

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: Physiological features of skeletal and smooth muscles

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

The student has to create idea of muscular contraction mechanisms, muscle work, maintenance of a tonus. To find out mechanisms of regulation of muscular activity.

Motivational characteristic of the subject

Muscular contraction is the main form of nervous activity implication (I. M. Sechenov). Skeletal muscles make executive mechanisms of purposeful behavior. The medical student has to know methods of research and assessment of physical working capacity of the person.

Tasks of the class

To study the structure, properties of skeletal and smooth muscular tissue, mechanisms of their contraction and relaxation, difference in activity of skeletal and unstriated muscles. When performing laboratory work students have to get acquainted with a technique of assessment of physical qualities of the examinee.

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

To know:

- morphofunctional characteristic of skeletal and unstriated muscles;
- methods of researches of skeletal and unstriated muscles;
- mechanisms of activity and regulation of skeletal and unstriated muscles;
- the basic concepts and terms on the class subject,
- basic physiological constants on the class subject

To be able:

To estimate physical working capacity of the examinee on PWC170 test

2. CONTROL QUESTIONS FROM RELATED SUBJECTS:

1. Structure of skeletal muscle fiber. Myoneural synapse.
2. Features of unstriated muscles.
3. Bioenergetics of muscular contraction.
4. Innervation of muscles.

3. CONTROL QUESTIONS ON THE CLASS SUBJECT:

1. Striated skeletal muscles, their value, structure and physiological properties.
 - 1.1. Neuromotor units, their classification (by structure and the functional value).
 - 1.2. Forms (dynamic, static, auxotonic) and types of muscular contraction (isotonic, isometric and eccentric).
 - 1.3. Phases of single muscular contraction. Origin of dentate and smooth tetanus. Concept of an optimum and pessimum of frequency (modes of muscular contraction).
 - 1.4. Mechanism of muscular contraction. Structure of myofibrils. Sarcomere. A role of myosin, actin, ATP and ions of calcium in muscular contraction.
 - 1.5. Force and work of muscle fiber.
2. Tiredness, its mechanisms. Orbeli-Ginetsinsky's phenomenon. Hypertrophy and atrophy of muscles.
3. Smooth muscles, features of their structure, functions and property. Classification. Plasticity of smooth muscles, its value.

Questions for independent studying:

1. Regulation of muscular force in a human body.

Report:

1. Physiological bases of the active recreation (I. M. Sechenov) and sporting training

The virtual experiment:

1. Influence of force of an irritant on amplitude muscle contraction. Influence of temperature on muscular excitability and contractility.
2. Study of influence of frequency of stimulation on contractility of skeletal muscles.
3. Study of role of a neuromuscular synapse in development of tiredness of a skeletal muscle.

4. PRACTICAL PART OF THE CLASS

Laboratory work 7.1 . Veloergometry. Definition physical work capacities by PWC170 test

5. THE COURSE OF THE CLASS

- *Introduction:* 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 sections of anatomy, histology, biophysics students have to know the morphofunctional characteristic of skeletal and smooth muscles, at home during preparation of control questions students have to give in workbooks the main definitions on a subject;

- *Correction and evaluation of the initial level of knowledge:* The student answers control questions on an occupation subject "Physiological features of skeletal and smooth muscles", the teacher corrects the answer of students, specifies methods of researches, the basic concepts, mechanisms of activity and regulation.

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

- *Setting of problems which will be solved by students:* - The teacher sets task to master a technique of evaluation of physical working capacity by PWC170 test;

- *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 works students are provided with methodical guiding and the necessary equipment. Presentation is provided by tables, drawings.

- *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;

- *Viewing of the video movie*

- *Fixing of knowledge*: Students solve 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 tells students 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 to explain difference in the speed of shortening and in the accuracy of movement of different skeletal muscles?

2. What is the difference between the processes happening in a skeletal muscle in case of maintenance of a tone and in case of its contraction?

3. If to administrate intramuscularly 10% CaCl₂ solution, then what physiological process it will cause and what are possible consequences of this introduction?

4. In fibers of muscles the content of ATP is decreased. How duration and amplitude of muscle contraction will change?

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.