

Ministry of Health of the Republic of Belarus
Education Establishment
"Gomel State Medical University"
Normal Physiology Department

It was discussed at the department meeting 30.08.16
The protocol № 8

METHODICAL INSTRUCTION

for carrying out classes by teachers with the 2nd course students
of Faculty for training specialists for foreign countries (teaching in English)
of normal physiology

Topic: Concluding class on the section: "Physiology of excitable tissues",
"The general and partial physiology of CNS".

The general time of the class – 4 hours.

**1. THE STUDYING AND EDUCATIONAL PURPOSES, THE MOTIVATION FOR
ASSIMILATION OF THE SUBJECT, REQUIREMENTS TO THE INITIAL LEVEL OF
KNOWLEDGE**

Purposes of the class

To form at students complex idea of the electric phenomena and functional changes in excitable tissues, the general principles of CNS coordinate activity and their role in ensuring normal functioning of an organism.

Motivational characteristic of the topic

The student should consolidate knowledge of regulation mechanisms of physiological functions and physical efficiency of the person, the reflex principle of functioning of nervous system, ways and mechanisms of information transfer to CNS and from CNS on the periphery, on which functional diagnostics in clinic is based. Also the student should consolidate knowledge of coordination of functions of an organism through chemical mediators.

Tasks of the class

Check the level of student's knowledge of the topics "Physiology of Excitable Tissues", "Central Nervous System".

As a result of carrying out the class the student should:

To know:

- morphofunctional characteristic of excitable tissues, structures of CNS, structures of autonomous nervous system, endocrine glands;
- levels of the CNS organization, property of the nervous centers and basic principles and distribution of exaltation in CNS, reflex principle of regulation of functions;
- mechanisms of functioning and regulation of excitable tissues, coordinated activity of CNS, VNS;
- methods of research of excitable tissues;
- the basic concepts and terms on the class topic;
- basic physiological constants on the class topics.

2. CONTROL QUESTIONS ON THE CLASS TOPIC:

1. A concept about irritability and excitability as a basis of response of a tissue (cell) to irritation. Irritants, its classification. History of its discovery (L. Galvani, A. Volt, Ch. Matteuchi). Modern ideas of a structure and functions of membranes, ion channels. Active and passive transport of ions through the membranes.
2. The electric phenomena in excitable tissues.
 - 2.1. Membrane potential of rest, its parentage and size.
 - 2.2. Action potential, mechanism of its parentage.
 - 2.3. Changes of excitability during excitation.
3. Laws of irritation and assessment of excitability. Rheobase. Chronoxy, its value in clinical practice.
4. Conduction of signal in myelinic and unmyelinated fibers. Types of nervous fibers, their characteristic.
5. Parabiosis according to N. E. Vvedensky.
6. Structure and morphofunctional classification of neurons.
7. Physiology of synapses.
 - 7.1. Synapse, its structure, properties, classification.
 - 7.2. The mechanism of transfer of exaltation in CNS synapses. Exciting and inhibiting synapses and their mediator mechanisms (EPP, PEP, IPP). The mechanism of transfer of exaltation in neuromuscular synapses.
 - 7.3. Structure, properties and functions of neuromuscular synapses.
8. Striated skeletal muscles, their value, structure and physiological properties.
 - 8.1. Neuromotor units, their classification (by structure and functional value).
 - 8.2. Forms (dynamic, static, auxotonic) and types of muscular contraction (isotonic, isometric and eccentric).
 - 8.3. Phases of single muscular contraction. Origin of dentate and smooth tetanus. Concept of an optimum and pessimum of frequency (modes of muscular contraction).
 - 8.4. Mechanism of muscular contraction. Structure of myofibrils. Sarcomere. A role of a myosin, an actin, ATP and calcium ions in muscular contraction.
 - 8.5. Force and work of muscle fiber.
9. Fatigue, its mechanisms. Orbeli-Ginetsinsky's phenomenon. Hypertrophy and atrophy of muscles.
10. Unstriated muscles, features of their structure, function and property. Classification. Plasticity of unstriated muscles, its value.
11. Central nervous system. Its functions and a role in ensuring vital activity of an integrated organism and its relationship with the external environment. Levels of integration in CNS.
12. Neurone. Functional classification of neurons. Physiological properties of nervous cells and function of structural elements of a neuron (soma, axon, dendrites). Features of origin and distribution of excitation in a neuron. Functions of a neuroglia. Hematoencephalic barrier, its functions. Cerebrospinal liquid, its structure.
13. Reflex principle of functioning of a nervous system (R. Descartes, G. Prokhazka, I. M. Sechenov, I. P. Pavlov, P.K.Anokhin). Reflex. Types of reflexes. Structure of a reflex arch. Feedback, its value. Multilevel organization of a reflex.
14. Physiological concept of the nervous center, functions of the nervous centers, their properties (space and time summation, transformation of excitation rhythm, tonus, plasticity, fatigability of the nervous centers). Age changes in CNS.
15. Inhibition in CNS. Definition, classification. Primary postsynaptic inhibition (Sechenovsky, lateral, reciprocal, antidromic). Secondary inhibition (pessimal inhibition and "inhibition after exaltation").
16. Spinal cord, its reflex and conduction functions. Law Bell-Mazhandi. Clinically important spinal reflexes. Spinal shock.
17. Medulla and pons varolii, their centers and participation in processes of regulation of functions.

