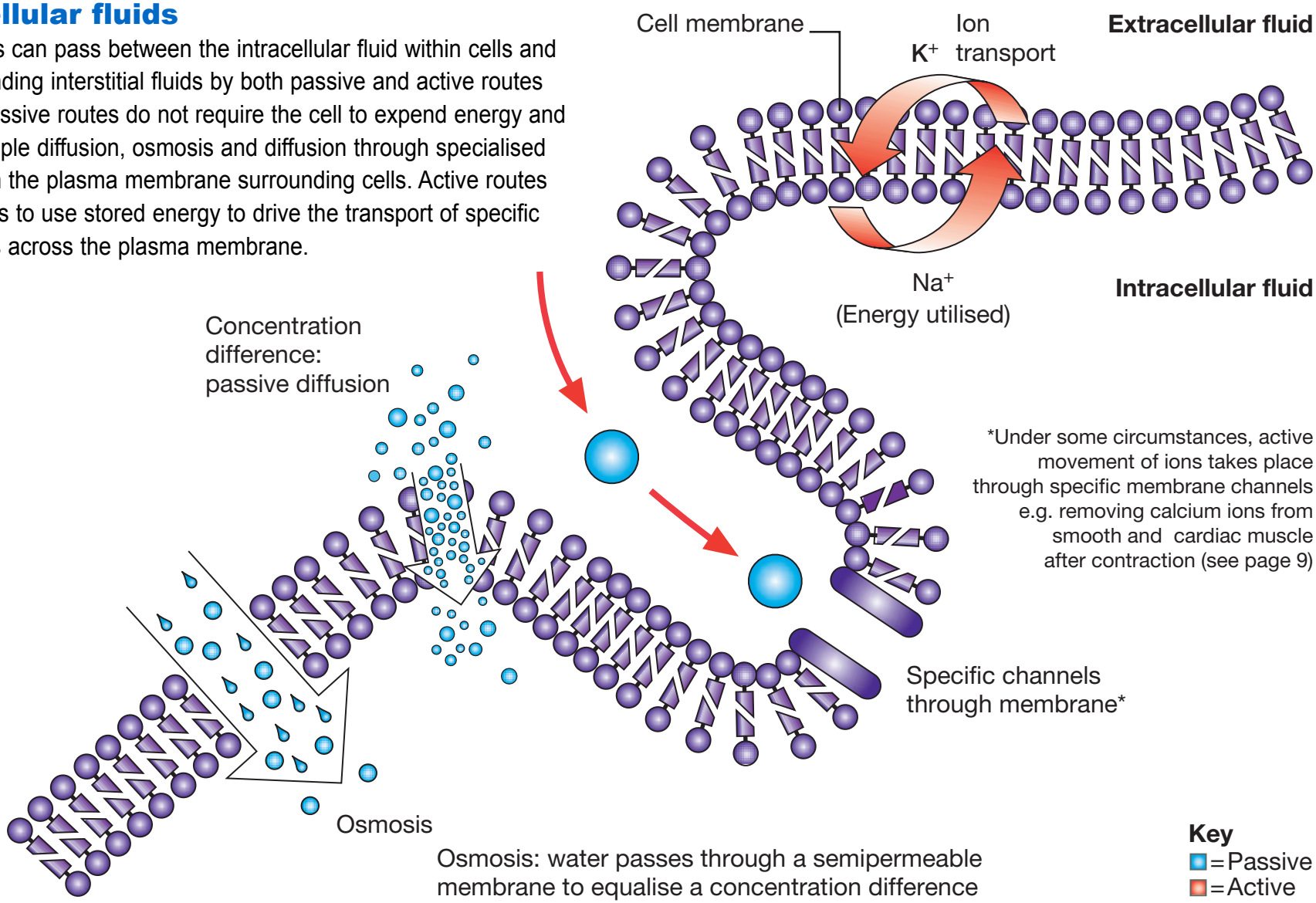
Exchange between the interstitial and intracellular fluids

Substances can pass between the intracellular fluid within cells and the surrounding interstitial fluids by both passive and active routes (Fig. 3). Passive routes do not require the cell to expend energy and include simple diffusion, osmosis and diffusion through specialised channels in the plasma membrane surrounding cells. Active routes require cells to use stored energy to drive the transport of specific substances across the plasma membrane.

