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Above: A doctor measuring a patient's blood pressure

Osmosis is an important part of the exchange mechanism in capillary beds.

The amount of fluid that can flow through a pipe is proportional to the radius⁴. A pipe can carry only 1/16th of the volume of a pipe twice as wide.

hormones and other useful substances (Figure 2). By the time blood has travelled to the end of a capillary bed it has lost much of its volume and pressure. The pressure of fluid in the tissues is now higher than blood pressure, so water can return to the blood from the tissues by **osmosis**.

Measuring blood pressure

Your blood pressure is given as two figures, for example 120 over 80 **mm of mercury (mmHg)**. Although we should use pascals to measure pressure (the reading above would be 16 over 10 kPa), the general public is more familiar with the older units.

A doctor or nurse measures your blood pressure using a **sphygmomanometer**. Usually a cuff is wrapped round your upper arm to measure the pressure in the main artery supplying your arm. This artery is one of the first branches from the aorta so the pressure is high.

As the cuff is inflated the pressure of the air inside it pushes on the artery and stops blood flow through it. The air pressure is then reduced slowly. When the air pressure is low enough for blood pressure to force blood through again the nurse can hear the blood flow. The pressure can be read off the scale. This gives the higher figure (120 in the example above). It represents the pressure of the blood as the left ventricle contracts to push blood out of the heart. This is the **systolic** pressure.

The lower figure (80 in the example above) is when the nurse can no longer hear the flow. It is the blood pressure in the arteries while the heart is relaxed and filling with blood. This is the **diastolic** pressure. Many hospitals now use digital blood pressure meters which are thought to be more accurate than a nurse's judgement of the flow.

Normal blood pressure

Healthy people have blood pressures around the figures given above (120/80 mmHg). If you need to have your blood pressure taken you may be asked to sit quietly for a while beforehand because when you are active your blood pressure rises slightly. During activity your body produces a hormone called **adrenaline** that causes you to tense your muscles and increases your heart rate. When you are relaxed your blood pressure drops slightly. Figures of 140/90 mmHg or more indicate you could have a problem with your blood pressure.

Blood pressure and the kidneys

Your blood pressure is not just due to heart action. Several different mechanisms are involved, including your kidneys. The water content of the blood is regulated in your kidneys. If you expel a lot of water

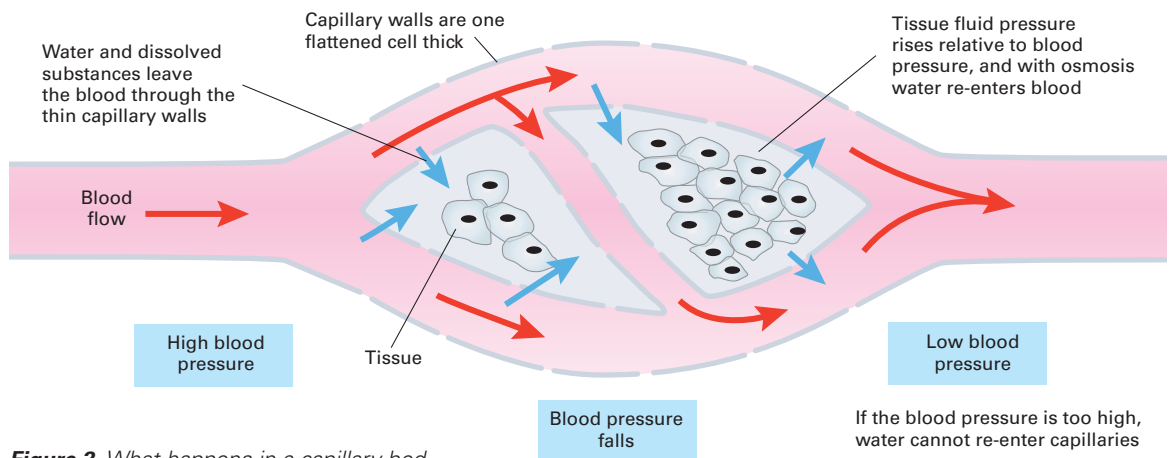
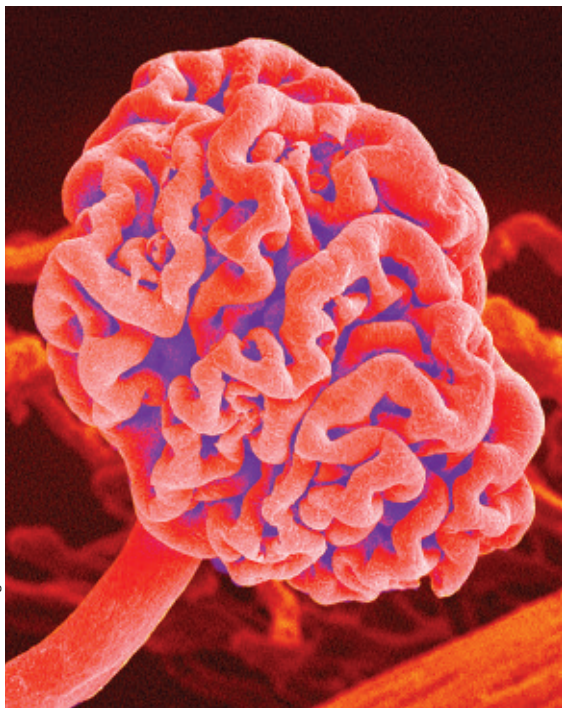


