

# Conduction System of the Heart and Electrocardiography

Heart contraction results from a series of electrical potential changes, or depolarization waves, that travel through the heart preliminary to each beat.

- The heart's ability to beat is intrinsic. It does not depend on impulses from the nervous system to start its contraction, and will continue to beat even when all nerve connections are severed.
- The intrinsic conduction system, or nodal system, of the heart consists of specialized noncontractile myocardial tissue. This system ensures that the heart muscle depolarizes in an orderly and sequential manner from atria to ventricles and that the heart beats as a coordinated unit.
- The intrinsic conduction system components include:
  - The sinoatrial (SA) node located in the right atrium just inferior to the entrance to the superior vena cava
  - The atrioventricular (AV) node in the lower atrial septum at the junction of the atria and ventricles
  - The AV bundle, or bundle of His, and right and left bundle branches located in the interventricular septum
  - The Purkinje fibers which ramify within the muscle bundles of the ventricular walls; the Purkinje fibers are long strands of barrel-shaped cells called Purkinje myocytes; they are denser in the left ventricle because of the larger chamber size
- The SA node, a.k.a. the pacemaker, provides the stimulus for contraction.
- The impulse follows the following path:  
SA node → AV node → AV bundle → right and left bundle branches → Purkinje fibers resulting in ventricular contraction

## Electrocardiography

The conduction of impulses through the heart generates electrical currents that spread throughout the body. These impulses can be detected on the body's surface and recorded with an electrocardiograph. The graphic recording of the electrical changes, depolarization and repolarization, that occur during the cardiac cycle is called an electrocardiogram (ECG).

- The normal ECG has a series of three waves called deflection waves.
  - The first wave is the P wave. It is a small wave that indicates depolarization of the atria immediately before atrial contraction.
  - The large QRS complex results from ventricular depolarization and has a complicated shape. It precedes ventricular contraction.
  - The T wave results from currents propagated during ventricular repolarization.

You should be able to correctly label an electrocardiogram and know what events cause each wave.

- Tachycardia is a heart rate over 100 beats/min.
- Bradycardia is a heart rate below 60 beats/min.
- Prolonged tachycardia may lead to fibrillation, which is rapid uncoordinated heart contractions, making the heart useless as a pump.
- Twelve standard leads are used to record an ECG for diagnostic purposes.