18. Midbrain. Reflex and conduction functions. Decerebrate rigidity.
19. Multilevel system of regulation of a muscle tone, pose and movements. A role of a cerebellum, basal nucleus and cerebral cortex in mechanisms of maintenance of muscle tonus, pose and performing of movements.
20. Reticular formation of brainstem, its descending influence on activity of spinal cord and the ascending activating influence on cortex of larger hemispheres.
21. Thalamus, its functions. Nonspecific and specific nucleus. Thalamo-cortical relations, their value in integrative activity of brain. Thalamus participation in formation of painful sensitivity. Hypothalamus and its nucleus.
22. Hypothalamus as the highest subcortical vegetative center providing integration of somatic, vegetative and endocrine functions.
23. Limbic system of brain. Its role in formation of biological motivations, emotions, the organizations of memory.
24. Basal nucleus. Their participation in formation of muscle tone and difficult motive acts. Functions of corpus striatum, caudate nucleus.
25. The cortex of cerebrum. Modern idea of localization of functions in cortex. Morphofunctional organization of the cortex. Sensory, associative and motor areas of the cortex.
26. Functional asymmetry of hemispheres at the person, value in activity of the cortex of cerebrum. Electrical activity of the cortex. Interhemispheres relations.
27. Autonomic nervous system, its structural organization and functional features. Metasympathetic department of an autonomous nervous system. Mediators of the autonomic nervous system.
28. Comparative characteristic of sympathetic and parasympathetic departments of an autonomous nervous system: synergy and functional antagonism of their influences on organs. Arch of an autonomous vegetative reflex. Vegetative reflexes. Axon reflex.

3. 5. THE COURSE OF THE CLASS

- *Introduction*: The teacher answers questions of students which caused certain difficulties in the course of mastering of a training material.
- *Requirements to the initial level of knowledge*: the student has to know the morphofunctional characteristic of excitable tissues, structures of CNS, structures of an autonomous nervous system, levels of the CNS organization, property of the nervous centers and the basic principles and distribution of exaltation in CNS, the reflex principle of the regulation of functions; mechanisms of the functioning and regulation of excitable tissues, coordinate activity of CNS, VNS, methods of researches of excitable tissues; the basic concepts and terms on topic of classes; basic physiological constants on topic of classes.
- *Computer testing according to sections*: "Physiology of excitable tissues", "Central nervous system".
- *Control of level of theoretical knowledge*. Control of level of knowledge of practical skills. Summing up, exposure of marks.
- *Conclusion of the teacher*: At the end of class the teacher makes the conclusion on the carrying-out of work and sums up the results of the class.

LITERATURE

Basic

1. Human physiology: textbook for overseas students = Физиология человека: учеб. пособие для иностранных студентов, обучающихся на английском языке / А. И. Киеня [и др.]; под ред. проф. Э. С. Питкевича; пер. на англ. яз. Р. А. Карпов, В. А. Мельник. — Гомель: УО ГoГМУ, 2009. — 352 с.

2. Text of lectures.

Alternate

1. Textbook of medical physiology // C. Guyton, 2006. — 1116 p.

2. Human anatomy and physiology // Alexander P., Spence-Elliott B. Masson.

3. Human physiology. The mechanisms of body function // Arthur J. Vander James H Sherman Dorothy S. Luciano, 1986. — 715 p.

4. Lecture notes on human physiology // John J Bray, Patricia A. Cragg, Anthony D.C. Macknight, Roland G. Mills and Douglass W. Taylor.

5. Human anatomy and physiology // Elaine N. Marieb, 1989. — 995 p.

6. Review of medical Physiology, International edition, 2003. — 912 p.