Figure 2 What happens in a capillary bed



Above: The tiny capillaries that make up the glomerulus in a kidney tubule are a filter for the blood. High blood pressure or very low blood pressure can lead to kidney failure

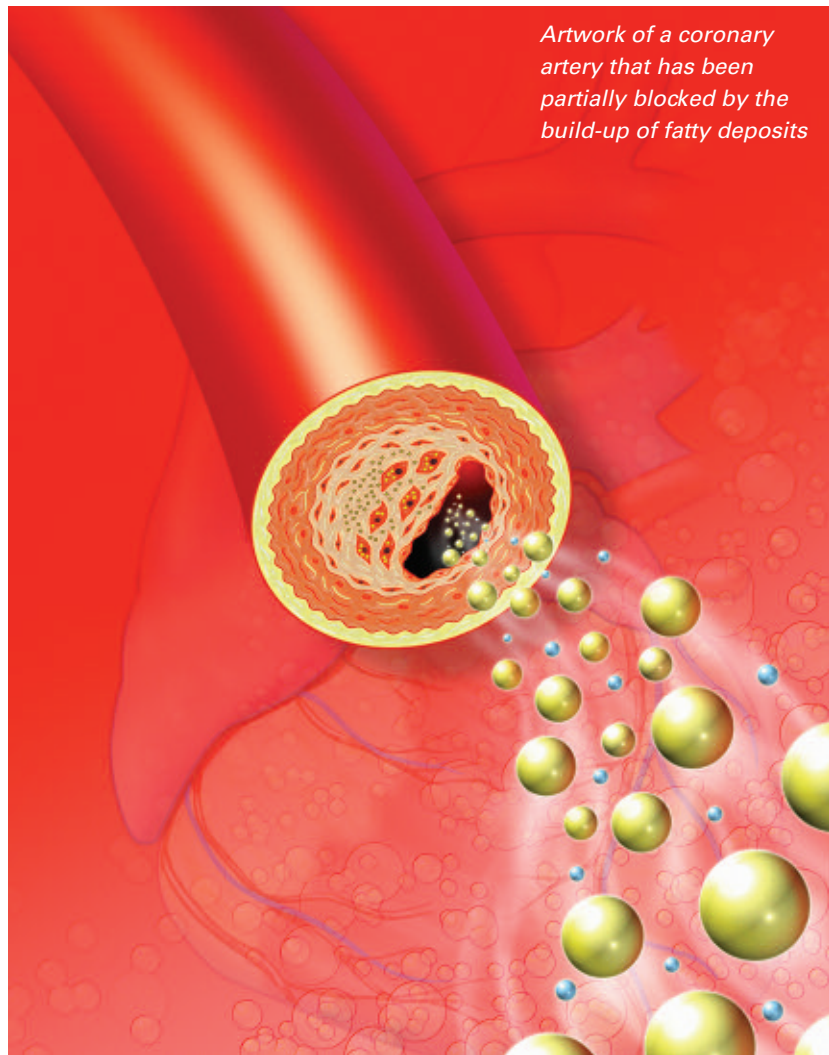
from blood into urine then the blood volume, and hence pressure, will be lower. When you are short of water a chemical is produced in the body called angiotensin II which causes your arteries to constrict. The pressure of blood inside these narrower arteries rises. Angiotensin also makes you feel thirsty.

Hypertension

Some people have high blood pressure. This is known as **hypertension**. Their blood pressure is greater than 140/90 mmHg. There are several causes, but a common one is fatty deposits in the arteries around the heart. These reduce the internal diameter of the blood vessels so much that less fluid can pass through. This raises the pressure and puts a strain on the heart.

If someone's blood pressure is too high, the pressure will not have dropped enough by the end of the capillary bed to allow fluid to return to the blood. Instead it stays in the tissues and makes them swollen and puffy. People with high blood pressure may develop swollen ankles and feet.

High blood pressure also damages some of the very tiny capillaries serving important organs such as the kidneys and brain. If blood vessels are damaged, or their lining is roughened by fatty deposits, there is a greater risk of a blood clot forming in the blood vessel — a condition known as thrombosis. Blood clots can cause local problems where they form, or they may be dislodged, to block blood flow elsewhere in the circulatory system.



Living with high blood pressure

People with high blood pressure are encouraged to make some changes to their lifestyle. Taking more exercise and eating a balanced diet help to reduce the 'furring up' of their arteries by reducing the amount of fats in the blood. Reducing salt intake helps the kidneys regulate the water concentration in blood. Stress and anxiety release adrenaline and nor-adrenaline that raise blood pressure, so managing stress also becomes important.

Some people need treatment to reduce their blood pressure. Drugs called **beta-blockers** reduce the rate at which the heart beats and the force of the ventricular contractions. As a consequence, blood pressure is reduced. **ACE-inhibitors** reduce the effects of angiotensin and dilate the arteries and veins so that blood flows more easily.

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Over 10 million people in the UK have hypertension.

The right ventricle pumping blood to the lungs generates only 25 mmHg (3.3 kpa).

Answer to Alchemical wordsearch, page 13

The word not in the grid is **spirit**.