Blood circulation



- Network of arteries, arterioles, and capillaries, venules and veins

- If all the vessels of this network were laid end to end, they would extend for about 96,500 kms - far enough to circle the planet Earth more than twice!

- This process of one-way blood flow within the body is called circulation:
  - **Arteries** carry oxygen-rich blood away from your heart
  - **Veins** carry oxygen-poor blood back to your heart

  (Opposite in pulmonary circulation)

Blood circulation



1. Pulmonary – transport of blood from heart to lungs and back



2. Systemic – from heart to the rest of the body and back



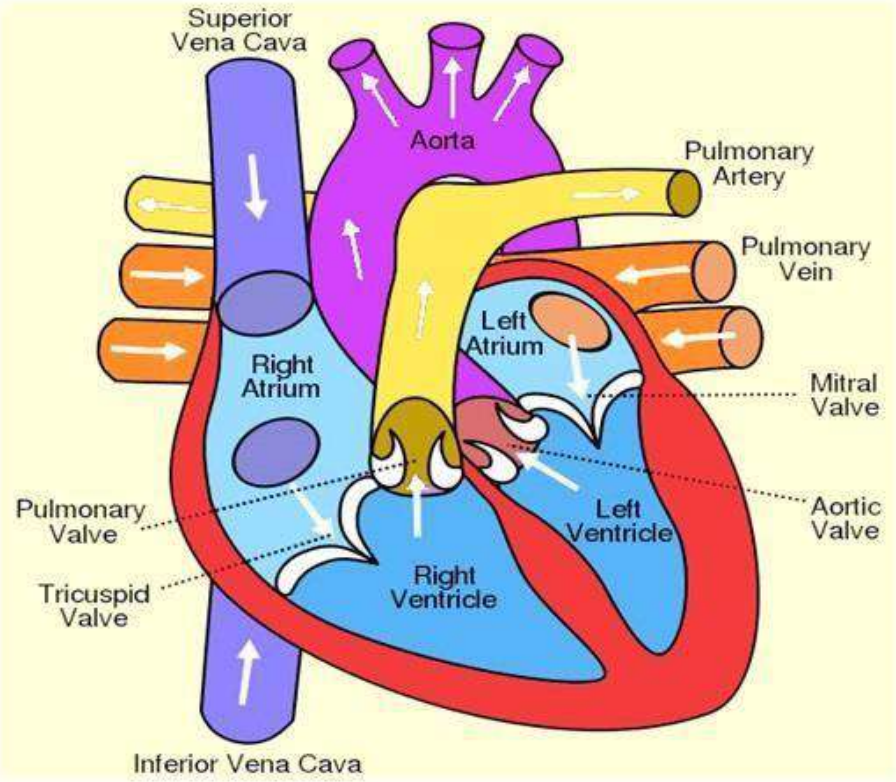
3. Portal – from stomach, spleen, pancreas & intestines to the liver

