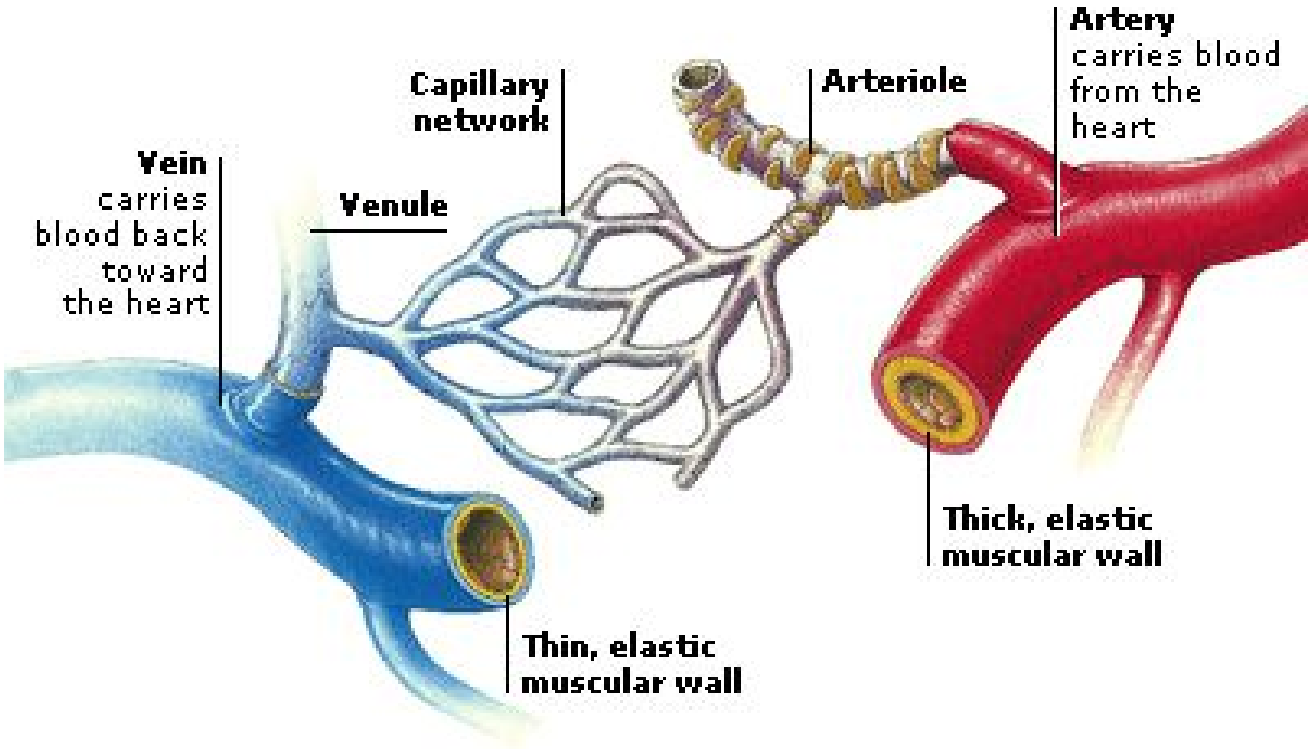
Organisation of Blood Vessels

(pg 178)



Arteries: Oxygenated blood - thick muscular wall, thick elastic layer, narrow lumen (Aorta is the major artery that carries blood from the heart to the body, Carotid artery is the major artery which supplies blood to the brain)

Arterioles: Oxygenated blood - thicker muscular wall compared to arteries, thinner elastic layer

Capillaries: Oxygenated and Deoxygenated blood - only one cell thick

Venules: Deoxygenated blood - thin muscle and elastic layer, close to the skin surface

Vein: Deoxygenated blood - large lumen, thin muscle and elastic layer, close to the skin surface (Superior and Inferior Vena Cava are the major veins which return the blood back to the heart. Jugular vein brings the blood back from the brain to the heart, via the superior vena cava)

Role of:

Outermost layer: A tough fibrous layer, that resists pressure changes from both within, and outside

