

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: Physical and chemical properties of blood. Physiology of erythrocytes.

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 create the conception about the rules of patient preparation for carrying out the general blood test at students. To acquire the main physical and chemical properties of a blood, its functional and clinical-diagnostic value of hematocrit number and amount of hemoglobin, and also to know its bonds and versions.

Motivational characteristic of the subject

The general clinical blood test is one of the most widespread laboratory researches. For its carrying out the capillary blood is often used. Therefore each student has to master the method of taking blood from a finger at the level of ability. Also the medical student needs to know standards and physiological value of the general blood test parameters, including amount of erythrocytes, hemoglobin and color index.

Tasks of the class

In the course of the class students should master the technique of determination of hematocrit, the technique of determination of quantity of erythrocytes by means of the calculating camera of Goryaev, determination of blood hemoglobin amount by Sali's method and a hemoglobin-cyanide method, and also to calculate the color index of blood.

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

To know:

- structure and functions of blood;
- compounds and kinds of hemoglobin
- main physical and chemical properties of blood plasma;
- main clinical-diagnostic methods of studying of indicators of blood;
- the basic concepts and terms on the class subject,
- basic physiological constants on the class subject

To be able:

To make blood sampling from a finger, to define hematocrit number, quantity of erythrocytes by means of the calculating camera of Goryaev and hemoglobin level.

2. CONTROL QUESTIONS FROM RELATED SUBJECTS:

1. Rules of work with blood and other biological liquids.
2. Morpho-functional characteristic of blood.
3. Structural functional characteristic of erythrocytes.
4. Structurally functional characteristic of hemoglobin.

3. CONTROL QUESTIONS ON THE CLASS SUBJECT:

1. Blood plasma, its structure and properties.
 - 1.1. Proteins of a blood plasma, their characteristic, quantity and functions.
2. Physical and chemical properties of a blood.
 - 2.1. The viscosity, relative density of a blood, factors causing them, its size and physiological value.
 - 2.2. Osmotic pressure, the factors determining it, its size. Hyper-, hypo - and isotonic (physiological) solutions. Oncotic pressure of blood plasma, its size and physiological value.
 - 2.2 Acid-base balance of blood. Active reaction (pH) of blood.
 - 2.3 Buffer systems of blood. Alkaline reserve. Acidosis, alkalosis, their kinds and origin.
3. Erythrocytes. Structure, properties and quantity of erythrocytes. Functions of erythrocytes. Erythrocytosis. Erythropenia (anemia).
 - 3.1. Hemoglobin, its structure, properties, functions and quantity. Hemoglobin bonds. Kinds of hemoglobin. Color index of blood.

Questions for independent studying

1. Extravascular liquid mediums of an organism, their role in ensuring activity of an organism. Lymph, its structure, quantity, functions. Transcapillary exchange of liquid.

Report:

1. Main mineral substances of blood plasma Value of normal concentrations for an organism.

4. PRACTICAL PART OF THE CLASS

- Laboratory work 2.1 Definition of erythrocytes amount
Laboratory work 2.2 Detection of the hematocrit number
Laboratory work 2.3. Definition of amount of hemoglobin in blood by Sali method
Laboratory work 2.4. Definition of hemoglobin by hemoglobin-cyanide (photoelectrocolorimetric) method
Laboratory work 2.5. Definition of color index of blood

5. THE COURSE OF THE CLASS

- *Introduction*: the teacher answers questions of students which caused certain difficulties in the course of independent mastering of education material;

- *Requirements to the initial level of knowledge*: From anatomy and histology students should know the morpho-functional characteristic of blood;

- *Correction of the initial level of knowledge*: The teacher checks and adds the initial level of knowledge of students on theoretical and application-oriented questions on the subject of the class "Physical and chemical properties of blood. Physiology of erythrocytes. Hemoglobin, its bonds". In this section questions about some physical and chemical properties of blood, about blood plasma, its structure and properties, about physiology of erythrocytes and compounds and kinds of hemoglobin 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 at the level of ability the technique of taking of capillary blood from a finger with observance of measures of infection prevention, and also to examiner a fresh preparation of blood under a microscope. The teacher sets the task to get acquainted with technology of taking capillary blood

from a finger with keeping of infection prevention, to master a technique of definition of quantity of erythrocytes, hematocrit number, amount of hemoglobin, and also calculation of a color index of the examined blood.

- *Independent performing of tasks by students:* students perform practical work under monitoring of the teacher or laboratory assistant, make out the protocol of laboratory work with the subsequent discussion of features of performance techniques:

- *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:* The teacher suggests students to solve several situation-dependent problems on the class subject, to pass computer test on the class subject;

- *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. At residents of Leningrad during blockade hypostases quite often developed. What mechanism of their formation?

2. Explain origins of a true erythrocytosis at inhabitants of highlands.

3. What protein of blood plasma is the carrier of antibodies?

4. How will hematocrit change in case of poisoning of the person which is followed by vomiting and diarrhea?

5. In healthy men the quantity of erythrocytes and hemoglobin in 1 l of peripheral blood is higher, than in healthy women. What it is connected with?

6. In smokers the quantity of erythrocytes and hemoglobin in blood is higher, than at non-smoking. Does it mean this improvement of delivery of oxygen to tissues?

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. Сборник нормативных документов по проблеме ВИЧ/СПИД. Минск, 1999. 132 с. Приказ № 351 от 16.12.1998г. Приложение № 8 «Инструкция о профилактике внутрибольничного заражения ВИЧ-инфекцией и предупреждению профессионального заражения мед. работников». С. 31-35.

3. 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.