

Transport in Animals

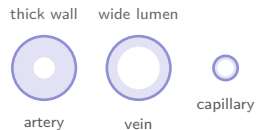
IGCSE Biology ■ Topic 9

IGCSE Biology



What we will cover

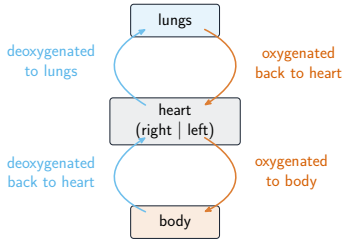
- 1 Single & double circulation
- 2 The heart
- 3 Heart rate & disease
- 4 Blood vessels
- 5 Blood & its defence



blood vessels

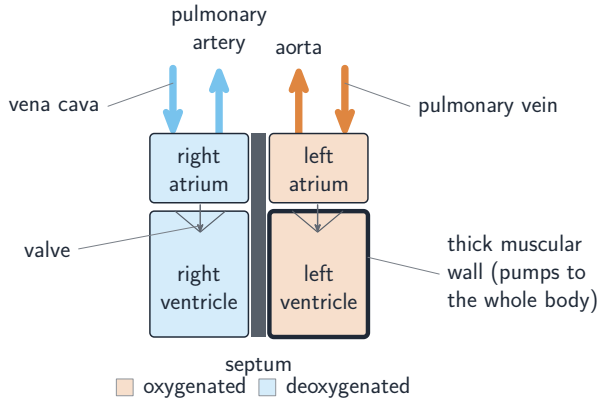


Single and double circulation



- A fish has a **single circulation** : the blood passes through the heart **once** on each trip around the body.
- A **mammal** has a **double circulation** : the blood passes through the heart **twice** on each full trip – once on the way to the lungs, and once on the way to the rest of the body.
- The advantage of a double circulation: the blood can be pumped again at **high pressure** before going to the body, so it travels faster and delivers **oxygen** quickly.

The heart



Four chambers: two **atria** (top) & two **ventricles** (bottom), split by the **septum** .

- left ventricle wall is **thickest** (pumps to the whole body)
- valves stop backflow

The four great vessels, and where each goes

Vena cava

Brings deoxygenated blood from the body into the right atrium.

Pulmonary artery

The **pulmonary artery** carries deoxygenated blood from the right ventricle to the lungs – the one artery that carries deoxygenated blood.

Pulmonary vein

The **pulmonary vein** returns oxygenated blood from the lungs to the left atrium – the one vein that carries oxygenated blood.

Aorta

Leaves the left ventricle for the whole body, which is why that wall is the thickest. To the kidney: **renal artery** in, **renal vein** out.

An artery carries blood away from the heart and a vein back to it. Oxygen is not part of the definition – the two pulmonary vessels prove it.

Heart rate and disease

exercise

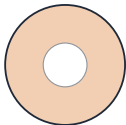
heart rate rises, so
blood reaches muscles
faster with O₂ & glucose

coronary heart disease

coronary arteries narrow; risks:
fatty diet, smoking, no exercise

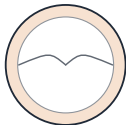


Blood vessels



artery

thick muscular,
elastic wall;
narrow lumen;
high pressure



vein

thin wall;
wide lumen;
has **valves**;
low pressure



capillary

wall one cell
thick; lets
substances be
exchanged

- **arteries** – thick, away at high pressure
- **veins** – thin, wide, **valves**, back
- **capillaries** – one cell thick; exchange

Main: **aorta** / **vena cava**,
pulmonary, renal.

What the blood is carrying, and what defends it

Red blood cells

Red blood cells carry oxygen using the red pigment **haemoglobin**. No nucleus, and a biconcave shape – both give more room and more surface for oxygen.

Phagocytes

Phagocytes carry out **phagocytosis**: they surround and digest pathogens.

Lymphocytes

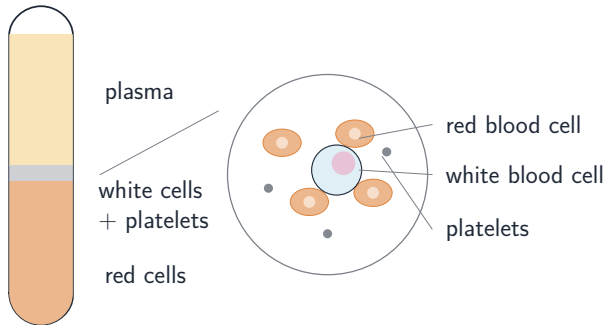
Make **antibodies** shaped to one antigen, and leave memory cells behind.

Capillaries

One cell thick and very narrow, giving a large **surface area** and a short diffusion distance – the whole point of the circulation.

Every structure here is a shape that fits a job. Say the feature *and* the job it serves.

