

NEUROPHYSIOLOGY

EXERCISE 1 – Self-evaluation

With the help of the following terms: fill the gaps.

Autonomous – peripheral – sympathetic – central – motor – somatic – sensitive – parasympathetic.

The nervous system is divided into 2 parts:

- 1- The _____ nervous system is composed of the brain and the spine. It is the integration centre for neural/sensitive messages, interprets incoming information and generates motor responses.
- 2- The _____ nervous system is composed of receptors, nerves and effectors. It allows the communication between the central system and the rest of the organism.

The second (2-) division is itself subdivided in two other systems:

- 3- The _____ nervous system is formed by neurons transporting information from peripheral organs (e.g. muscle receptors) to the central nervous system.
- 4- The _____ nervous system is formed by neurons transporting information from the central nervous system to the effectors (e.g. muscles).

Each of these divisions is itself divided into two systems:

- 5- The _____ nervous system is under the voluntary control. It is composed by sensitive receptors (e.g. muscle spindles), sensitive/afferent neurons that project the information toward the CNS, and motor neurons that project the information toward the muscles.
- 6- The _____ nervous system, or involuntary system, functions in a non-conscious way. It is made of organs (stomach, lungs...) and sensitive neurons transmitting the information toward the central system, and motor neurons transmitting information from the central system towards smooth muscles, heart and glands.

The autonomous nervous system is divided into two systems:

- 7- The _____ nervous system transmits information that increases its activity (excitation). This system prepares the body for emergency situation (danger), and is linked to energy-consuming processes.
- 8- The _____ nervous system transmits information that reduced its activity (inhibition). This system mainly regulates the activity that allow the conservation and restoration of body energy.

EXERCISE 2 - Multiple choices questions

1 – A sensitive nerve is

Deferent

Afferent

Efferent

2 – A motor nerve is

Efferent

Deferent

Afferent

3 – The majority of nerves are

Motor

Sensitive

Motor and sensitive

4 – Motor nerves transmit information

From muscle to brain stem

From brain to muscles

From muscles to brain

5 – Sensitive neurons transmit information

From organs to brain stem

From organs to brain

From brain to organs

6 – From neuron to neuron, the message is conducted with

Neurotransmitter

Neuroleptic

Neutrophil

7 – Breathing, blood flow and digestion are controlled by

Vegetative nervous system

Central nervous system

Spine

8 – Autonomous (vegetative) nervous system is composed of

Sympathetic and parasympathetic systems

Parasympathetic system

Sympathetic system

9 - Parasympathetic system usually allows

Resting and stimulating the organism

Stimulating the organism

Resting the organism

10 – Transmission from a neuron to another is

Electrical or chemical

Mechanical and electrical

Electrical and chemical

11 – Stopping neuronal transmission is due to

Activation signal

Stimulating signal

Inhibiting signal

12 – The vegetative system

Is under voluntary and involuntary control

Is under voluntary control

Is not under voluntary control

13 – The sympathetic system

Increases heart rate

Do not control heart rate

Slow down heart rate

14 – Which neurotransmitter is involved in both sympathetic and parasympathetic systems

Acetylcholine

Noradrenalin

Adrenalin

15 – Which neurotransmitter is involved in sympathetic system (pre-ganglia)

Adrenalin

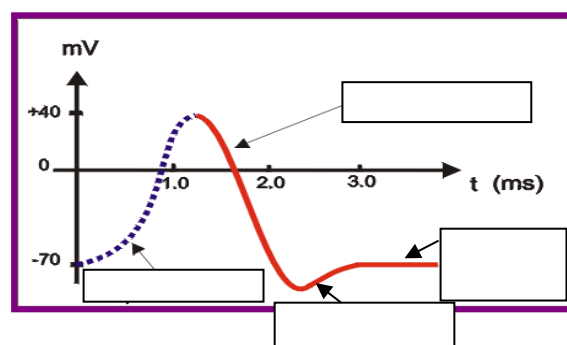
Acetylcholine
None of them

EXERCISE 3 – Resting membrane potential

Give the definition of resting membrane potential. Give its value.
What phenomenon creates this resting voltage? How is it maintained?

EXERCISE 4 – Nervous action potential

Give a concise definition and description of the action potential. Legend the figure below.
Describe and explain the different physiological phenomenon associated with the production of an action potential.



EXERCISE 5 – Synapse

Give the definition of synapse.
Describe the different steps of a synapse. What are the main neurotransmitters in the nervous system?

EXERCISE 6 – Synaptic transmission and signal integration

We consider a synapse with one post-synaptic element and 5 pre-synaptic elements:

- Neuron A: generate a depolarization of post-synaptic membrane of 9 mV
- Neuron B: generate a depolarization of post-synaptic membrane of 16 mV
- Neuron C: generate a hyperpolarization of post-synaptic membrane of 4 mV
- Neuron D: generate a hyperpolarization of post-synaptic membrane of 2 mV
- Neuron E: generate a hyperpolarization of post-synaptic membrane of 3 mV

1 – Which neurons are excitatory? Inhibitory?

The post-synaptic neuron has a resting voltage of -70 mV. Its excitatory threshold is -50 mV. When all A,B,C,D,E are activated, what happens in the post-synaptic neuron, and why?

2 – Inhibitory neurons are GABAergic. Bicuculline, an inhibitory competitor of neurotransmitter GABA is injected. What happens in the post-synaptic neuron (all neurons being activated)?

EXERCISE 7 – Nervous conduction velocity

Two neurons with the same diameter present different conduction velocities: 2 m/s and 100 m/s. How do you explain this difference,