كلية المستقبل الجامعة
قسم الفيزياء الطبية
المرحلة الرابعة

Medical Physics

Neurophysics

Lecture 1

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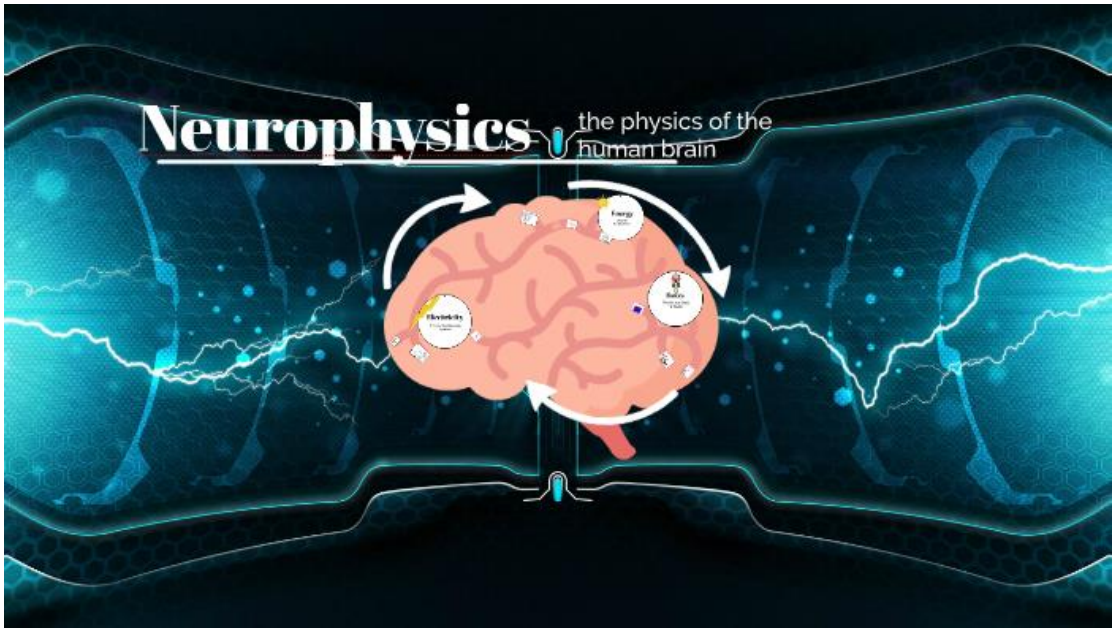
Neurophysics :

Neurophysics (or neurobiophysics): is the branch of biophysics dealing with the development and use of physical methods to gain information about the nervous system.

Neurophysics : is an interdisciplinary science using physics and combining it with other neurosciences to better understand neural processes.

The methods used include the techniques of experimental biophysics and other physical measurements such as EEG mostly to study electrical and mechanical properties, as well as theoretical and computational approaches. The term **neurophysics** is a portmanteau of (neuron) and (physics) .

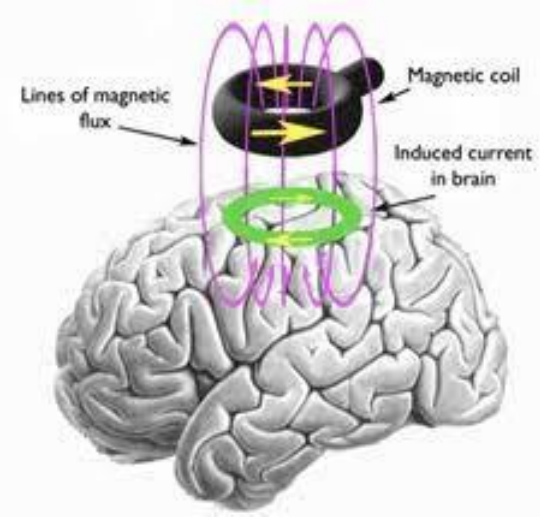
Among other examples, the description of physical phenomena measured during an EEG using a dipole approximation use neurophysics to better understand neural activity .



General Define of Neuroscience :

is the scientific study of the nervous system. It is a multidisciplinary science that combines physiology, anatomy, molecular biology, developmental biology, cytology, computer science and mathematical modeling to understand the fundamental and emergent properties of neurons, and neural circuits .

