Editorial on Neurophysiology

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Editorial Note

Neurophysiology (from Greek, neuron, "nerve," physis, "nature, root," and -, -logia, "knowledge") is a branch of physiology and neuroscience concerned with the study of the nervous system's functioning. Electrophysiology—the electrical recording of neuronal activities ranging from the molar (the electroencephalogram, EEG) to the cellular—has dominated it in the past (intracellular recording of the properties of single neurons). It's difficult to distinguish electrical events from the biochemical and molecular processes that cause them because the neuron is an electrochemical machine. To research brain function, neurophysiologists now use chemistry (calcium imaging), physics (functional magnetic resonance imaging, fMRI), and molecular biology (site guided mutations).

Below you will learn all about

- Ion channels
- Resting membrane and action potential
- Neuromuscular junction/synapses
- Nerve conduction
- Neurotransmitters, receptors and pathways

Ion channels

An ion channel is a macromolecule of protein that stretches the width of a membrane and allows molecules to move through. The electrochemical gradient across the membrane defines the direction in which the ions travel. Ions prefer to move from a high-concentration region to a low-concentration area.

Types of Channels

- Voltage Gated
- Chemically Activated
- Mechanical Stretch/Pressure.

Resting membrane and action potential

Since the membrane is largely permeable to K+ in the resting state, the membrane potential arises. The positive charge of the sodium ions pushes the potential within the cell from negative to more positive as they rush back into the cell. An action potential is produced when a threshold potential is reached.

Neuromuscular junction/synapses

A synaptic connection between the terminal end of a motor nerve and a muscle (skeletal, smooth, or cardiac) is known as the neuromuscular junction (NMJ). It is where the action potential is transmitted from the nerve to the muscle.

Nerve conduction

Action potential propagation is achieved by local current spread.

The nerve is insulated with myelin if its size is above a certain diameter, with the Nodes of Ranvier at various intervals along its length.

Neurotransmitters, receptors and pathways

The neurotransmitter is released at the synapse and interacts with a protein called the receptor in the postsynaptic membrane. The neurotransmitter can also interact with a presynaptic autoreceptor in certain synapses. The PSA regulates the amount of transmitter that is released.

In most cases, receptors are unique to a single neurotransmitter. Receptors come in a variety of shapes and sizes. The binding of another transmitter can be controlled by co-released neurotransmitters. Specific neurotransmitter receptors may be connected directly to ion channels or indirectly to membrane enzymes, with the neurotransmitter binding to the receptor either opening an ion channel through an intracellular enzyme cascade or indirectly modulating the likelihood of other ion channels opening in response to voltage changes. Once the neurotransmitter is removed through enzymatic hydrolysis (uptake) into the presynaptic nerve terminal or adjacent glial cells, the activated receptor can only return to its resting state.

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