Experiment No. 05

5.1 Experiment Name

Action Potential and bio electrical impedance measurement of human limbs

5.2 Objectives

- To investigate the relationship between action potentials in the limbs and bioelectrical impedance
- To understand how the electrical activity associated with action potentials influences the impedance of the limb

5.3 Theory

The action potential, a critical electrical phenomenon, is observed in excitable cells like neurons and muscle cells. These rapid changes in membrane potential involve depolarization and repolarization, facilitating signal transmission along the cell's length. Bioelectrical impedance refers to the resistance living tissues present to electric current flow. In the context of human limbs, measuring bioelectrical impedance offers valuable insights into limb composition, revealing proportions of muscle, fat, and fluids.

Bioelectrical Impedance Analysis (BIA) is a method for estimating body composition, particularly body fat and muscle mass. This technique involves passing a weak electric current through the body and measuring voltage to calculate impedance (resistance and reactance). Since most body water resides in muscles, individuals with higher muscle mass typically exhibit lower impedance. BIA precisely determines electrical impedance, representing tissue resistance to electric current flow.

5.4 Apparatus

- ❖ Measuring electrodes
- ❖ Bio-electrical impedance measurement device
- ❖ Gel

5.5 Data Table (Measured value)

Ashraf (1801171)			**Efaz (1801179)**		
Position	Impedance (MOhm)	Voltage	Position	Impedance (MOhm)	Voltage
RA-RW	1.95	1.95 V	RA-RW	1.92	1.92 V
RA-LA	1.75	1.75 V	RA-LA	1.88	1.88 V
RL-LL	25	25 V	RL-LL	41	41 V
Saad (1801141)			**Sagor (1801172)**		
Position	Impedance (MOhm)	Voltage	Position	Impedance (MOhm)	Voltage
RA-RW	1.90	1.90 V	RA-RW	1.93	1.93 V
RA-LA	1.78	1.78 V	RA-LA	1.66	1.66 V
RL-LL	28	28 V	RL-LL	18	18 V

Here, injected current is 1 micro ampere.

5.6 Discussion & Conclusion

This experiment aimed to explore action potential and bioelectrical impedance across different body regions, comparing right arm to left arm, arm to leg, and leg to leg. Prior to analysis, theoretical groundwork was laid. Using a specialized device, a constant 1 microampere current was injected through the body, and impedance was measured at 15s, 30s, and 60s intervals. The report includes a theoretical framework and data table. The report combines theoretical foundations with practical insights, demonstrating a systematic approach.