1 Pacemaker Cells

- Function as the natural "pacemakers" of the heart, initiating the electrical impulses that set the heart's rhythm.
- Gradual depolarization occurs until a threshold is reached, triggering the action potential.
- Located primarily in the sinoatrial (SA) node, with secondary pacemakers in the atrioventricular (AV) node and Purkinje system.

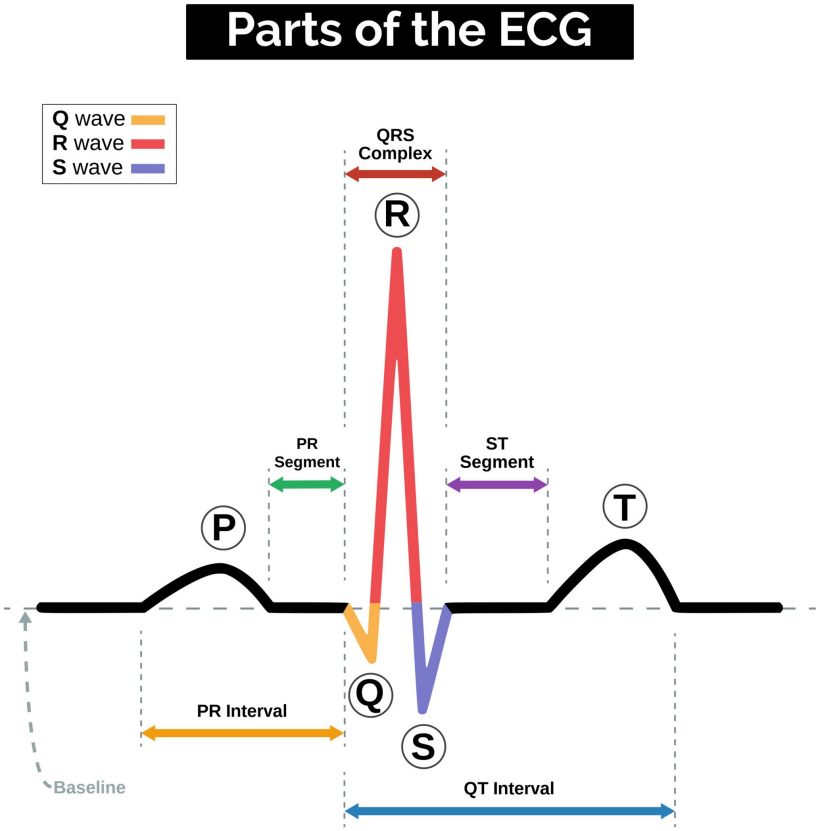
2 Contractile (Myocardial) Cells

- Responsible for the mechanical contraction of the heart.
- Generate forceful contractions upon electrical stimulation from the pacemaker cells.

3 The major types of Waves in a given ECG waveform,

- P-wave
- QRS complex
- T-wave

Between these three waves, there are transition segments like the P-R segment(between P and QRS complex), the S-T segment(between QRS and T).



4 Significance of each part

4.1 P wave:

1. This part represents Atrial depolarisation, which leads to contraction of atria.

2. When atria contracts , P wave is observed.

4.2 PR segment:

1. This tell about the delay of AV(atrioventricular) node .
2. AV node is like a gatekeeper , which gives time to atria for dumping blood into Ventricules.

4.3 PR interval:

1. It extends from the beginning of the P wave till QRS complex.
2. Demonstrates time it takes for electrical signal to go form atria to AV node.
3. This can be used to determine whether patient has a heart block or not.

4.4 QRS complex:

1. It represents Ventricular Depolarization(leading to contraction of the ventricules).
2. Atrial repolarization also occurs here , but not visible.

4.5 ST segment:

1. Signifies completion of ventricular depolarization and the beginning of ventricular repolarization.
2. This is a flat line(isoelectric), which signifies the resting of the heart cells.

4.6 T wave:

1. Signifies the beginning of ventricular repolarization(Relaxation).
2. Caused by large size of the ventricules as they relax.

After T wave a flat line is observed due to ventricular repolarization and again it goes to new P wave and continues this Cycle again.

4.7 QT interval:

1. This represents the time taken for electrical signals to cause the ventricles to contract and then rest.

5 Coordination of Action Potentials and the Cardiac Cycle

The sequence of pacemaker and contractile cell action potentials coordinates the electrical and mechanical phases of the heart as follows:

1. **Atrial Depolarization and Contraction:** The SA node action potential propagates through atrial myocardium, causing atrial depolarization (P wave) and contraction, which contributes to ventricular filling.

2. **AV Nodal Delay:** The impulse is delayed at the AV node (PR interval), ensuring atrial contraction completes before ventricular activation.

3. **Ventricular Depolarization and Isovolumetric Contraction:** Rapid conduction through the His-Purkinje system leads to synchronized ventricular depolarization (QRS complex) and isovolumetric contraction, raising intraventricular pressure.

4. **Ventricular Ejection:** During the plateau phase of ventricular action potentials (ST segment), the semilunar valves open and blood is ejected into the aorta and pulmonary artery.

5. **Ventricular Repolarization and Relaxation:** Ventricular repolarization (T wave) initiates relaxation; ventricular pressure falls, semilunar valves close, and the heart returns to diastole with passive filling.