

Exercise walk-through

The circulatory system ■ 8.1

eXercise

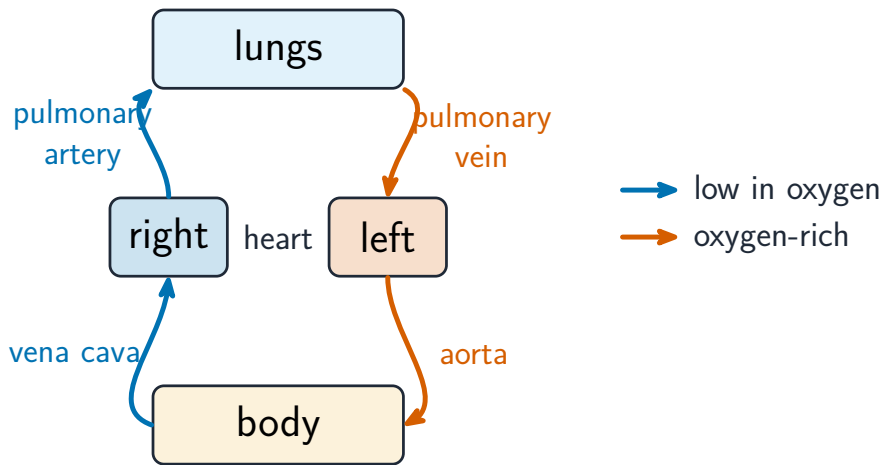
You must be able to

- describe the closed double circulation and the functions of the main vessels
- relate the structure of arteries, veins and capillaries to their functions
- describe the formation of tissue fluid in a capillary network

Method — Double circulation

Main vessels: **pulmonary artery** (heart → lungs, low O₂); **pulmonary vein** (lungs → heart, high O₂); **aorta** 主动脉 (heart → body); **vena cava** 腔静脉 (body → heart).

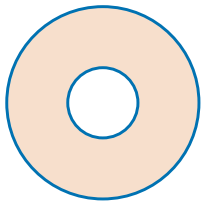
Method — Double circulation



Method — Vessel structure and function

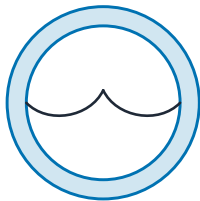
vessel	structure	function
artery	thick muscle + elastic 弹性 wall, narrow lumen	high-pressure flow; recoil smooths flow
capillary	wall one cell thick	short distance for exchange
vein	thin wall, wide lumen, valves 瓣膜	low-pressure return; valves stop backflow

Method — Vessel structure and function



artery

thick muscular,
elastic wall;
narrow lumen
(high pressure)



vein

thin wall;
wide lumen;
valves
(low pressure)



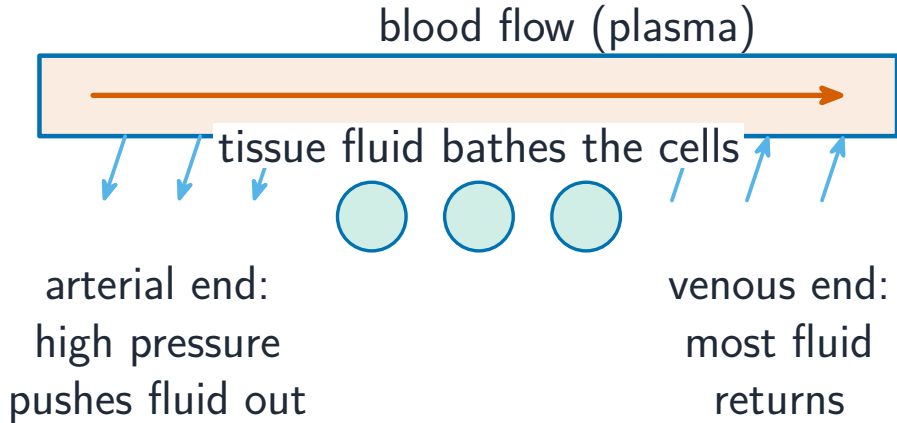
capillary

wall one cell
thick; very
narrow (exchange)

Method — Tissue fluid

At the arterial end the high blood pressure forces plasma (not cells or large proteins) out of the capillary to form **tissue fluid**, which supplies cells with O_2 and glucose. Most returns at the lower-pressure venous end.

Method — Tissue fluid



Practice 2.1 ■ 1 mark

Name the vessel that carries oxygen-rich blood from the lungs to the heart.

Solution 2.1

Method: Double circulation

Worked steps

the pulmonary vein **B1**.

Practice 2.2 ■ 2 marks

Explain why an artery has a thick wall of elastic fibres.

Solution 2.2

Method: Vessel structure and function

Worked steps

the elastic wall stretches when the heart pumps and recoils between beats **M1**,
smoothing the high-pressure flow / maintaining pressure **A1**.

Exam-style 3.1 ■ 1 mark

Which feature is found in veins but **not** in arteries?

A a muscular wall

B valves

C a lumen

D an endothelium

Solution 3.1

A a muscular wall

B valves



C a lumen

D an endothelium

Worked steps

B. Veins have valves to prevent backflow; arteries do not.

Exam-style 3.2 ■ 1 mark

Why is a capillary wall only one cell thick?

- A** to carry blood at high pressure
- B** to give a short diffusion distance for exchange
- C** to prevent backflow
- D** to store tissue fluid

Solution 3.2

Method: Vessel structure and function

- A to carry blood at high pressure
- B to give a short diffusion distance for exchange** 
- C to prevent backflow
- D to store tissue fluid

Worked steps

- B. A one-cell-thick wall gives a short diffusion distance for exchange.**

Exam-style 3.3 ■ 3 marks

- (a) Describe how tissue fluid is formed at the arterial end of a capillary.
- (b) State **two** substances that pass from the tissue fluid into the body cells.

Solution 3.3

Method: Tissue fluid

Worked steps

(a) at the arterial end the blood (hydrostatic) pressure is high **M1**; this forces plasma/fluid out through the capillary wall **M1**; cells and large plasma proteins stay in **A1**.

(b) oxygen and glucose **B1**.

Exam-style 3.4 ■ 2 marks

Explain why most tissue fluid returns to the capillary at the venous end.

Solution 3.4

Method: Tissue fluid

Worked steps

at the venous end the blood pressure is lower **M1**; and the plasma proteins left behind lower the water potential, so water returns by osmosis **A1**.