

HUMAN ANATOMY AND PHYSIOLOGY-I, BP-101(T)

UNIT-V (Cardiovascular system)

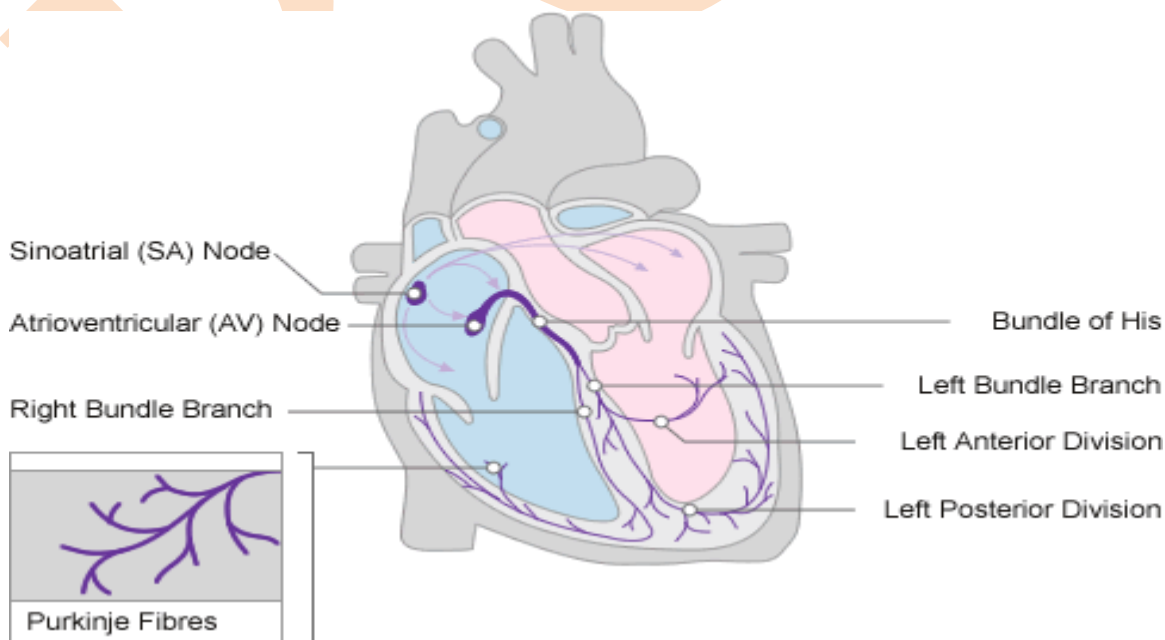
CLASS:4

TOPIC – Elements of Conduction system of Heart and Heart Beat

Cardiac Conduction System:

This pathway is made up of 5 elements:

1. The sino-atrial (SA) node
2. The atrio-ventricular (AV) node
3. The bundle of His
4. The left and right bundle branches
5. The Purkinje fibres
6. he cardiac conduction system



- The SA node is the natural pacemaker of the heart. You may have heard of permanent pacemakers (PPMs) and temporary pacing wires (TPWs) which are used when the SA node has ceased to function properly.
- The SA node releases electrical stimuli at a regular rate, the rate is dictated by the needs of the body. Each stimulus passes through the myocardial cells of the atria creating a wave of contraction which spreads rapidly through both atria.
- As an analogy, imagine a picture made up of dominoes. One domino is pushed over causing a wave of collapsing dominoes spreading out across the picture until all dominoes are down.
- The heart is made up of around half a billion cells, In the picture above you can see the difference in muscle mass of the various chambers. The majority of the cells make up the ventricular walls.
- The rapidity of atrial contraction is such that around 100 million myocardial cells contract in less than one third of a second. So fast that it appears instantaneous.
- The electrical stimulus from the SA node eventually reaches the AV node and is delayed briefly so that the contracting atria have enough time to pump all the blood into the ventricles.
- Once the atria are empty of blood the valves between the atria and ventricles close. At this point the atria begin to refill and the electrical stimulus passes through the AV node and Bundle of His into the Bundle branches and Purkinje fibres.
- Imagine the bundle branches as motorways, if you like, with the Purkinje fibres as A and B roads that spread widely across the ventricles . In this way all the cells in the ventricles receive an electrical stimulus causing them to contract.
- Using the same domino analogy, around 400 million myocardial cells that make up the ventricles contract in less than one third of a second.
- As the ventricles contract, the right ventricle pumps blood to the lungs where carbon dioxide is released and oxygen is absorbed, whilst the left ventricle pumps blood into the aorta from where it passes into the coronary and arterial circulation.
- At this point the ventricles are empty, the atria are full and the valves between them are closed.
- The SA node is about to release another electrical stimulus and the process is about to repeat itself. However, there is a 3rd section to this process. The SA

node and AV node contain only one stimulus. Therefore every time the nodes release a stimulus they must recharge before they can do it again.

- In the case of the heart, the SA node recharges whilst the atria are refilling, and the AV node recharges when the ventricles are refilling.
- In this way there is no need for a pause in heart function. Again, this process takes less than one third of a second.
- The times given for the 3 different stages are based on a heart rate of 60 bpm, or 1 beat per second.
- The term used for the release (discharge) of an electrical stimulus is "depolarisation", and the term for recharging is "repolarisation".

So, the 3 stages of a single heart beat are:

1. Atrial depolarisation
2. Ventricular depolarisation
3. Atrial and ventricular repolarisation.

As the atria repolarise during ventricular contraction, there is no wave representing atrial repolarisation as it is buried in the QRS.

IMPORTANT QUESTIONS:

2M QUESTIONS:

- 1) Define Heart and its functions.
- 2) Define ECG.
- 3) Define Cardiac Output.

5M QUESTIONS:

- 1) Explain the physiology and anatomy of heart.
- 2) Explain in details about blood circulation of heart with the help of diagram and conduction system of heart

10M QUESTIONS:

- 1) Explain the physiology and anatomy of heart.
- 2) Explain in details about blood circulation of heart with the help of diagram and conduction system of heart