Experiment HH-9: ECG and Heart Sounds using an Electronic Stethoscope

Background

Blood enters the arterial system from the ventricles of the heart in a pulsatile manner. However, when blood is leaving the arterial system through the capillaries, it flows in a continuous manner. Between contractions, when the heart is relaxed and blood is not being pumped into the arterial system, there is still enough pressure in the arterial system to move blood along the arteries. The pressure in the arterial system exists because the elasticity of the arteries allow them to distend and recoil and function as a pressure reservoir.

When the ventricles contract, the pressure of the blood inside the ventricles increases to close the atrioventricular valves. Further contraction increases the ventricular pressure until it exceeds the arterial pressure. At this point, when the arterial pressure is at its lowest point during the cardiac cycle (called diastolic pressure) the semilunar valves are forced open, and blood flows into the artery. Blood entering the arterial system inflates the arteries a little and increases blood pressure to a maximum, which is the systolic pressure.

In this lab you will record the ECG and heart sounds from a subject and, with the aid of a stethoscope, hear those characteristic sounds of the heartbeat, typically described as a "lub-dub." These sounds are produced by the closure of the heart valves.

The first heart sound or "lub" results from closure of the tricuspid and mitral valves. It is a rather low-pitched and a relatively long sound which represents the beginning of ventricular systole.

The second heart sound, or "dub," marks the beginning of ventricular diastole. It is produced by closure of the aortic and pulmonary (pulmonic) semilunar valves when the intraventricular pressure begins to fall. This "dub" sound is typically heard as a sharp snap because the semilunar valves tend to close much more rapidly than the AV valves. Because diastole occupies more time than systole, a brief pause occurs after the second heart sound when the heart is beating at a normal rate. Therefore, the pattern that one hears is one of: "lub-dub" pause, "lub-dub" pause, and so on.

Heart auscultation and ECG are two important tools for cardiovascular disease diagnosis. Physicians perform diagnoses from listening to heart sounds and by a visual examination of the ECG waveforms. It has been shown that patients with the same disease tend to have similar-looking ECG shapes with comparable heart sounds.