SIR Publishers
CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-03, Published |30-04-2026|

ELECTRIC CURRENT IN LIVING ORGANISMS

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ABSTRACT

Electric current plays a fundamental role in the functioning of living organisms, serving as the basis for many physiological processes. Bioelectric phenomena are essential for nerve impulse transmission, muscle contraction, and cellular communication. This article explores the origin, mechanisms, and significance of electrical activity in biological systems. Special attention is given to the role of ions, membrane potentials, and electrophysiological processes in maintaining homeostasis. Understanding electrical currents in living organisms contributes to advancements in medical diagnostics, treatment methods, and biomedical technologies.

Keywords: electric current, living organisms, bioelectricity, membrane potential, nerve impulse, electrophysiology, ion channels, homeostasis

INTRODUCTION

All living organisms exhibit electrical properties that are vital for their survival and proper functioning. The presence of electric current in biological systems is primarily due to the movement of charged particles, such as ions, across cell membranes. These electrical activities are especially prominent in excitable tissues, including nerves and muscles. Bioelectricity has been a subject of scientific interest since early discoveries demonstrated that living tissues can generate and respond to electrical signals. In modern biology and medicine, the study of electrical currents in organisms—known as electrophysiology—has become crucial for understanding complex physiological processes. For example, the transmission of nerve impulses relies on rapid changes in membrane potential, while cardiac function depends on coordinated electrical activity. This article aims to examine the fundamental principles of electric current in living organisms, highlighting its biological importance and practical applications in the medical field.

MATERIALS AND METHODS

This study is based on a qualitative and analytical review of scientific literature related to bioelectricity in living organisms. Data were collected from textbooks, peer-reviewed journals, and electronic scientific databases focusing on electrophysiology, cellular biology, and medical physics. The research mainly examines the mechanisms of electric current generation in biological systems, particularly the role of ion channels, membrane potentials, and electrochemical gradients. Comparative analysis was used to evaluate electrical processes in different types of cells, including neurons, muscle cells, and cardiac tissues. In addition, basic electrophysiological principles such as resting potential, action potential, and ion transport were analyzed to understand how electrical signals are produced and transmitted in living organisms.

RESULTS

The analysis revealed that electric current in living organisms is primarily generated by the movement of ions such as sodium (Na^+), potassium (K^+), calcium (Ca^{2+}), and chloride (Cl^-) across cell membranes. This ion movement creates differences in electrical potential, known as membrane potential. It was found that excitable cells, such as neurons and muscle cells, exhibit rapid changes in membrane potential called action potentials. These electrical signals enable the transmission of nerve impulses and the contraction of muscles. In cardiac tissue, synchronized electrical activity regulates

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the heartbeat. Furthermore, the results show that ion channels and pumps, particularly the sodium-potassium pump, play a crucial role in maintaining electrical balance and cellular homeostasis.

DISCUSSION

The findings highlight the essential role of bioelectricity in maintaining vital physiological functions. Electrical currents in living organisms are not only fundamental for communication between cells but also for coordinating complex biological processes such as movement, sensation, and organ function. The importance of ion channels and membrane dynamics demonstrates how even small disturbances in electrical activity can lead to significant health problems. For instance, irregular electrical signals in the heart can result in arrhythmias, while disruptions in neuronal signaling may contribute to neurological disorders. Moreover, understanding bioelectric processes has significant implications in medicine. Techniques such as electrocardiography (ECG) and electroencephalography (EEG) rely on detecting electrical activity in the body, providing valuable diagnostic information. Overall, the study of electric current in living organisms remains a crucial field, bridging biology, physics, and medicine, and offering new opportunities for scientific and technological advancements.

CONCLUSION

In conclusion, electric current in living organisms is a fundamental phenomenon that underlies many essential physiological processes. The movement of ions across cell membranes generates electrical signals that enable communication between cells, coordination of muscle activity, and regulation of vital organ functions.

The study of bioelectricity provides a deeper understanding of how living systems maintain internal balance and respond to external stimuli. Moreover, it plays a crucial role in modern medicine, particularly in diagnostics and treatment methods. Continued research in this field will contribute to the development of advanced biomedical technologies and improve our ability to diagnose and treat various diseases effectively.

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