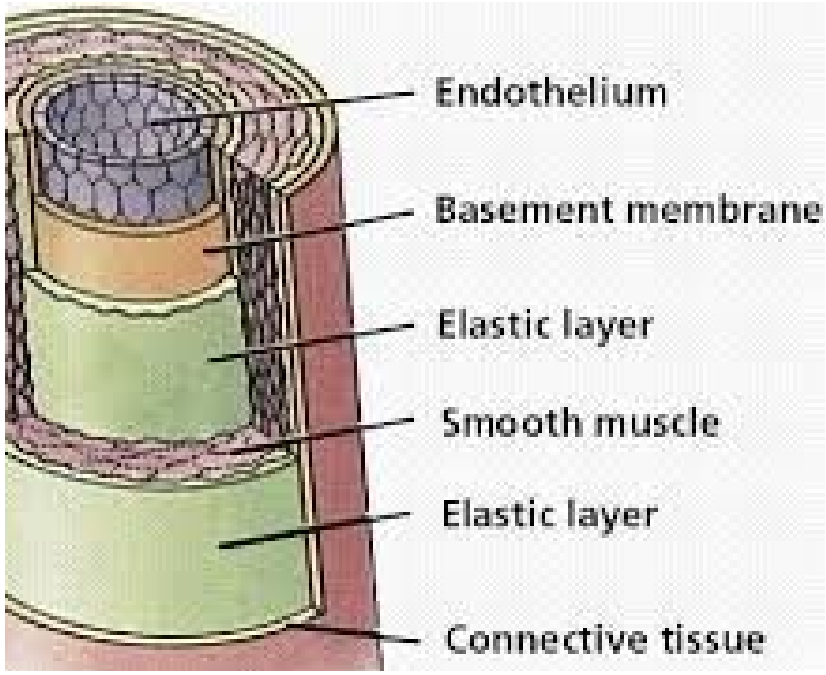
Muscle layer: Can contract, causing the lumen to narrow - this helps to control the flow of blood

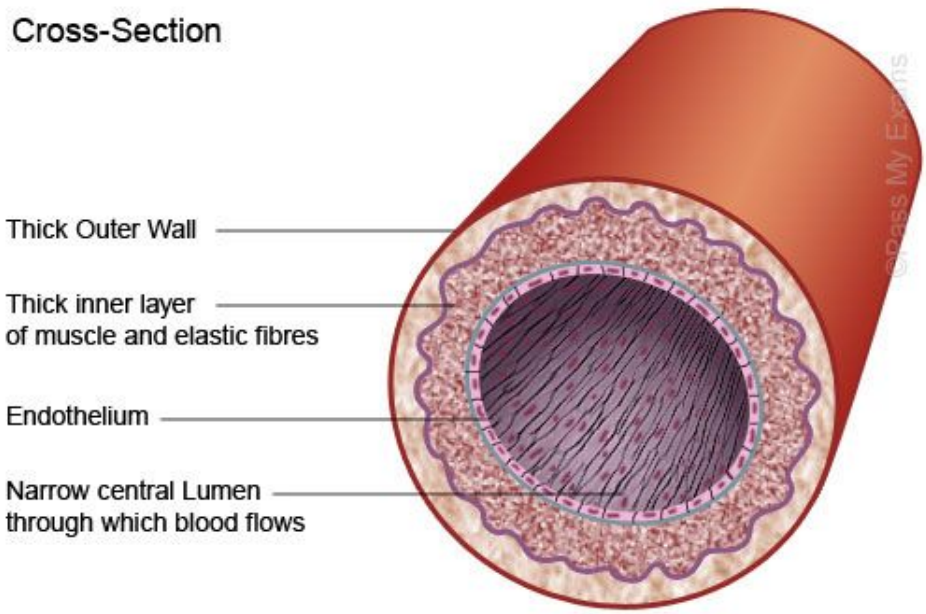
Elastic layer: Has a stretch and recoil action. Helps to maintain blood pressure.

Endothelium: Smooth lining to minimise friction (damage to the endothelium can result in blood clots)

Lumen is the central cavity through which the blood flows.

