

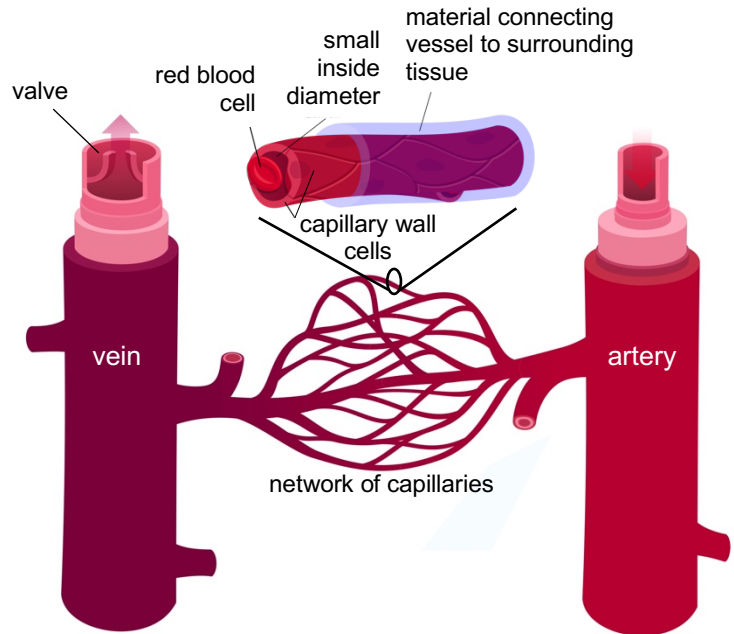
Blood vessels

The three main types of **blood vessel** are adapted for their functions.

Arteries carry blood away from the heart. They have thick, strong walls to withstand the high pressure of the blood being pumped out of the heart. Their walls are also elastic, which means that they stretch as blood enters and then pull inwards again. This widening and narrowing of the inside tube of the artery makes blood flow more smoothly.

Capillaries have walls that are only one cell thick, so substances pass easily into and out of them. They form huge networks in tissues, to make sure that all the cells in tissues are supplied with nutrients and oxygen, and that waste materials are taken away.

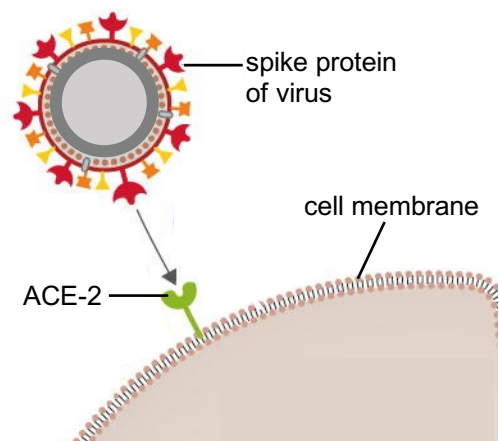
Veins carry blood back to the heart and have wide internal diameters. When blood reaches veins, it is under lower pressure and so vein walls do not need to be thick. The blood in most veins must flow against gravity. To help blood move towards the heart, veins contain **valves**. In the diagram above, the valve flaps open when blood flows in the direction of the arrow but shut if blood falls back down.



Clotting

The majority of blood is a straw-coloured liquid **plasma**, in which various substances are dissolved (e.g. nutrients, hormones, wastes). There are also **red blood cells** (to carry oxygen), **white blood cells** (to attack microorganisms) and **platelets** (fragments of cells that help clots to form).

The SARS-CoV-2 virus enters cells by attaching to a protein called ACE-2, which sticks out of the cell membrane of some cells. Cells in the alveoli of the lungs have ACE-2, and so the virus can destroy these cells if it gets deep into the lungs. If alveoli cells are destroyed, the virus can then get to the cells that form capillary walls (which also have ACE-2). If these cells are destroyed, the capillaries leak and this causes platelets to form clots (to stop the leaks). In people with severe forms of COVID-19, many clots form and some can move to other parts of the body and cause **heart attacks** and **strokes**.



Find out

1. What pushes blood up leg veins? _____
2. Some research suggests that having high blood pressure increases the number of clots.

Suggest a reason for this. _____

3. (Tricky!) Suggest why statins are being tested to see if they help with serious COVID-19.

Test yourself

4. Complete this flow chart to show how blood flows through blood vessels in your body.



5. Complete the table.

Blood vessel	Function	Adaptation
	smooth out blood flow	
	allow substances in and out	
	withstand high pressure	
	carry blood in one direction	

6. State a difference by which urea (a waste from the liver) and oxygen are carried in blood.

7. Give the name of the virus protein that attaches to a cell. _____

8. Explain why capillaries leak easily when attacked by the virus. _____

9. Some people have leg vein valves that do not work properly. Suggest a symptom of this.

Check-up

- I. Check your answers.
- II. Use scissors to make a tiny cut in the top (round part) of a party balloon.



Insert a drinking straw into the cut and push the straw halfway into the balloon. Use sticky tape to hold the straw in place and make a seal. Submerge the balloon in a glass of water. Blow out through the straw. Then try to drink water through the straw. Write a short description or make a short video of what you find and explain what this is a model of.

Answers

Note to home educators

This worksheet is designed to support understanding of blood and the circulatory system. You may wish to share these objectives with students:

- Explain how the structure of the blood is related to its function. (GCSE)
- Explain how the structure of the blood vessels is related to their function. (GCSE)

It is suggested that students complete the worksheet independently, using the internet for questions 1 - 3. Note that question 3 is difficult. Questions 4 - 9 should be completed without help from additional sources.

This sheet draws on material from the UK National Curriculum for Science for Key Stage 4 (GCSE) (Years 10 - 11). However, while the topic material does not form part of many Key Stage 3 (Years 7 – 9) programmes of study, the sheet should be accessible by many students at this stage. It may be useful for students to have completed Worksheet 4 before this one. Other sheets in the series are available: <https://shwca.se/covid19science>

If you wish to check the answers, keep this part of the sheet away from the questions!

1. The heart/blood pressure (as explained in the text the text) and muscles in the legs (from research).
2. High blood pressure is more likely to make damaged capillaries leak.
3. A hard question. Statins lower cholesterol levels. Cholesterol can form plaques that narrow blood vessels. It is thought that statins may reduce the narrowing of blood vessels and so clots that move are less likely to get stuck.
4. heart → arteries → capillaries → veins → heart
- 5.

Blood vessel	Function	Adaptation
artery	smooth out blood flow	elastic walls
capillary	allow substances in and out	thin walls (one cell thick)
artery	withstand high pressure	thick/strong walls
vein	carry blood in one direction	valves

6. Urea is dissolved in plasma but oxygen is carried in (red blood) cells.
 7. Spike protein.
 8. They only have very thin walls.
 9. Blood collects in the lower legs/feet (because gravity pulls it back down through the poorly functioning valves).
- II. Students should find that it is easy to blow out through the balloon but very hard to suck up water through it. This is because the open end of the balloon (which you normally use to inflate it) is acting as a valve. Veins have valves in order to ensure that blood only flows in one direction.