Blood



- **red cells** – carry O_2 via **haemoglobin**
- **white cells** – defence
- **platelets** – **clotting**
- **plasma** – carries everything else

Defence and clotting

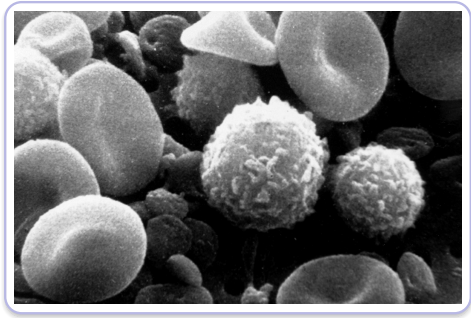
white blood cells

phagocytes engulf **pathogens** ;
lymphocytes make **antibodies**

clotting

fibrinogen → **fibrin** threads
trap cells & seal the wound

Blood, continued



Real blood cells under an electron microscope: red cells (discs), white cells and platelets

The vessels, the chambers, and what plasma carries

the lumen

the space inside a vessel – narrow in an artery, wide in a vein, tiny in a capillary

the atrium

receives blood; the **ventricle** pumps it out, so its wall is far thicker

atrioventricular valves

stop backflow from ventricle to atrium; semilunar valves stop it from the arteries

deoxygenated blood

right side of the heart, to the lungs; oxygenated blood returns to the left side

plasma

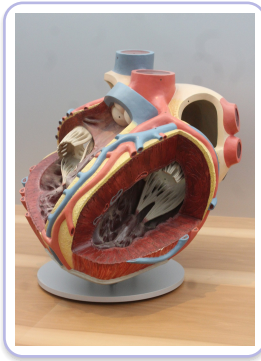
a liquid carrying blood cells, **ions** , **nutrients** , **urea** , hormones and **carbon dioxide**

the liver's vessels

(Supplement) **hepatic artery** in, **hepatic vein** out, and the **hepatic portal vein** from the gut

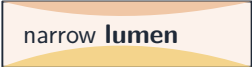
Clotting seals a wound: it stops blood loss **and** stops pathogens getting in. (Supplement) fibrinogen becomes insoluble fibrin, which traps the cells.

The heart, continued



A museum model of the heart: four chambers, and a left ventricle wall you can see is the thicker one

Coronary heart disease



narrow **lumen**

coronary heart disease: fatty build-up narrows the coronary artery, so the heart muscle cannot get enough **oxygen**

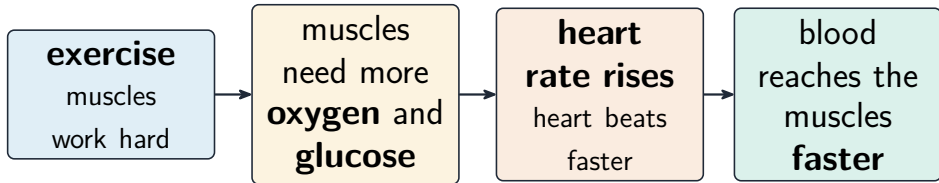
risk factors

high-fat diet smoking lack of exercise stress family history older age

a healthy diet regular exercise **lower the risk**

Coronary heart disease narrows the artery; several risk factors raise it and a healthy lifestyle lowers it

Heart rate and exercise



check the heart's activity by feeling the **pulse**, listening to the valves, or with an **ECG**

During exercise the heart rate rises so blood reaches the muscles faster

Exam tips

- Circulatory system = pump (heart) + vessels + valves for one-way flow.
- Double circulation (mammals): blood passes through the heart twice. The left ventricle wall is thickest because it pumps to the whole body.
- Arteries carry blood **away** (thick, high pressure); veins carry it **back** (valves, low pressure); capillaries are for exchange (one cell thick).
- Blood = red cells (oxygen, haemoglobin) + white cells (defence) + platelets (clotting) + plasma (transport).
- Phagocytes engulf pathogens; lymphocytes make antibodies.



Worked example – why is one wall thicker?

Explain why the left ventricle wall is much thicker than the right.

- The **right** ventricle pumps blood only to the **lungs** – a short trip, and delicate capillaries.
- Too high a pressure would **damage** them.
- The **left** ventricle pumps to the **whole body**, a much longer distance.
- A thicker **muscle** wall contracts harder $\Rightarrow$ **higher pressure**.

Thicker wall = more **muscle** = more force = higher pressure. Say **muscle**, and say **how far the blood must travel**.

Topic 9 – key takeaways

1

Double

blood passes the heart twice each trip

2

Heart

left ventricle is thickest; valves stop backflow

3

Vessels

arteries away, veins back, capillaries exchange

4

Blood

red O₂, white defence, platelets clot, plasma

Check yourself

- 1 Why is the left ventricle wall the thickest?
- 2 Which vessel carries blood away from the heart?
- 3 What pigment lets red cells carry oxygen?
- 4 How do lymphocytes fight pathogens?



Answers 1. it pumps blood to the whole body 2. an artery 3. haemoglobin 4. they make antibodies