Artery


Endothelium
Basement membrane
Elastic layer
Smooth muscle
Elastic layer
Connective tissue


Cross-Section
Thick Outer Wall
Thick inner layer
of muscle and elastic fibres
Endothelium
Narrow central Lumen
through which blood flows

Arteries

Thick muscle layer - easy to control blood flow

Thick elastic layer - every time the heart ‘beats’ the elastic layer absorbs the shock by stretch and recoil action. Helps to main high blood pressure in the arteries, and smoothes pressure surges

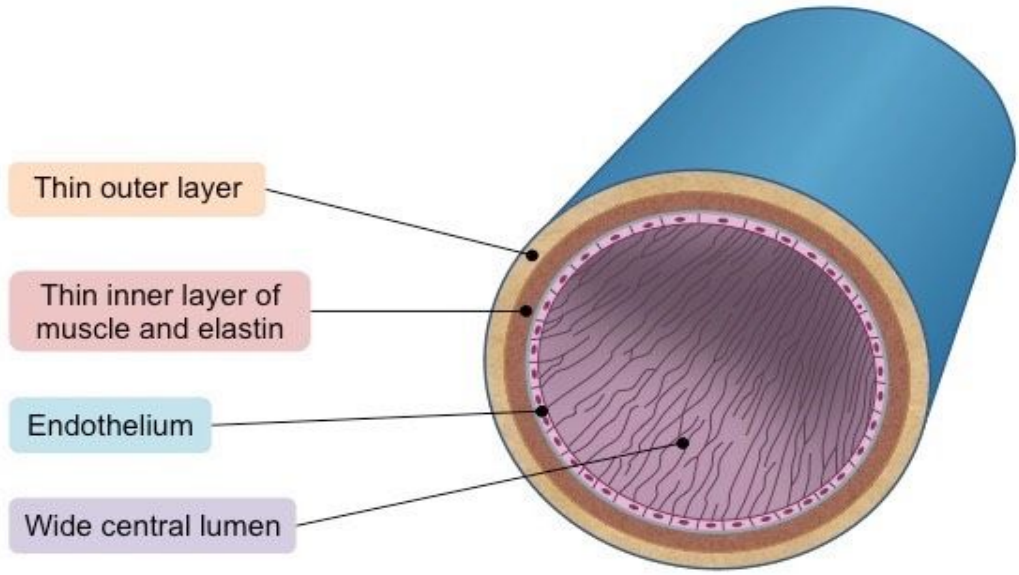
Outer wall - prevents artery bursting under pressure

Arterioles

Thick muscle layer - thicker than arteries, which restricts blood flow to the capillaries

Thinner elastic layer - blood pressure is lower, as the artery branches into arterioles, the blood pressure drops

Veins



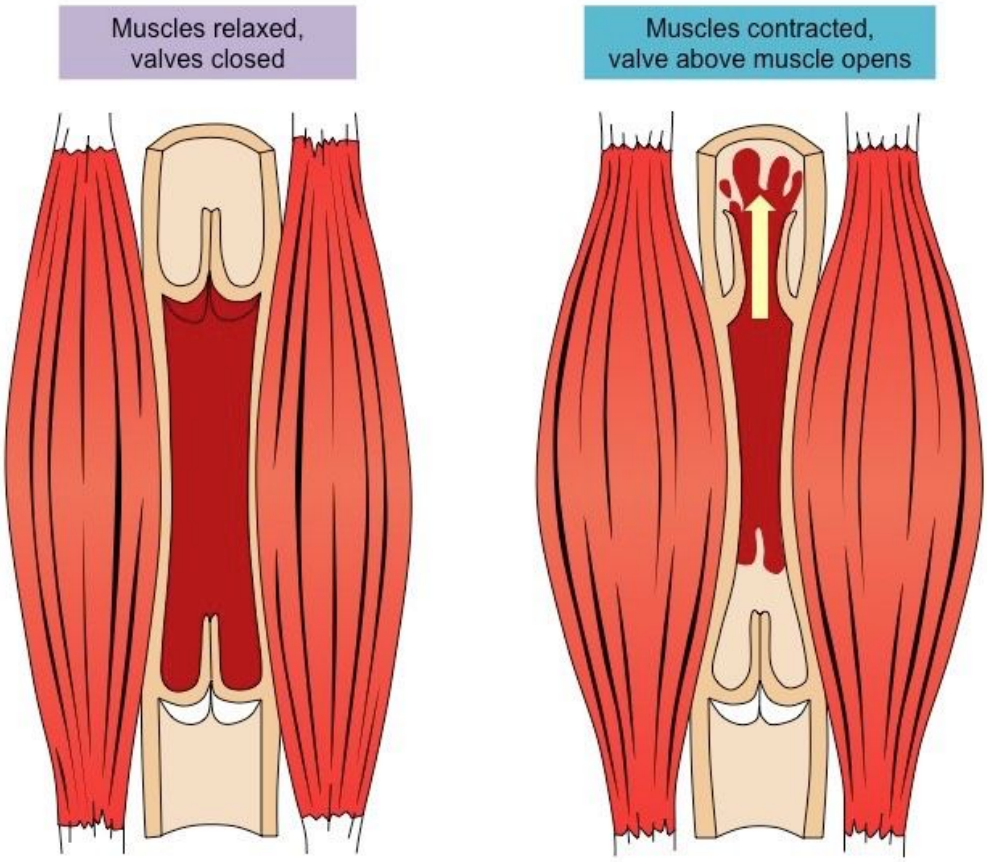
Thin muscle layer - no need to control the rate of flow

