

# Neurogenic and Myogenic hearts

- In animals with open circulatory system the heart is usually sac-like or tubular. It has ostia or lateral openings which get closed when heart contracts and opens when heart relaxes. When heart relaxes vacuum is created to suck blood in the heart. Hence these hearts are known as suction pumps.
- In most of the suction pump hearts the beating rhythm is set through nerve impulses. Such hearts are known as Neurogenic hearts.

- **In higher animals with closed circulatory system 2, 3 or 4 chambered hearts are seen with muscular ventricles which pumps the blood in the body with pressure and hence heart are known as pressure pumps.**
- **In pressure pump heart the rhythm is set in specialised muscle cells within the heart. They are known as Myogenic hearts.**
- **Most of the embryonic hearts are myogenic which later on may become myogenic or neurogenic.**

- **Myogenic heart and their pacemakers** –
- **In some invertebrates and all vertebrates the heart is myogenic. In them the setting of the rhythm (pacemaking) is by specialized cells (pacemakers).**
- **These cells are highly specialized for generating and conducting the impulse.**
- **In some animals they can be distinguished histologically from the other heart muscles**
- **whereas in some others the distinction is not clear.**

Snakes

Bat

Rat

Guinea pig

Rabbit

Pace maker cells cannot be distinguished

i.e. the distinction between pacemakers and other cells is not clear.

Humming bird  
Chick

Platypus

Anteater

Sheep

Cow

Pig etc.

Specialized cells can be distinguished or differentiated

- **The pacemaking regions are different from animal to animal.**
- **In Teleost cells of floor of atrium and auriculo-ventricular junction act as pacemaker.**
- **In elasmobranch fishes sinus venosus, auriculoventricular junction and truncus arteriosus act as pacemaker.**
- **In amphibians and reptiles sinus venosus act as pacemakers**
- **In mammals and birds sinu-atrial and auriculo-ventricular nodes act as pacemakers.**
- **In invertebrates the pace making area is wandering i.e. changing place.**

- **In birds and mammals as mentioned above pacemaking impulse arises in sinu-atrial node (S.A. node). It is a small mass in right atrium. (In man 2 cm x 2cm) It is situated near entrance of vein. Atrio-ventricular node (A.V. node) is situated near auriculoventricular junction from which the impulse is carried to ventricle by specialised conducting muscles forming auriculoventricular bundle (AV bundle) or Bundle of 'His' i.e. bundle of God.**
- **In birds bundle of His forms a network in atria.**

