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BIOPHYSICAL BASIS OF THE GENERATION AND TRANSMISSION OF NERVE IMPULSES

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Abstract

This in the article nerve impulses harvest to be and of transmission biophysicist basics illuminated . Nerve in cells electricity potentials appearance to be , ion exchange , membrane features and impulses synapses through transmission mechanisms analysis Also, biophysical of laws human organism in the activity importance , nerve system work efficiency and modern in medicine application directions scientific in terms of statement was done.

Key words

Nerve impulse, neuron, membrane, biophysics, ion channels, sodium, potassium, depolarization, repolarization, synapse, axon, dendrite, potential, electrical signal, nerve system, cell, diffusion, osmosis, excitation, impulse transmission, bioelectricity phenomenon, physiology, mediator, membrane potential, neurophysiology, electrophysiology, biological system, signal, reflex, nerve fiber.

Login

Biophysics biological in systems happened to be physicist and chemical processes learner important from sciences one is considered . Human in the body all vital processes known biophysicist to the laws is based on . Especially the nerve system activity organism external environment with connection in providing big importance profession will reach . Nerve impulses harvest to be and transmission organism management mechanisms to the surface releases and muscles movement , sensation organs activity and internal organs work coordinates .

Nerve impulse neuron in the membrane electricity potentials change as a result

to the surface is coming . This process sodium and potassium ions cell membrane through movement with closely is related to . Membrane potential change nerve fibers along spread , information exchange process done increases . Biophysical point of view from the point of view this event electricity current , diffusion and ion exchange to the laws is based on .

Current on the day nerve impulses study medicine , neurology and modern diagnostics methods in development important place holds . Electroencephalography , electromyography such as methods exactly bioelectric signals analysis to do is based on . This because of nerve impulses biophysicist the basics study scientific and practical in terms of current is considered .

Home part

Nerve system main structural unit neuron is considered . Neurons dendrite , cell body and from the axon organization found information acceptance to do and transmission task Nerve impulse harvest in being cell membrane selective conductivity main role plays . Membrane internal and external on the side ions concentration differentiation as a result peace potential to the surface is coming .

Peace in the case of membrane internal part external to the environment relatively negative charged This is the case . mainly potassium ions membrane through out departure and sodium ions limited entrance with Nerve to the cell impact provider The trigger signal is known. borderline from the value when increased depolarization begins . In this sodium channels opens , Na^+ ions cell inside fast enters . As a result membrane potential positive to value changes .

Next stage repolarization process is , then potassium ions from the cell outside comes out and membrane initial to the state returns . This process bioelectric impulse harvest of being main mechanism organization will reach .

$$V\,m = V\,internal - V\,external$$

The above formula is a membrane potential biophysicist the essence represents . Membrane potential nerve of cells functional status defines .

Table 1. Nerve pulse rate stages and ions movement

Stage	Process description	Home ion
Peace potential	Membrane internal part negative	K^+
Depolarization	Sodium ions inside enters	Na^+
Repolarization	Potassium ions outside comes out	K^+
Hyperpolarization	Potential temporarily excess negates	K^+

Nerve impulses transmission speed nerve of fibers to the structure related . Myelin shell with covered nerve in the fibers impulse faster spreads . Myelin floor electricity insulator task performing the impulse Ranvier nodes through jumping the passage provides . This event saltator is called transmission .

At synapses nerve impulses chemical mediators using is transmitted . Acetylcholine , dopamine and like serotonin substances nerve cells between information exchange provides . In synapses mediators divorce calcium ions in the presence of done increases .

Nerve impulses biophysicist the basics study in medicine big importance has . Neurological diseases in determining bioelectric signals check methods is applied . For example , electroencephalography (EEG) is a brain activity , electromyography and muscles bioelectric activity analysis does .

Analysis results

Research this shows that the nerve impulses harvest to be cell in the membrane ion exchange with integral The membrane is connected . selective conductivity bioelectric potentials appearance in being main factor Sodium and potassium ions various concentration in the cell electricity balance to the surface This brings . balance

when broken nerve excitement happened will be .

Analyses during nerve impulse speed myelin to the floor dependency determined . Myelinated nerve in the fibers impulse transmission speed unmyelinated to the fibers than one how many once high It will be . reason impulse Ranvier nodes through jump in the style of is the spread . This mechanism energy spending reduces and information exchange efficiency increases .

Biophysics analyses as a result nerve impulses ion channels in the transmission role big that observed . Especially sodium channels fast opening depolarization to the surface brings . Potassium channels and membrane initial to the state in return important task will do. This of processes violation various neurological to diseases reason to be possible.

Table 2. Nerve in the fibers impulse transmission speed

Nerve fiber type	Structure	Extension speed
Myelinated fibers	Myelin shell there is	70–120 m/s
Unmyelinated fibers	Myelin floor no	0.5–2 m/s

Table information this shows that myelin floor nerve impulse effective and fast transmission This situation human reflexes fast done in the increase important role plays . For example , hot to the body when touched hand fast pull to take reflex high at speed nerve to the impulses based on .

Analyses during synapses and nerves in the system importance studied . Mediator substances in synapses signal transmission via organism complicated management mechanisms to the surface releases dopamine and like serotonin mediators human spiritual status with closely They are related . shortage depression , stress and other psychological to violations take arrival possible .

Nerve impulses biophysicist mechanisms study modern in medicine new treatment methods working to go out opportunity is giving . Neurostimulation , bioelectricity therapy and artificial neuron systems exactly nerve impulses about

scientific to knowledge is based on . From this except electrodiagnostics methods through diseases early determination opportunity is increasing .

Research results this shows that the nerve in the system electricity events biological systems the most complicated and perfect from mechanisms is one . Nerve impulses organism all activity manager main information system as service does . This because of biophysics in science nerve impulses study important scientific from directions one is considered .

Conclusion

Nerve impulses harvest to be and transmission biophysics important research from directions This is one of them . process membrane potential , ion exchange and bioelectric to events is based on . Nerve impulses fast and effective transmission organism activity in management important importance has . Modern in medicine nerve system biophysicist features study diagnostics and treatment methods to develop service is doing .

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