Thin elastic layer - blood is under low pressure, no recoil action

Thin outer wall - veins need to be flattened to allow transport of blood back to the heart

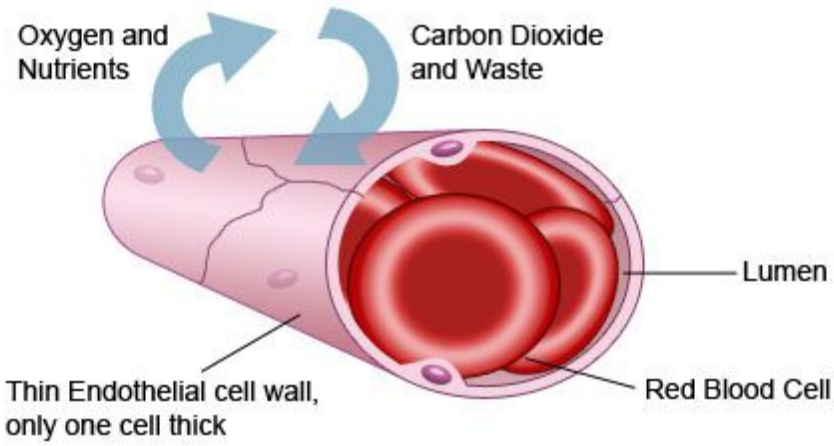
Pocket valves - prevent backflow

Pocket valves in veins



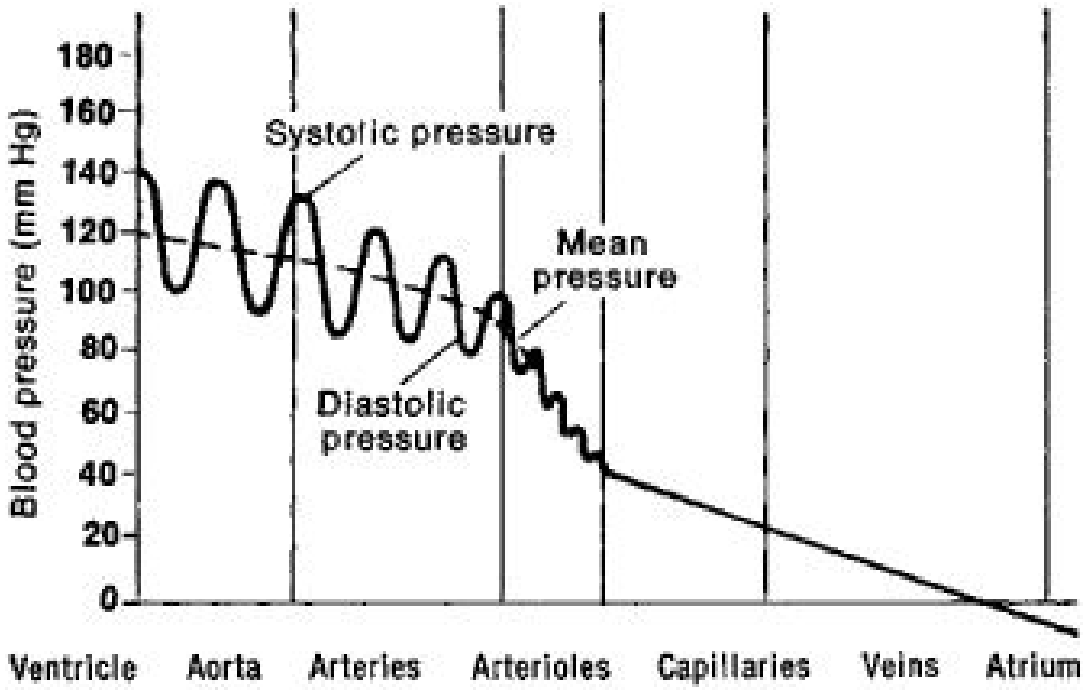
- Muscles around the vein contract, this pushes against the walls of the vein and flattens it, causing the valves to open
- Blood is pushed up towards the heart
- When the muscles relax, the valves shut
- This prevents the blood from flowing backwards