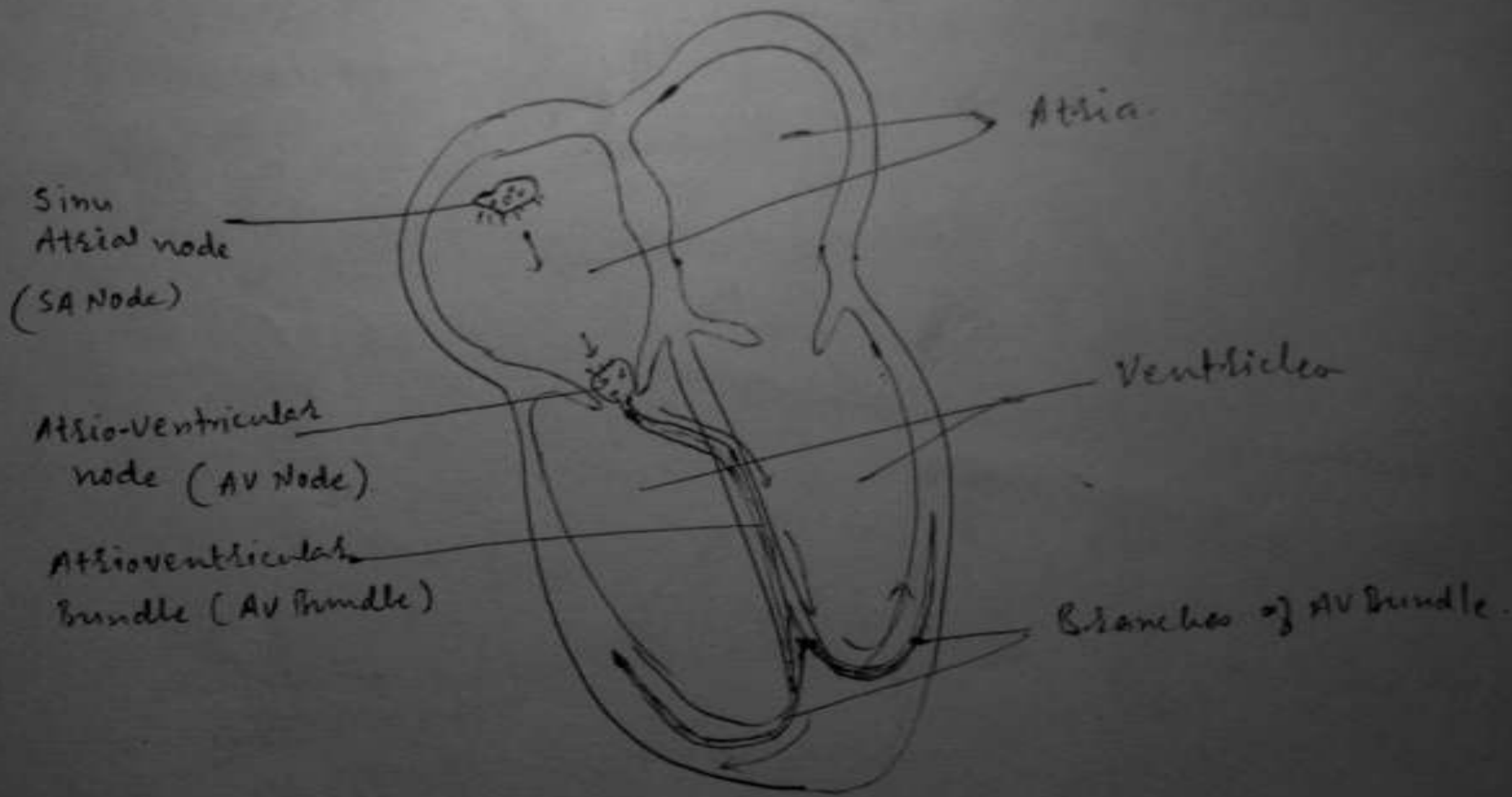


Fig. 2 Pace makers in Myogenic Heart -



- **S.A. node is known to be true pacemaker. If it is surgically manipulated or given temperature, chemical or electrical stimuli, it affects cardiac activity, thus the wave of heart action starts from this point.**
- **The wave is picked up by A.V. node situated in right atrium near AV septum and then spreads into ventricle through the branches of auricular-ventricular bundles which forms a network in ventricle.(Purkinje fibres)**

- **In birds network is present in right and left atria as well. AV bundle tissue is highly specialized in conductance and hence spreads the impulse very fast.**

- **In myogenic heart in fact all cells have ability to set the rhythm. But certain cells are more specialized.**
- **The difference in them and other cells is they are highly unstable and have changing electrical potential. These cells are known as pacemaker cells.**
- **According to Kollikar and Miller heart have 3 type of cells 1) Pacemaker muscle cell 2) Conductive muscle cell 3) Contracting muscle cells**

- **Pacemaker cells initially have inside negative as compared to outside and have a charge or potential of about  $-55$  mV.**
- **This charge is unstable there is a slow leakage up to  $-30$  mV which is known as slow depolarization.**
- **This is followed by rapid depolarization up to  $+10$  mV.**
- **This depolarization causes contraction of muscles.**
- **The depolarization is followed by repolarisation which causes relaxation or diastole.**

