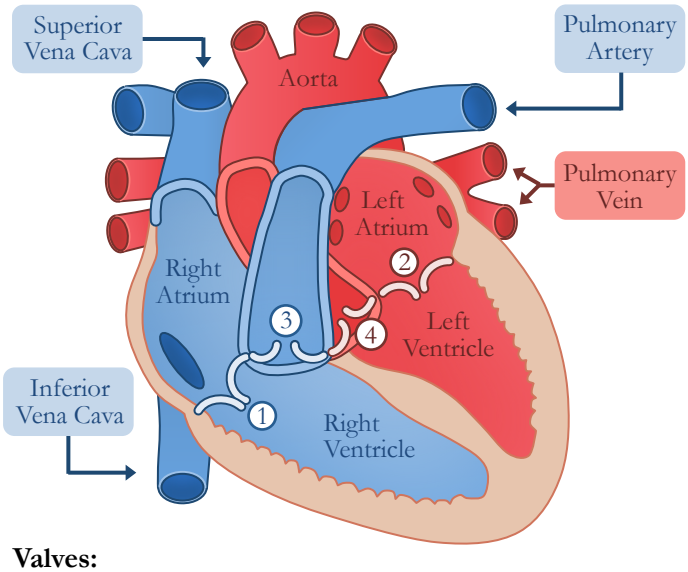
TOPIC 6.2: THE HEART

Heart Structure



Valves:

1. Tricuspid valve *(right)*
2. Bicuspid valve *(left)*
3. Pulmonary valve *(right)*
4. Aortic valve *(left)*

Mechanism of Heart Beat

A heart beat is **myogenic** (contraction initiated by the heart)

- Electrical signals are initiated by a sinoatrial (SA) node
- This pacemaker stimulates the atria to contract and also relays signals to an atrioventricular (AV) node
- The AV node sends signals to ventricular Purkinje fibres (via a Bundle of His within the wall of the septum)
- The Purkinje fibres cause the ventricular walls to contract

The SA node maintains a normal sinus rhythm *(60-100 bpm)*

- The pacemaker is regulated by the medulla oblongata
- Sympathetic nerves release noradrenaline *(⬆ heart rate)*
- Parasympathetic nerves release acetylcholine *(⬇ heart rate)*
- Heart rate may also be increased via hormonal action (via the release of adrenaline / epinephrine)
- Adrenaline will cause a more sustained elevation in heart rate than that achieved by the action of the brainstem

Cardiac Cycle

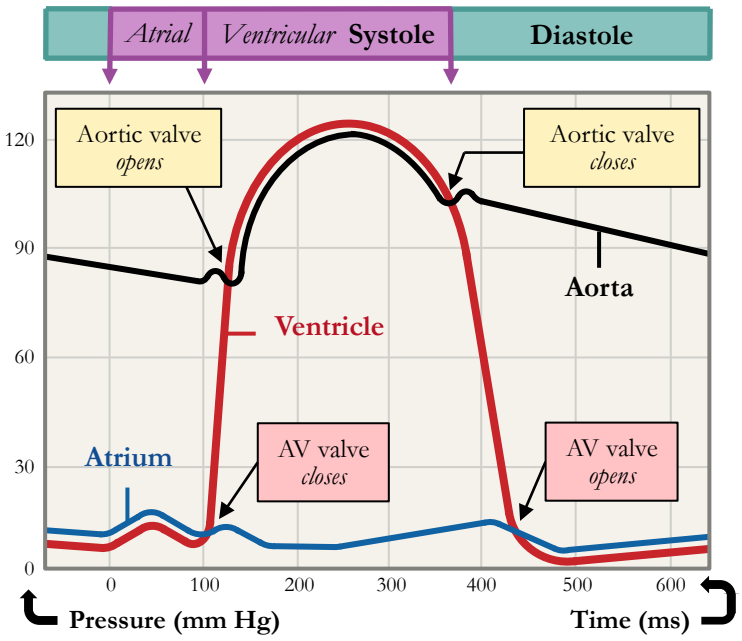
The cardiac cycle describes the events of a heart beat

Systole (contraction)

- As atria contract, atrial pressure exceeds ventricular pressure (AV valves open → blood flows to ventricles)
- As ventricles contract, ventricular pressure exceeds atrial pressure (AV valves close → 1st heart sound)
- Pressure builds (isovolumetric contraction) until the ventricular pressure exceeds the arterial pressure
- Semilunar valves open and blood flows into arteries

Diastole (relaxation)

- As blood flows into arteries, ventricular pressure drops
- Backflow closes semilunar valves → 2nd heart sound
- When ventricular pressure drops below atrial pressure, the AV valves will open and cardiac cycle is repeated



Coronary Heart Disease

Coronary thrombosis is caused by clots within the coronary arteries

- Vessels are damaged by cholesterol deposition (atherosclerosis)
- The deposits reduce vessel diameter and increase blood pressure
- The stress damages arterial walls (and is repaired with fibrous tissue)
- The vessel wall loses elasticity and forms atherosclerotic plaques
- If a plaque ruptures, blood clotting is triggered, forming a thrombus
- If the thrombus blocks blood flow, a myocardial infarction results
- These events are collectively described as coronary heart disease

Risk Factors

Risk factors for CHD include:

- **G**enetics (e.g. hypertension)
- **O**besity (overweight = risk)
- **D**iseases (e.g. diabetes)
- **D**iet (e.g. ⬆ *trans* fats)
- **E**xercise (inactivity = risk)
- **S**moking (⬆ blood pressure)
- **S**ex (males = higher risk)