Capillaries

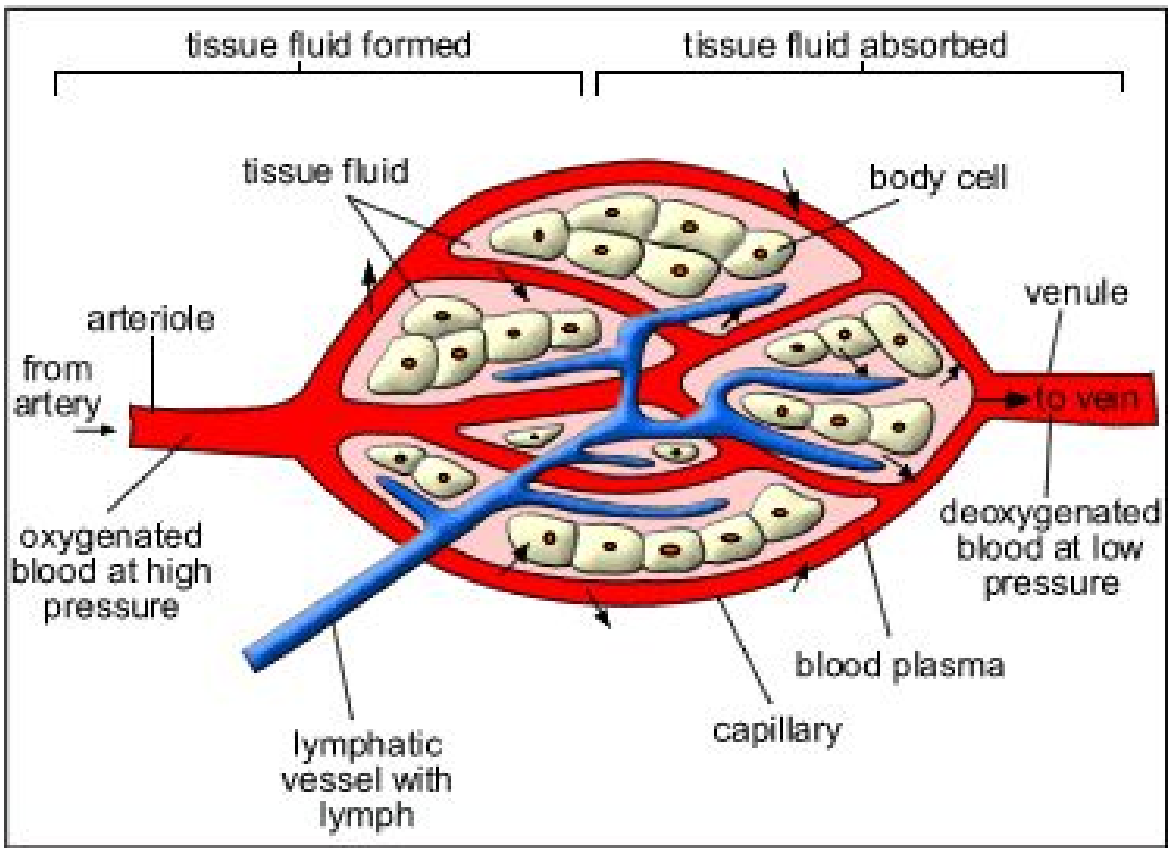


- one cell thick (endothelium)
- short diffusion distance for oxygen and carbon dioxide
- highly branched -> large surface area
- size of the lumen is just sufficient to fit the circumference of a RBC -> RBC can only move very slowly, giving more time for diffusion
- numerous -> no cell is far away from a capillary
- gaps between endothelial cells - allows fluid, containing nutrients, to diffuse from the capillary to the tissue

Changes in mean blood pressure from arteries to capillaries (pg 182)



Tissue Fluid (pg 180)



Formation of Tissue Fluid (pg 180)

