

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)
on normal physiology

Topic: Resting membrane potential. Action potential

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

Purpose of the class

To create the concept of ways of intercellular relationship, electric and chemical signals, mechanisms of their influence on a cell. To give the concept about functions of receptors and synapses. To find out mechanisms of regulation of physiological functions and ways of pharmacological correction at their violation.

Motivational characteristic of the subject

Assessment of physical development and functional condition of organs and systems of an organism is an important indicator in functional diagnostics. Therefore the student of medical and medico-diagnostic faculties has to master a technique of assessment of organism functional condition.

Tasks of the class

To give an idea of the chemical and electric signal system, to study mechanisms of formation of the membrane resting potential (RP) and action potential (AP).

As a result of carrying out the class the student has to:

To know:

- General properties of excitable tissues;
- Mechanism of formation of the action potential (AP);
- Ratio of phases of excitation and excitability.
- Features of distribution of exaltation on unmyelinated and myelinic nervous fibers;
- Laws of response of excitable tissues to irritation.

To be able:

- To estimate physical working capacity of the examinee by method a step test.
- To estimate force and level of working capacity of hand and back muscles.

2. CONTROL QUESTIONS FROM RELATED SUBJECTS:

1. Structure of cellular membranes.
2. Structure of unmyelinated and myelinic nervous fibers. Types of fibers.
3. Structure of synapses, their classification.
4. Structure of receptors. Primary-sensitive and secondary-sensitive receptors.

3. CONTROL QUESTIONS ON THE CLASS SUBJECT:

1. Excitable tissues. General properties of excitable tissues. Excitability and excitation. Criteria for evaluation of excitability. Classification of stimuli.
2. The electric phenomena in excitable tissues. History of their opening (Galvani, A. Volt, Ch. Matteuchi).
3. Modern ideas of structure and functions of membranes, ion channels. Active and passive transport of ions through membranes.
4. Membrane resting potential, its origin and mechanism of maintenance (selective permeability, Na^+ / K^+ , etc.).
5. Action potential, mechanism of its origin.
 - 5.1. Change of excitability in the course of excitation.
6. Laws of response of excitable tissues to irritation. Excitability assessment. Rheobase. Chronaxia, its value in clinical practice.
7. Physiology of synapses. Structure, classification and functional properties of synapses. Transfer of excitation in CNS synapses. Exciting and inhibiting synapses and their mediator mechanisms (EPSP, PTP, IPSP).
 - 7.1. The mechanism of transfer of excitation in neuromuscular synapses.
8. Functions and physiological properties of nervous fibers. The theory and laws of carrying out excitation on peripheric nerves (single fibers and the mixed nervous trunks). Features of distribution of excitation on unmyelinated nervous fibers. Functional characteristics of nervous fibers, their classification.
9. Parabiosis according to Vvedensky N. E.

Questions for independent studying

1. Laws of response of excitable tissues to irritation.
2. Action of a direct current on excitable tissues. Polar law of irritation.
3. The electrotonic phenomena in tissues, their value in carrying out excitation.
4. Cathodic depression, anodic exaltation.

Report:

1. A ratio of phases of an electrogenesis with excitability change phases.

4. PRACTICAL PART OF THE CLASS

Laboratory work 6.1. Dynamometry. Measuring of human power. Torso dynamometry.

Laboratory work 6.2. PWC definition by step-test method

5. THE COURSE OF THE CLASS

- *Introduction*: the students ask the teacher questions which caused certain difficulties in the course of independent mastering of education material;
- *Requirements to the initial level of knowledge*: From anatomy, histology and biophysics students should know the structure of cellular membranes, myelinic and unmyelinated nervous fibers, structure of synapses and receptors;
- *Correction of the initial level of knowledge*: The students answer on control questions on the subject of the class "Membrane resting potential. Action potential" in which questions of genesis of MRP and AP, regularities of response of tissues to irritation, estimates of excitability, mechanisms of reception and synaptic transfer of excitement are considered. The teacher corrects the answers of students on the considered subject;
- *Setting of problems which will be solved by students*: - The teacher sets the task to master a technique of definition of physical working capacity by method a step-test and definition of power qualities by dynamometry method;
- *Independent performing of tasks by students*:

-students make out the protocol of laboratory work with the subsequent discussion of its performance techniques:

-students perform practical work under monitoring of the teacher and laboratory assistant, For performance of work students are provided with methodical guiding. Presentation is provided by tables, drawings, a slide projector;

- students report papers on the class subject with the subsequent discussion;

- *Assessment of final level of knowledge of the class subject:* - The teacher specifies the final level of knowledge of students on theoretical and practical questions, the basic concepts and terms, and also knowledge of basic physiological constants of the class subject;

- *Fixing of knowledge:* Students solve several situation-dependent problems on the class subject and answer on test questions;

- *The conclusion of the teacher and the task to the next class:* At the end of the class the teacher makes the conclusion about the carried-out work, and students get the home task for the independent work. Then summing up the results of the class and signing of experience protocols is made.

Note: time of breaks is 15 minutes during a class.

6. QUESTIONS FOR SELF-CHECKING OF KNOWLEDGE

1. How it is possible to break physiological integrity of a nerve?
2. Whether carrying out a signal through a synapse in the absence of calcium ions is possible?
3. Why action potential extends along a fiber, but doesn't come back to the place of its generation?
4. Why the synapse is most subject to a fatigue? What are the reasons of depression of synapse lability at its fatigue?
5. How will signal transmission in a neuromuscular synapse be changed under action the anticholinesterase substances (physostigmin, proserin)?

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.