

BME 301 Homework

1-Why do we study this subject?

Homework

1. The Action Potential process described is a simplification. Develop a more detailed view showing all of the types of channels, pumps, ions, etc. that are involved in this process.

Across the membrane there are Potassium and Sodium leak channels and Potassium/Sodium pump (uses ATP) which keep the membrane at -70mV. Voltage gated channels associated with Sodium open up when the cell potential reaches -55 mV and potassium ions rush in causing depolarization and the voltage to increase towards 30mV. When 30 mV is achieved the Sodium voltage channels close and the voltage gated channels associated with Potassium open and Potassium ions rush in causing repolarization and the voltage drops. It can drop below -70mV due to the slowness of these Potassium voltage gated channels to close. The leak channels re-establish the voltage back to -70mV. See <https://youtu.be/HYLyhXRp298> for more detail.

Homework

2. In Einthoven's triangle, the electrodes connected to what sort of electrical amplifier? Why? Skip this until they get to Amplifiers.

The voltages along the sides of Einthoven's triangle are amplified using a differential amplifier. One electrode on the triangle is connected to the positive input of the amplifier and the another electrode on the triangle is connected to the negative input of the same amplifier. A ground electrode which is usually situated at the right leg is also connected to the reference terminal of the same amplifier. It is assumed that the signal from one corner of the triangle to ground contains the same amount of noise as the other corners of the triangle (to ground) and in this way the differential amplifier subtracts out the noise yielding a cleaner signal. This is repeated 2 more times to obtain the voltage across the other 2 side of the triangle.

Homework

3. HONORS STUDENTS ADD THE FOLLOWING

Determine a method to calculate the Heart Rate from the ECG bio-signal. Name the type of circuit needed to perform this calculation.

One can detect the time between successive peaks of the ECG signal occurs. This might be call the Inter-beat interval or IBI. The best peak to detect is the R-wave. One can determine determine the average Heart Rate, HR, by calculating the average IBI and then invert this number to yield the HR.

A circuit used to find when the R-wave occurs is called a peak detector.