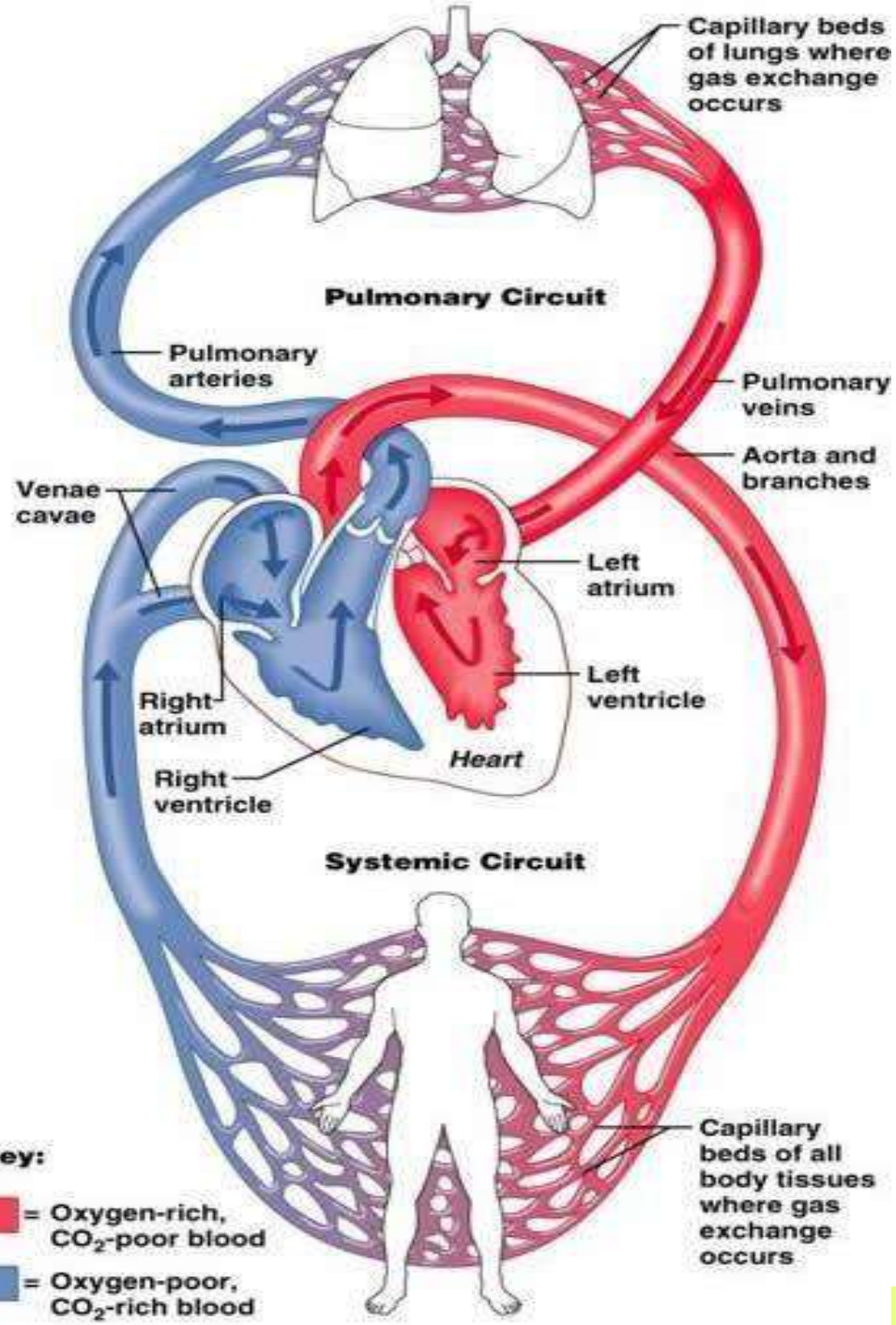
Pulmonary circulation

- Flow of blood through the heart
- Blood from the body is emptied into the RA via the inferior and superior venae cavae
- RA contracts, increasing its pressure and opening the tricuspid valve
- RA's contents empty into the RV
- The RV contracts, forcing blood through the pulmonary artery via the pulmonary valve to the lungs

(by the way, the pulmonary artery is the only artery in the body to carry deoxygenated blood)

- Gaseous exchange takes place in the bronchioles of the lungs
- Pulmonary veins carry oxygenated blood back to the LA
- LA contracts and pushes blood via the bicuspid valve to the LV
- LV moves blood via the aortic valve into the aorta and on to the rest of the body