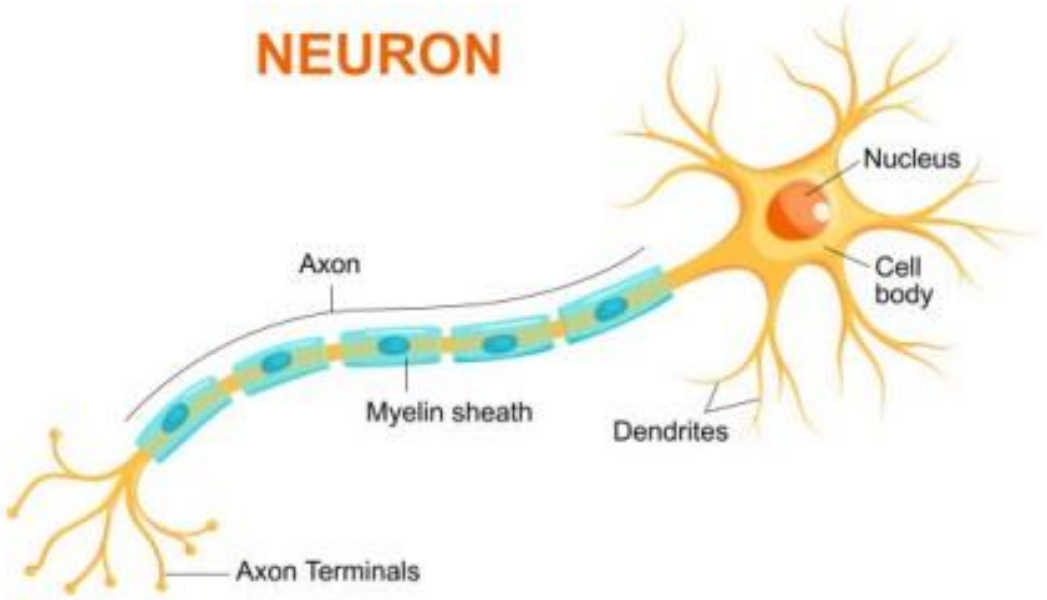
Our main focus is on advancing non-invasive transcranial brain stimulation (TBS) methods as a means to modulate and shape brain activity. Most TBS approaches use electric currents that are focally induced in superficial brain areas. We develop and apply biophysical models to reveal and optimize the current flow patterns in the brain and to estimate their impact on neural activity.



Nerve Cells :

Neurons are the information processing units of the brain which have a responsibility for sending, receiving, and transmitting electrochemical signals throughout the body .

Neurons, also known as nerve cells, are essentially the cells that make up the brain and the nervous system. Neurons do not touch each other, but where one neuron comes close to another neuron, a synapse is formed between the two .



Components of central nervous system :

1- The Brain .

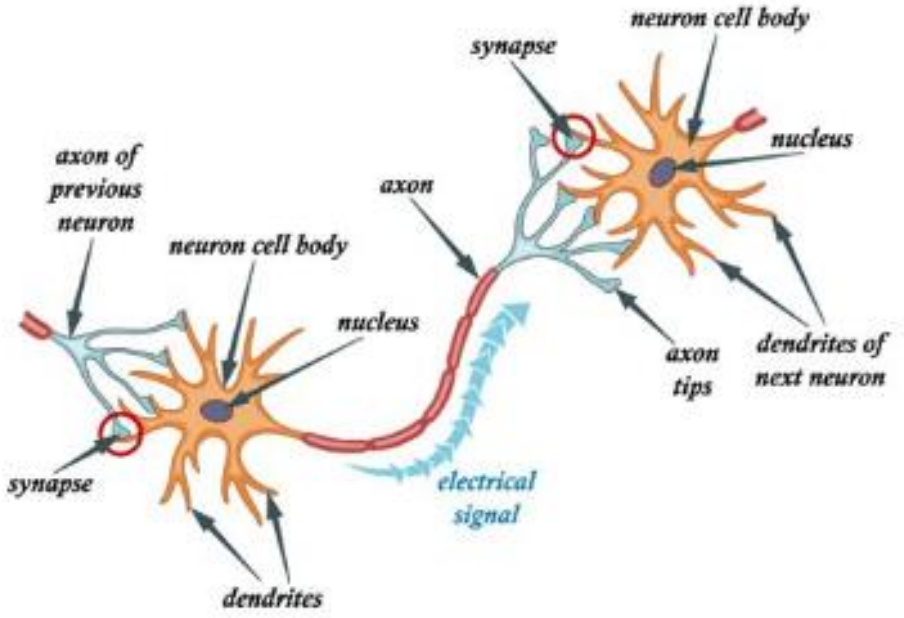
2- Spinal Cord .

3- peripheral nervous system, which consists of sensory and motor nerve cells all contain these information processing neurons .

How Neurons Communicate :

1- Electrical signal that travels on the membrane of a neuron .

2- Based on movements of ions between the outside and inside of the cell .



Factors Effecting on Electrical Activity of A Neuron :

1- Electrical potential : there is difference in electrical potential between the inside and outside the membrane .

2- Excitability : the ability to respond to any stimulus by generating action potential .

3- Conductivity : the ability to propagate action potential from point of generation to resting point .

Electrical Properties of Neurons (Nerve Cells) :

1- In neurons, information is carried from one part of the cell to another in the form of action potentials—large and rapidly reversible fluctuations in electrical voltage across the plasma membrane that propagate along the axon .

2- Different neurons exhibit different patterns of action potential firing .

3- Some neurons are normally silent .

4- The membrane potential remains at the resting potential unless the firing of action potentials is triggered by some external stimulus .

5- The electrical properties of a neuron are subject to modulation by input from the environment, including sensory information from the outside world, hormones released from other parts of the organism, and chemical and electrical signals from other neurons to which the neuron is functionally connected .

ELECTRICAL PROPERTIES OF NEURON