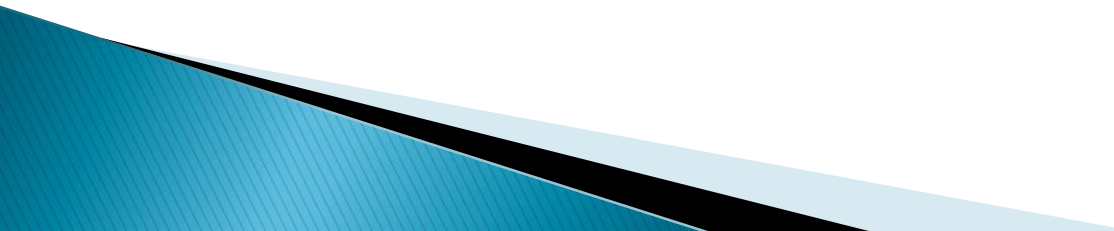


Mechanism to control the cardiac cycle and heart rate.

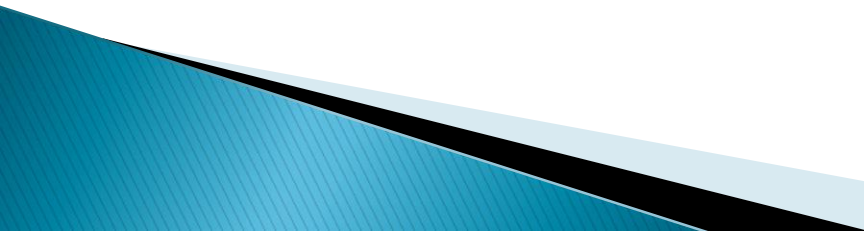
- ▶ The cardiac cycle has the property of **automatism**
 - ▶ Each cardiac cycle (contraction and relaxation) of the heart results in a sound known as the **heartbeat**
 - ▶ To hear the heartbeat we use a stethoscope
 - ▶ The sound of one heartbeat can be heard as a **lub-dup sound**.
 - ▶ Lub sound is the closing of the bicuspid and tricuspid valves and is lower as the dup sound
 - ▶ The dup sound is caused by the closing of the semi-lunar valves in the aorta and the pulmonary artery
- 

Mechanism to control the cardiac cycle and heart rate.

How does the heart beat?

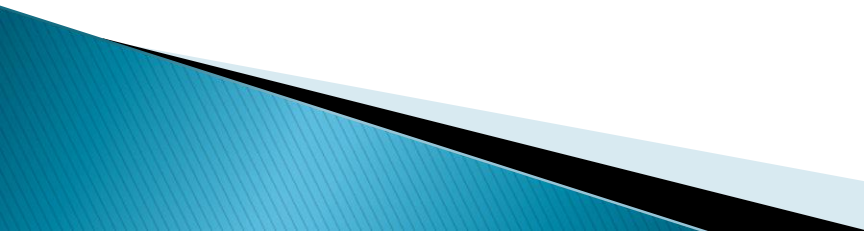
- ▶ Specialised conducting tissue occurs in the walls of the heart
- ▶ Inside the walls of the RA is specialised muscle cells called the **sino-atrial (SA) node**.
- ▶ The SA node initiates the impulses for contraction and is known as the **pacemaker** of the heart
- ▶ Another specialised group of cells are called the **artrio-ventricular (AV) node** occurs at the lower end of the septum between the RA and the RV
- ▶ Specialied muscle – the **bundle of His** extends throughout the septum between the two ventricles and conducts impulses from the atria to the ventricles
- ▶ At the apex of the heart the bundle if His branches into a network of fibres – **Purkinje fibres**

Mechanism to control the cardiac cycle and heart rate.

- ▶ The Purkinje fibres branch throughout the walls of the ventricles to conduct impulses faster and more effectively
 - ▶ During the cardiac cycle the contraction begins at the SA node and spreads across the two atria to the AV node
 - ▶ The two atria contract simultaneously
 - ▶ From the AV node the impulse passes along the bundle of His, between the two ventricles to the Purkinje fibres. This causes the ventricles to contract simultaneously from their lower ends
- 

Mechanism to control the cardiac cycle and heart rate.

Control of the heartbeat

- ▶ Controlled by the nervous system and the hormones
 - ▶ Adult resting heartrate is 72 bpm but can increase to 200 bpm after exercise
 - ▶ **Autonomic nervous system** controls the heartbeat by conducting impulses via two types of nerve fibres, the **sympathetic** and **parasympathetic** nerves from the brain to the SA node
 - ▶ Nerve impulses from the sympathetic nerve fibres accelerate the heartbeat
 - ▶ Nerve impulses from the parasympathetic fibres slow the heartbeat to normal
 - ▶ **Adrenaline** and **thyroxine** also accelerate the heartbeat
- 

Mechanism to control the cardiac cycle and heart rate.

Effect of exercise on heartbeat

- ▶ During exercise more respiration occurs to release more energy for muscle contraction
- ▶ More CO₂ is released into the blood
- ▶ Receptors in the carotid arteries detect the increase in CO₂ and send nerve impulses to the brain
- ▶ Sympathetic nerve fibres transmit nerve impulses to the SA node which accelerates heartbeat
- ▶ Blood is pumped faster so more deoxygenated blood can be pumped to the lungs to release excess CO₂
- ▶ Oxygenated blood reaches the muscles faster