

Transport in Animals

IGCSE Biology ■ Topic 9

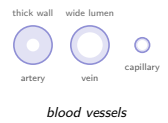
IGCSE Biology



Transport in Animals

What we will cover

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

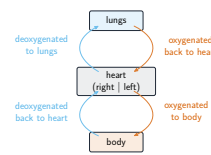


1 Heart and circulation

Transport in Animals

Heart and circulation

Single and double circulation

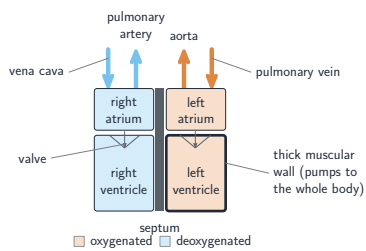


- A fish has a **single circulation** 单循环: the blood passes through the heart **once** on each trip around the body.
- A **mammal** 哺乳动物 has a **double circulation** 双循环: the blood passes through the heart **twice** on each full trip – once on the way to the lungs, and once on the way to the rest of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

Transport in Animals

Heart and circulation

The heart



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

- 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** 肺动脉 carries deoxygenated blood from the right ventricle to the lungs – the one artery that carries deoxygenated blood.

Pulmonary vein The **pulmonary vein** 肺静脉 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** 肾动脉 in, **renal vein** 肾静脉 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 心率 rises, so
blood reaches muscles
faster with O₂ & glucose

coronary heart disease 冠心病
coronary arteries narrow; risks:
fatty diet, smoking, no exercise

2 Vessels and blood

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** 动脉 – thick, *away* at high pressure
 - **veins** 静脉 – thin, wide, **valves** 瓣膜, back
 - **capillaries** 毛细血管 – one cell thick; exchange
- Main: **aorta** 主动脉/**vena cava** 腔静脉, pulmonary, renal.

What the blood is carrying, and what defends it

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

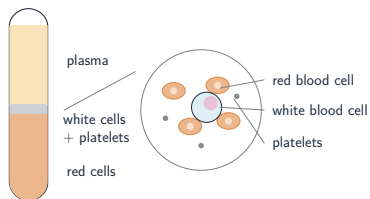
Phagocytes **Phagocytes** 吞噬细胞 carry out **phagocytosis** 吞噬作用: they surround and digest pathogens.

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

Capillaries One cell thick and very narrow, giving a large **surface area** 表面积 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



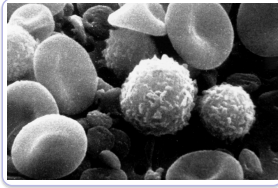
- **red cells** 红细胞 – carry O₂ via **haemoglobin** 血红蛋白
- **white cells** 白细胞 – defence
- **platelets** 血小板 – clotting 凝血
- **plasma** 血浆 – carries everything else

Defence and clotting

white blood cells
phagocytes 吞噬细胞 engulf **pathogens** 病原体;
lymphocytes 淋巴细胞 make **antibodies** 抗体

clotting
fibrinogen 纤维蛋白原 →
fibrin 纤维蛋白 threads
trap cells & seal the wound

Blood, continued



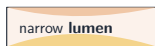
Real blood cells under an electron microscope: red cells (discs), white cells and platelets

The vessels, the chambers, and what plasma carries

the lumen 管腔	the space inside a vessel – narrow in an artery, wide in a vein, tiny in a capillary
the atrium 心房	receives blood; the ventricle pumps it out, so its wall is far thicker
atrioventricular valves 房室瓣	stop backflow from ventricle to atrium; semilunar valves stop it from the arteries
deoxygenated blood 脱氧血	right side of the heart, to the lungs; oxygenated blood returns to the left side
plasma 血浆	a liquid carrying blood cells, ions 离子, nutrients 营养物质, urea 尿素, hormones and carbon dioxide 二氧化碳
the liver's vessels	(Supplement) hepatic artery 肝动脉 in, hepatic vein 肝静脉 out, and the hepatic portal vein 肝门静脉 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.

Coronary heart disease



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

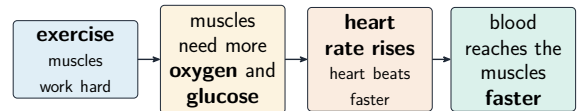
risk factors

high-fat diet | smokin | lack of exercise | stress | family histo | older age

a healthy die | 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.

3 Recap

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 ⇒ **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