Figure 3. Exchange between intracellular and extracellular fluids



*Under some circumstances, active movement of ions takes place through specific membrane channels e.g. removing calcium ions from smooth and cardiac muscle after contraction (see page 9)

Osmosis: water passes through a semipermeable membrane to equalise a concentration difference

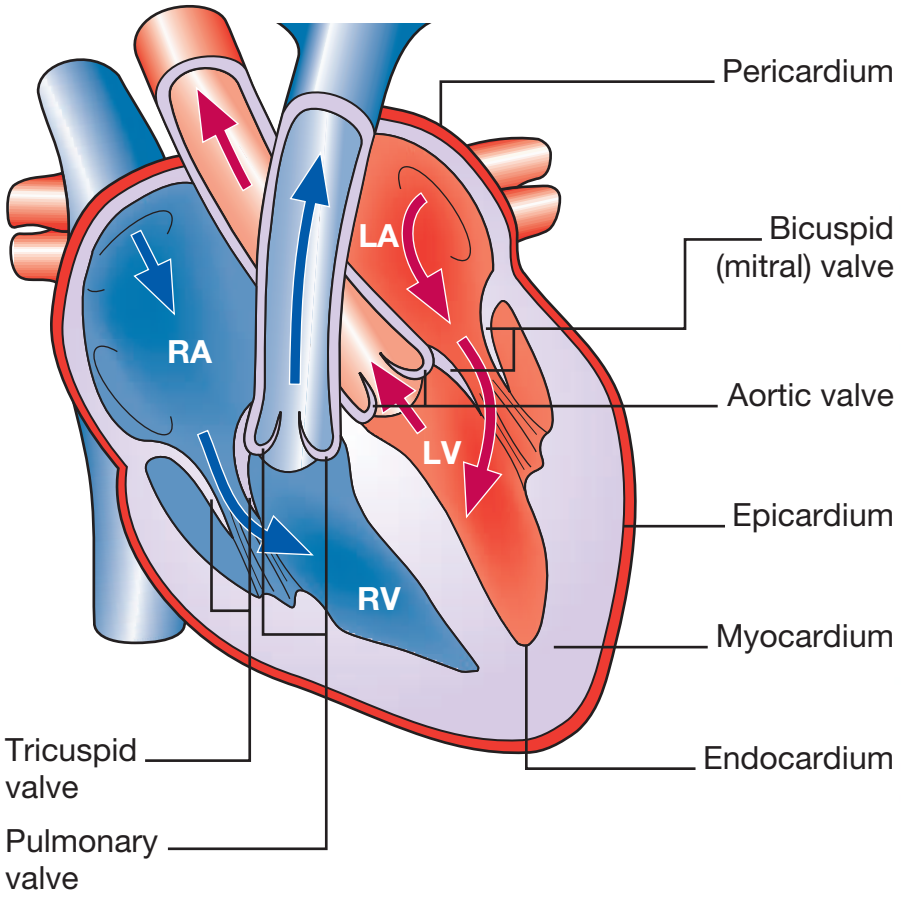
1.3 The structure and function of the heart

The heart is a hollow muscular organ about the size of a clenched fist that is situated in between the lungs and that tilts slightly to the left. Its function is to pump blood around the circulatory system.

The heart is surrounded by a protective sac called the pericardium. The innermost membrane of the pericardium, the epicardium, is also one of the three layers that make up the heart wall (Fig. 7):

- the epicardium – the outer layer, which forms part of the pericardial sac
- the myocardium – comprising the bulk of the heart wall, consists of cardiac muscle cells and provides the pumping power of the heart the endocardium – a thin sheet of tissue that lines the vessels of the heart and provides a smooth surface for blood flow. The endocardium forms a continuous lining throughout the heart and blood vessels.

Figure 7. Flow of blood through the heart



Key
RA = Right atrium
LA = Left atrium
RV = Right ventricle
LV = Left ventricle

= Oxygenated blood
= Deoxygenated blood

Peripheral vascular resistance

There is a strong association between peripheral vascular disease and hypertension.[8] Most patients with essential hypertension have a normal cardiac output but a raised **peripheral vascular resistance**.[9]

One cause of increased peripheral vascular resistance is renal artery stenosis (see Module 2.7 for more detail).

Another cause of peripheral vascular disease (PVD) is atherosclerosis, particularly in the arteries of the legs (Fig. 15). In this condition, the blood supply may be insufficient to meet the muscles demand for oxygen during exercise. This causes pain in the muscles that is relieved by rest – **intermittent claudication**. As the disease progresses, pain may become troublesome even at rest and gangrene may occur, requiring amputation of part of the limb.

5% patients with PVD require amputation, but the impact of the disease is higher still because PVD is an independent predictor of increased risk of cardiovascular death:

- 30% risk of death within 5 years
- 50% risk of death within 10 years, primarily due to myocardial infarction (MI) or stroke.[10]

Figure 15.