Fluid pressure = hydrostatic pressure

- blood from the heart is under high hydrostatic pressure
- hydrostatic pressure of the blood inside the arterioles and capillaries is higher than the hydrostatic pressure in the tissue
- this pushes the fluid out of the capillaries, through the gaps in the endothelial lining, along with:

  - Glucose, amino acids, dissolved oxygen, ions

But NOT

  - Large proteins (albumin), antibodies, RBCs, WBCs

This process is called ultrafiltration

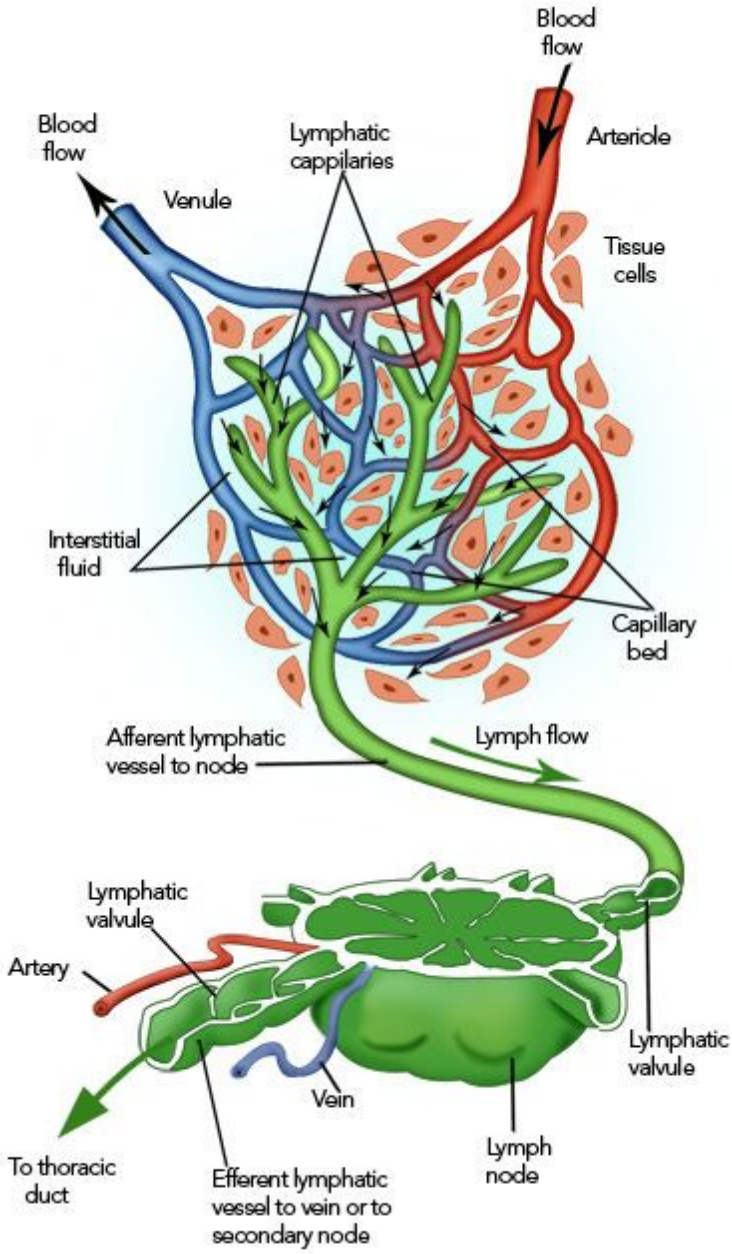
Return of Tissue Fluid to the circulatory system

- the loss of fluid reduces the hydrostatic pressure in the capillaries
- the hydrostatic pressure in the capillaries is now lower than in the tissues
- the loss of fluid also decreases the water potential in the capillaries (more negative)
- this draws fluid into the capillary by osmosis

Containing

- Carbon dioxide and other waste material like lactic acid

Lymphatic System
(pg 181)



Circulation of Lymph

- not all the fluid can return back to the heart via the veins
- some of it drains into vessels called as lymph vessels
- lymph vessels carry lymph, a colourless fluid
- lymph vessels pass through lymph nodes - which are rich in immune cells -> helps the body to pick up early signs of infection in the tissues

{breast cancer = lymph nodes under armpits are swollen}

- lymph vessels drain into the vena cava
- one-way flow of fluid from the tissues to the heart

Movement of lymph towards the heart is due to

- hydrostatic pressure of the tissue fluid
- contraction of body muscles
- one-way valves