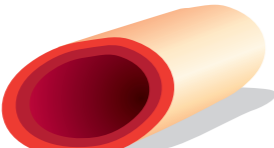
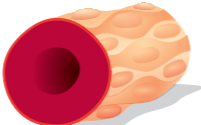
- Explain how the components of blood are adapted for their roles
- Explain how the different types of blood vessels are adapted for their functions
- Describe the structure and function of the heart
- Explain the adaptations that allow gaseous exchange to take place between the lungs and the blood.

## Blood

- Blood is a tissue.
- It is made of a liquid called **plasma**, which has three different components suspended in it:
  - red blood cells
  - white blood cells
  - platelets.
- Plasma transports various chemical substances around the body, such as the products of digestion, hormones, antibodies, urea and carbon dioxide.
- Red blood cells:
  - contain **haemoglobin**, which binds to oxygen to transport it from the lungs to the tissues and cells, which need it for respiration
  - do not contain a nucleus, so there is more room for haemoglobin
  - are very small, so they can fit through the tiny capillaries
  - are shaped like biconcave discs, giving them a large surface area that oxygen can quickly diffuse across.
- White blood cells:
  - help to protect the body against infection
  - can change shape, so they can squeeze out of the blood vessels into the tissues or surround and engulf microorganisms.
- Platelets are fragments of cells, which collect at wounds and trigger blood clotting.

## Blood Vessels

- The blood passes around the body in blood vessels.
- The body contains three different types of blood vessel:

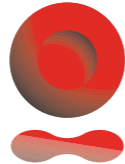
Arteries	Veins	Capillaries
<ul style="list-style-type: none"> <li>• Take blood from your heart to your organs.</li> <li>• Thick walls made from muscle and elastic fibres.</li> </ul> 	<ul style="list-style-type: none"> <li>• Take blood from your organs to your heart.</li> <li>• Thinner walls and valves to prevent backflow.</li> </ul> 	<ul style="list-style-type: none"> <li>• Allow substances needed by the cells to pass out of the blood.</li> <li>• Allow substances produced by the cells to pass into the blood.</li> <li>• Narrow, thin-walled blood vessels.</li> </ul> 

### Key Point

**In the lungs:**  
haemoglobin + oxygen → oxyhaemoglobin

**In the tissues:**  
oxyhaemoglobin → haemoglobin + oxygen

Red Blood Cell



No nucleus, so packed full of haemoglobin to absorb oxygen.

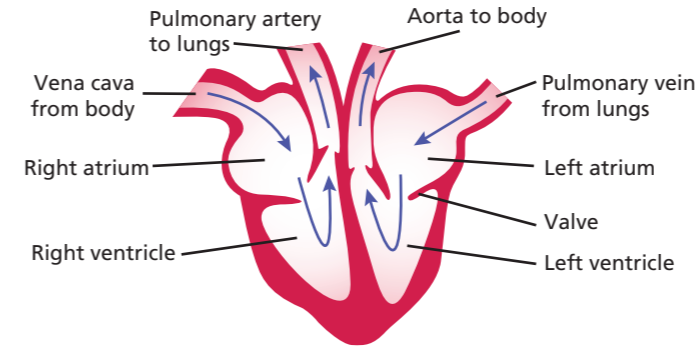
White Blood Cell



Can change shape in order to engulf and destroy invading microorganisms.

## The Heart

- The heart pumps blood around the body in a **double circulatory system**.
- Blood passes through the heart twice on each circuit.
- There are four chambers in the heart:
  - the left and right **atria**, which receive blood from veins
  - the left and right **ventricles**, which pump the blood out into arteries.



- Blood enters the heart through the atria.
- The atria contract and force blood into the ventricles.
- The ventricles then contract and force blood out of the heart.
- Valves make sure the blood flows in the correct direction.
- The natural resting heart rate is controlled by a group of cells located in the right atrium, which act as a **pacemaker**.
- Artificial pacemakers are electrical devices used to correct irregularities in the heart rate.

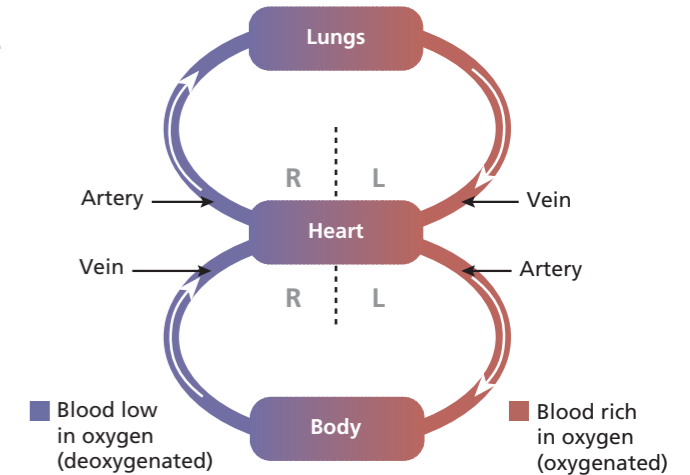
## Gaseous Exchange

- The heart sends blood to the lungs via the **pulmonary artery**.
- Air obtained by breathing reaches the lungs through the **trachea** (windpipe), which has rings of **cartilage** to prevent it collapsing.
- The trachea divides into two tubes – the **bronchi**.
- The bronchi divide to form **bronchioles**.
- The bronchioles divide until they end in tiny air sacs called **alveoli**.
- There are millions of alveoli and they are adapted to be very efficient at exchanging oxygen and carbon dioxide:
  - They have a large, moist surface area.
  - They have a very rich blood supply.
  - They are very close to the blood capillaries, so the distance for gases to diffuse is small.
- The blood is taken back to the lungs through the **pulmonary vein**.

### Quick Test

1. Which component of blood makes it clot?
2. How are red blood cells adapted to carry oxygen?
3. Which type of blood vessel carries blood away from the heart?
4. In which chamber does deoxygenated blood enter the heart?
5. What do the heart and veins contain to prevent backflow of blood?

## Revise



### Key Point

The pulmonary artery is unusual because, unlike other arteries, it carries deoxygenated blood. The pulmonary vein carries oxygenated blood.

### Key Words

plasma  
haemoglobin  
double circulatory system  
atria  
ventricles  
pacemaker  
pulmonary artery  
trachea  
cartilage  
bronchi  
bronchioles  
alveoli  
pulmonary vein