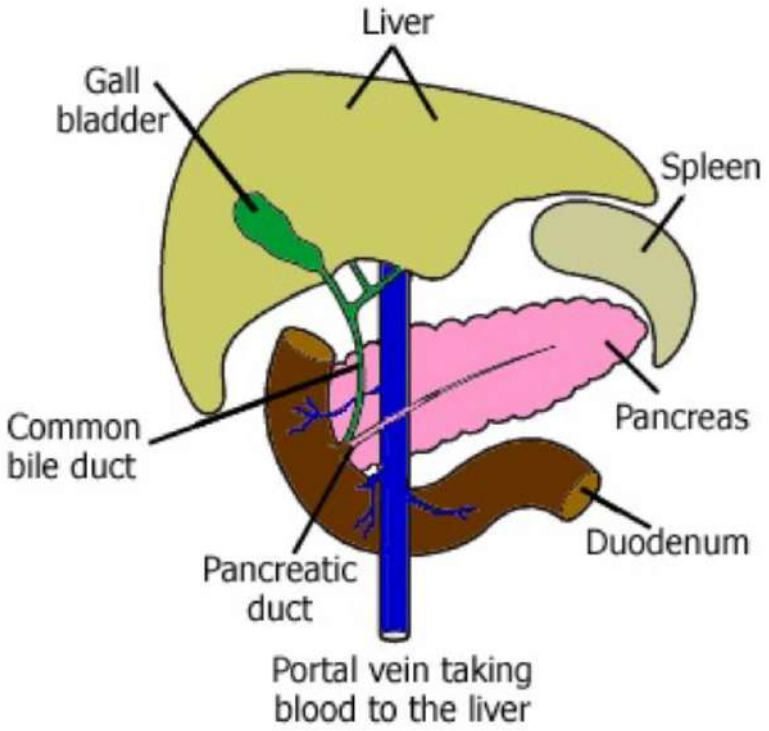



Capillary beds of lungs where gas exchange occurs
Pulmonary Circuit
Pulmonary arteries
Pulmonary veins
Aorta and branches
Venae cavae
Left atrium
Left ventricle
Right atrium
Heart
Right ventricle
Systemic Circuit
Capillary beds of all body tissues where gas exchange occurs
Key:
= Oxygen-rich, CO_2-poor blood
= Oxygen-poor, CO_2-rich blood

Systemic and portal circulation

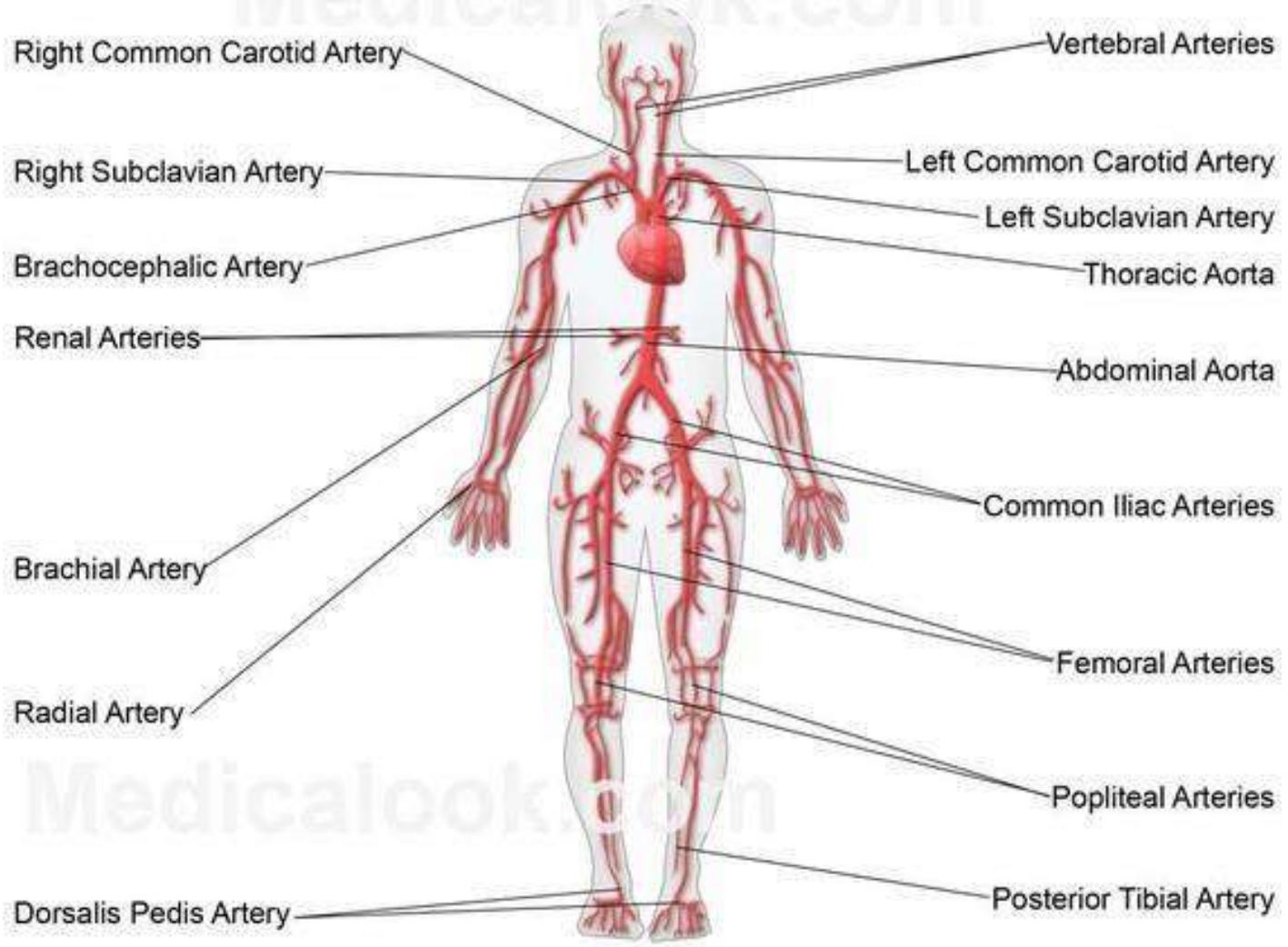
- **Systemic** - Circulation of blood from the heart to the body via the aorta
  - Returns via the inferior / superior venae cavae