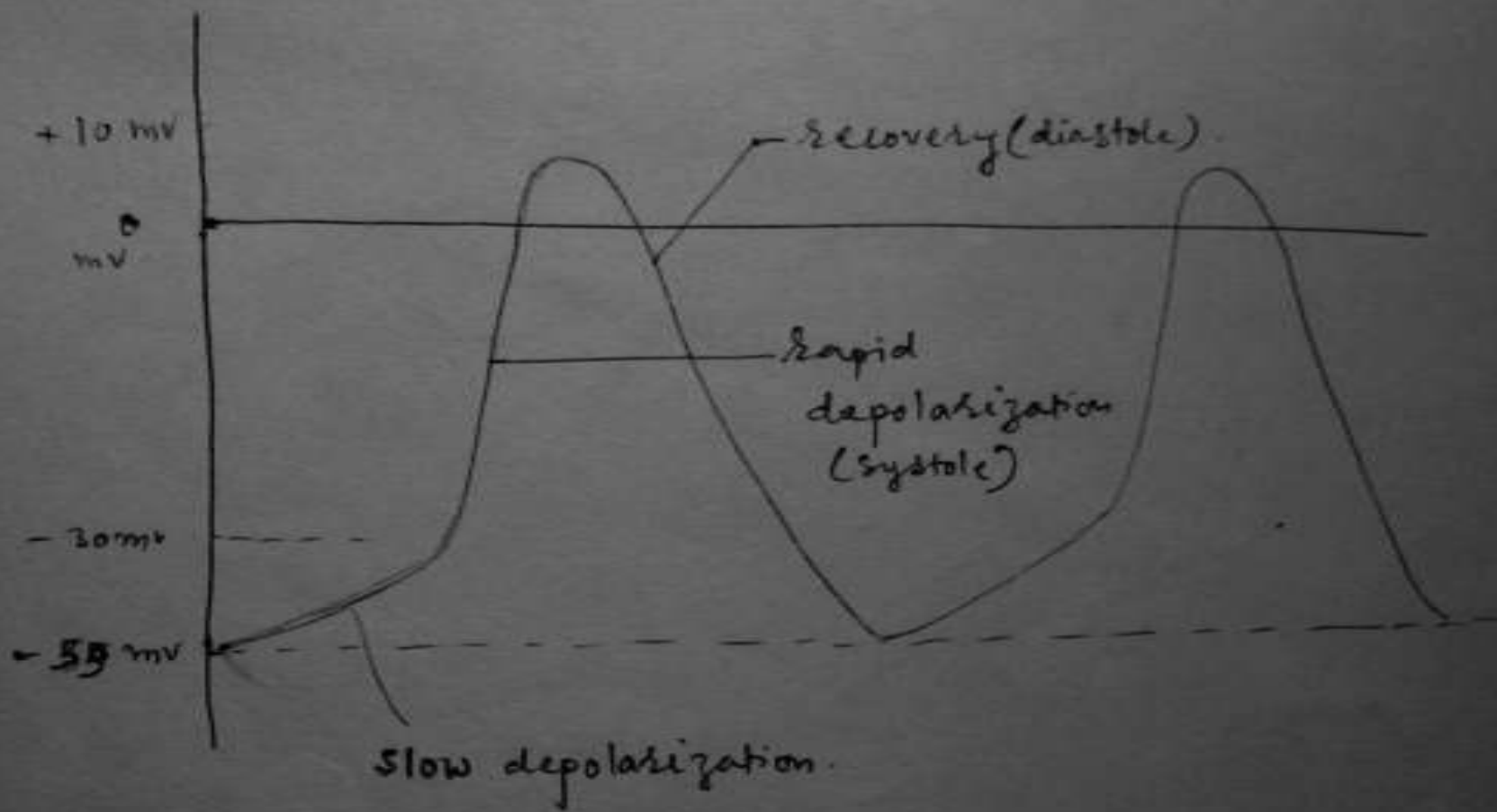


Fig 3 → Electrical recording from pacemaker cell.

- **This way the charges on pacemaker cells keep on changing constantly.**
- **These changes in the form of depolarisation and repolarisation spread in the heart muscle through conducting cells causing rhythmic contraction and relaxation of heart.**