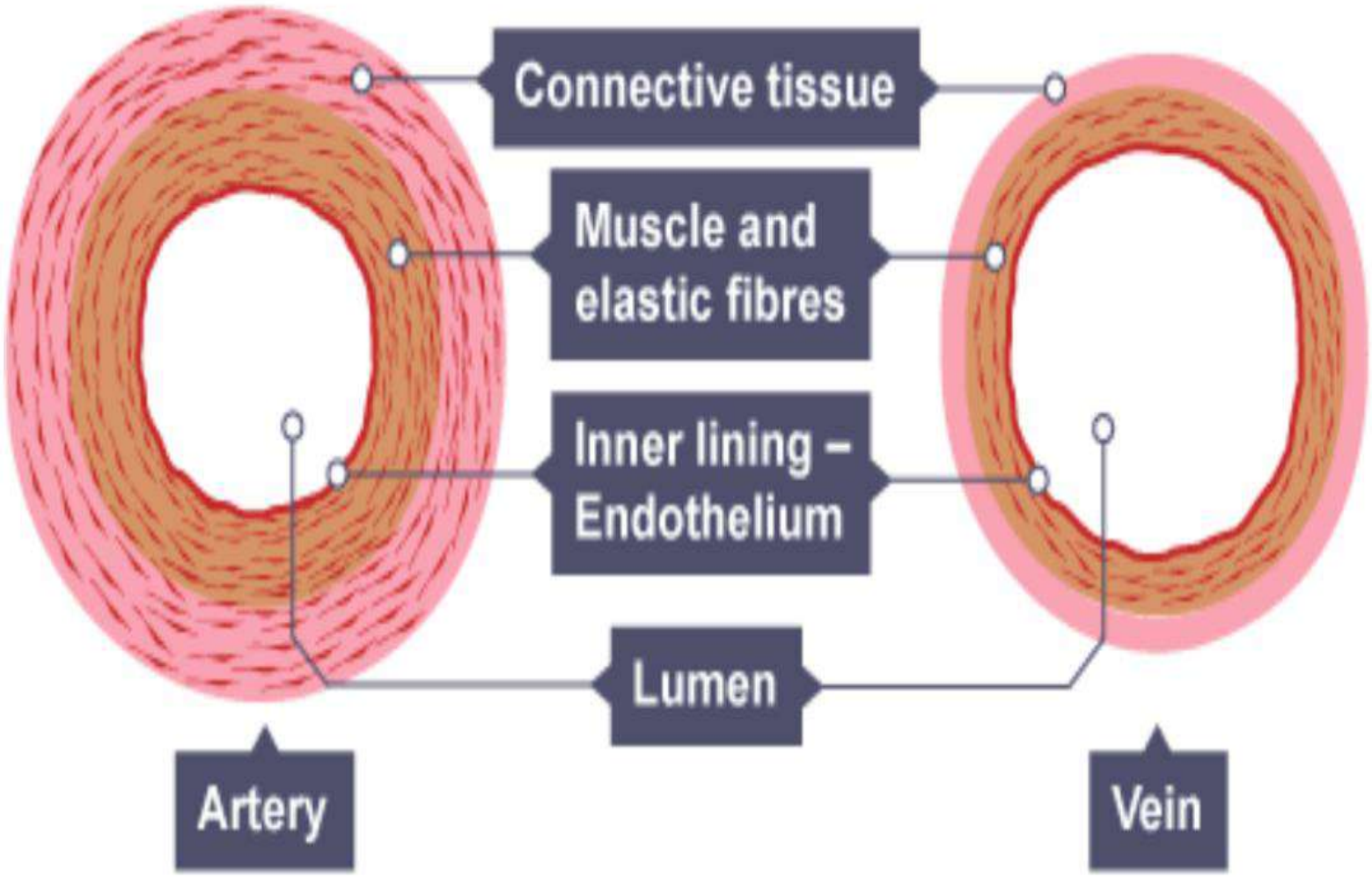
- **Portal** – Circulation of blood from stomach, spleen, pancreas and intestines to the liver
  - Via hepatic-portal vein
- Transported via arteries, veins and capillaries

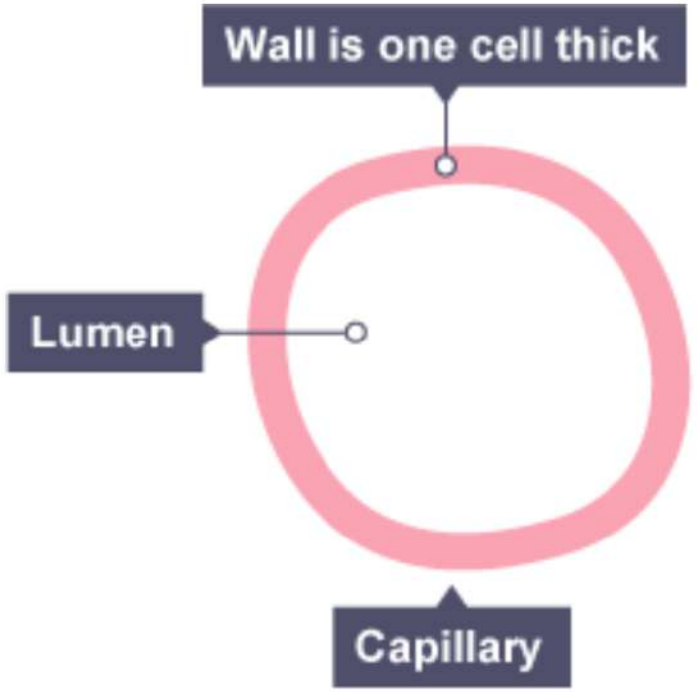


Vessels

- Carry blood away from the heart:
  - Arteries
  - Arterioles
- Carry blood towards to the heart:
  - Veins
  - Venules
- Networks throughout the tissues
  - Capillaries



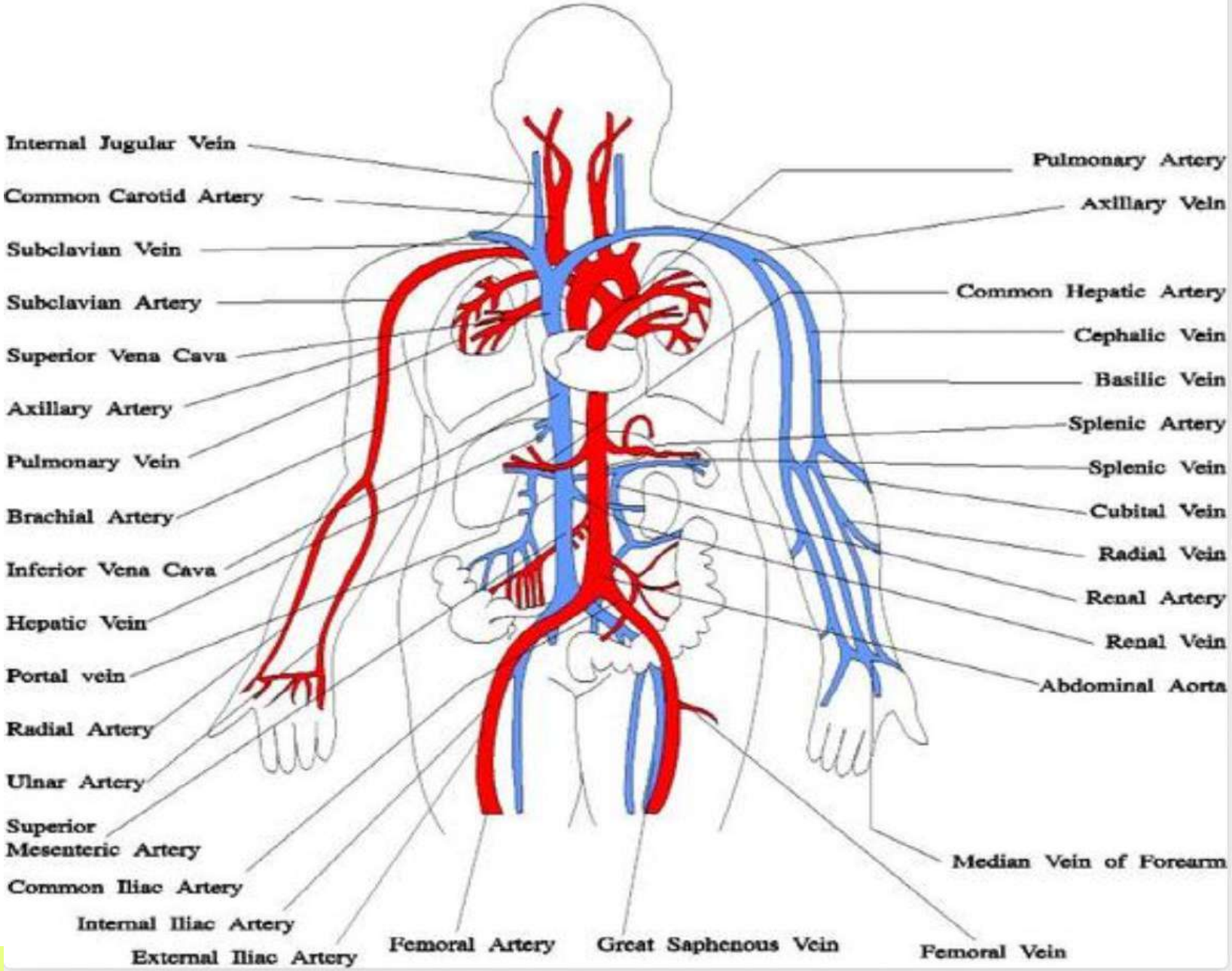

Connective tissue
Muscle and elastic fibres
Inner lining – Endothelium
Lumen
Artery
Vein


Wall is one cell thick
Lumen
Capillary

Arteries	Veins
Always carry blood **away** from the heart	Always carry blood **to** the heart
Carry oxygenated blood, except for the pulmonary artery	Always carry deoxygenated blood, except for the pulmonary vein
Carry blood under high pressure	Carry blood under low or negative pressure
Have thick muscular and elastic walls to pump and accommodate blood	Have thin walls - have less muscular tissue than arteries
A type of supporting tissue called connective tissue provides strength	Have less connective tissue than arteries
The channel in the blood vessel that carries blood - the **lumen** - is narrow	Have a wide lumen

Blood Circulation

Principal Veins and Arteries



Blood pressure

- The force blood exerts on the walls of the blood vessels as it is pumped from the heart
- Pressure varies depending on the type of vessel
  - Higher in arteries / Lowest in capillaries
  - High on contraction of ventricle / low when dilating

Factors affecting BP:

- Cardiac output
- Vessel resistance
- Total blood volume
- Viscosity of blood
- Elasticity of artery walls

Measuring BP

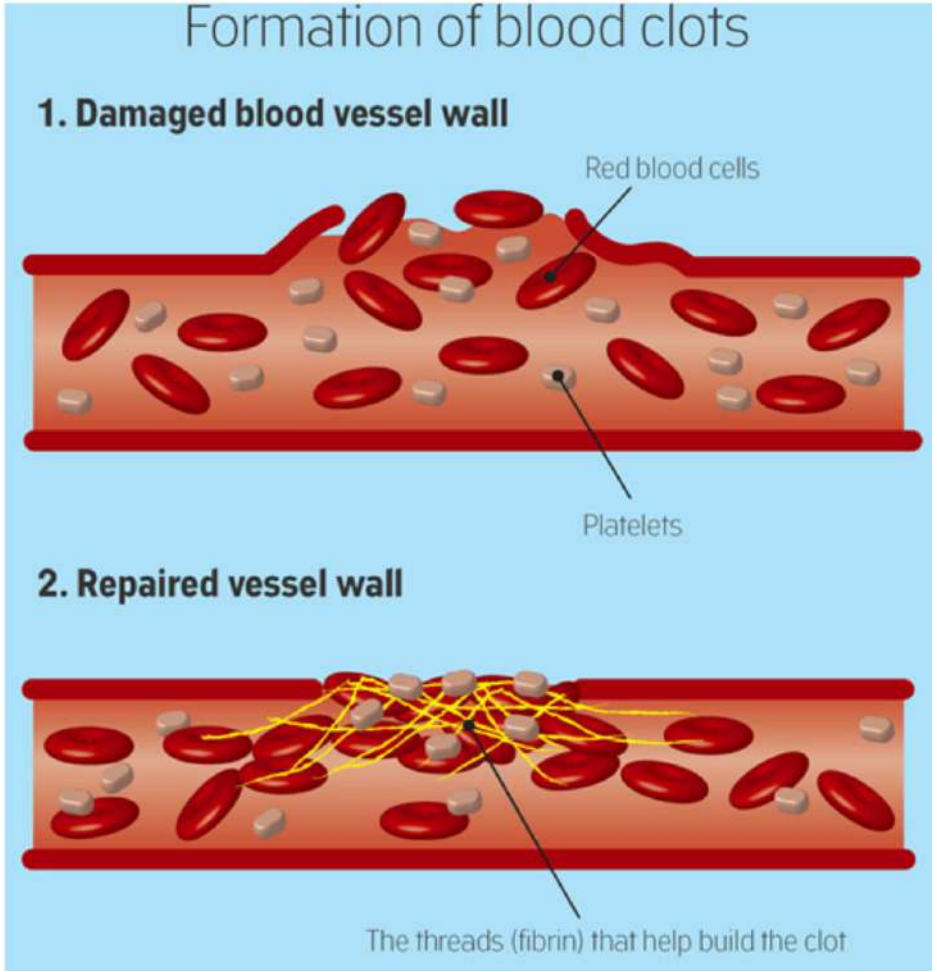
- **Systolic** – when heart is contracting
- **Diastolic** – when heart is relaxing

- **Hypertension** – stress, meds, hardening of arteries, smoking, alcohol, diet, hereditary
  - Angina, stroke, heart attack
- **Hypotension** – underactive adrenals, shock, hereditary
  - Dizziness, fainting



Blood Clotting

- **Bleeding occurs** until a clot forms to help repair damaged tissue
- **4 stages:Haemorrhage – no clot formation**
  - Thrombocytes
  - Thromboplastin
  - Thrombin + Fibrinogen – Fibrin (web-like net)
  - Clot formation
- **Factors affecting clotting**
  - Deficiency of platelets (e.g. bone marrow disease)
  - Lack of components causing haemophilia
  - Lack of Vit K (helps produce prothrombin)
  - Excess fibrinogen can cause thrombosis



What are blood types?

Composition and function the same across all types

- A, B, AB, O
  - O universal donor
  - AB universal recipient
- **Rhesus factor – antigen (not contained in all blood groups)**

Type	Can give to	Can receive from
O	Any blood type	O
AB	AB	Any blood group
A	A, AB	A, O
B	B, AB	B, O