METHODOLOGICAL RECOMMENDATIONS FOR PRACTICAL CLASSES

Discipline: 'Basics of Physiology'

Discipline Code: MFN-1203-2

Speciality: 'General Medicine'

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Protocol of the meeting of the Department No. __10a___ dated '_06_' _05_ 2022

Methodical Recommendations No. 1

1. Theme: Physiology of excitable tissues. Parameters of excitability.

2. Learning goals: to be aware with the main types of excitable tissues, to be familiarized with the following notions: excitability, excitation, threshold of irritation, and functional lability.

3. Learning objectives:

* to learn how to prepare a neuromuscular frog preparation;
* to work with an electrostimulator;
* to work with Engelman's lever;
* to work with an electromyograph;
* to work a kymograph
* to master methods for studying excitable tissues.

4. Questions relating to the theme:

1. The notion of excitable tissues, irritability, excitability;
2. Membrane and ionic mechanisms of the origin of biopotentials at rest. Methods for registering biopotentials;
3. The action potential, its phases, ionic mechanisms. Changes in the permeability of the cell membrane during excitation;
3. Change in excitability during the generation of the action potential. Characteristics of refractoriness and exaltation;
4. The basic physiological conditions of the biological membrane;
5. The value of the concentration gradients of sodium, potassium, chlorine for the biopotentials being happenned;
6. Research methods for excitable tissues;
7. Resting membrane potential;
8. The action potential;
9. Change in excitability at the various phases of the excitation process.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of situational cases.

Laboratory work No. 1.

Preparation of a neuromuscular preparation of a frog

Equipment: preparation kit, Ringer's solution for cold-blooded animals, gauze, ether. The work is done on a frog.

The content of the work. To wrap by gauze an anesthetized frog so that its legs to be pressed to the trunk but its head to be remained uncovered. To cut off by scissors the upper jaw behind the eyebrows. To insert a dissection needle or probe in the central canal of the spinal cord to destroy the spinal cord. To vertically insert the end of the preparation needle into the suboccipital opening to a depth of 1-2 mm, then to turn it parallel to the central canal and move it to the sacrococcygeal joint destroying the spinal cord in a circular motion. The sign of destruction is the complete relaxation of all groups of frog muscles and the lack of protective motor reflexes to tingle the skin and pulling at the leg. To withdraw the needle from the central canal and rotate it 180 degrees to destroy the brain.

Laboratory work No. 2.

Description of the graphic registration methods.

Electrodes for registration do not differ in principle from the irritating ones. Their design, form, parameters depend on the research tasks and are given in the descriptions of the corresponding devices for recording electrical processes (electromyographs, electroencephalographs, electrocardiographs, etc.).

For the registration of non-electrical values, special sensor transducers are used. A sensor transducer is the device that converts a measured or monitored value into a signal that is convenient for transmission, further conversion, or registration.

Sensors are designed in the classical version for recording mechanical movements (contractions of skeletal or cardiac muscle, pulsation of blood in the vessel, movements of the chest, limbs, etc.). The main sensor in these devices is a mechanical lever connected to the object under investigation directly (myograph, Engelman's lever) or indirectly through a pneumatic chamber (Marey's capsule) or a mercury manometer (direct record of blood pressure). Lever of sensors of this type is equipped with a writing device and drum kymograph (Fig. 1).

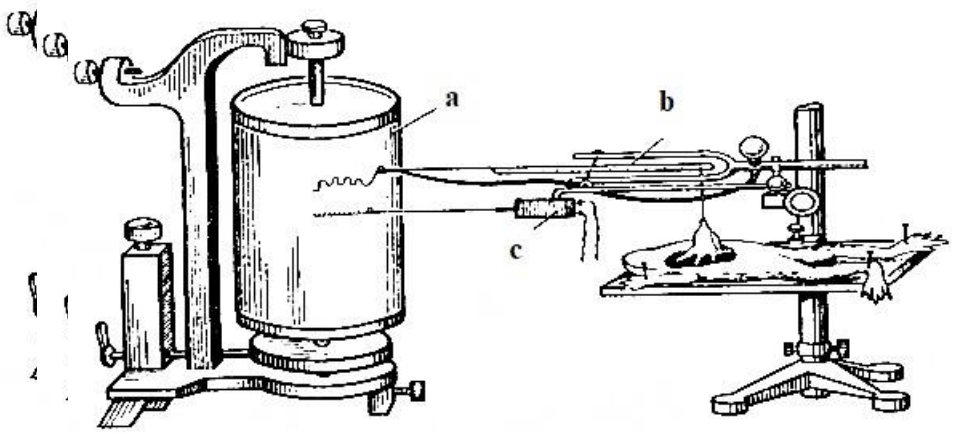


Fig. 1. Device for graphical registration of the heart of a frog

a – kymograph, b - Engelman's lever, c - electromagnetic timer

Laboratory work No. 3.
Reproduction of the first Galvani experiment (contraction with metal)

The essence of Galvani's first experiment is that when the neuromuscular preparation comes into a contact with bimetallic tweezers, then muscle contraction is observed.

Equipment: bimetallic tweezers, consisting of copper and iron branches, dissection set, pipette, cotton wool, Ringer's solution. The object of the study is a neuromuscular frog preparation.

The content of the work. To prepare a neuromuscular preparation of the two posterior legs of a frog, without separating them from each other. To bring one brunch of bimetallic tweezers under the roots of the sacral nerve of the frog's spinal cord, while trying not to touch the preparation with the other branch. When the second branch touches the frog's thigh muscles, there is a contraction of the musculature of the entire preparation, the frequency of which corresponds to the frequency of

contact. When the preparation dries, the muscle contractions might disappear, so during the experiment it is necessary to abundantly rinse the preparation with Ringer's solution.
The results of work and their design. 1. Write in the protocol and draw an outline of the experiment. 2. Give assessment to Galvani's first experience.

Laboratory work No. 4.
Reproduction of the second Galvani experiment (contraction without metal)
This Galvani experiment was the fact that the contraction of the muscles of the frog's foot was produced without the participation of metal but by putting the prepared sciatic nerve onto the injured part of the calf muscles. The potential differences between the external surface of the muscle and its internal one, which is unexcited, is clearly observed in cases when the muscle is damaged. The action potential arising between intact and damaged areas is called "damage potential" or "demarcation potential". When the sciatic nerve contacts the damaged electronegative part of the muscle, the electric circuit closes, in which the undamaged surface of the muscle and the portion of the nerve that comes into contact play the role of the positive charged potential. Thus, in the second Galvani experiment, the cause of nerve excitation is the irritating effect of the electricity that appears directly in the tissues.
Equipment: dissection set, a glass hook, a glass plate, Ringer's solution. The object of research is the neuromuscular preparation of the frog.
The content of the work. The part of the muscle of the neuromuscular preparation adjacent to the knee joint is damaged, then the preparation is placed on a glass plate. Then the nerve is brought to damaged muscle with glass hooks so that its middle part touches the undamaged surface of the muscle.
The results of work and their design. 1. Write the protocol and draw an outline of the experiment. 2. Explain the fundamental difference between the first and second experiments of Galvani.

Laboratory work No. 5.
Secondary tetanus (the experience of Matteuchi)
Matteuchi showed that it is possible to cause a muscle contraction of the neuromuscular preparation by applying its nerve to the contracting muscles of another praparation. This experience indicates that in the contracting muscle there are electrical points which are so significant that they can be used as an irritant for the nerve of another preparation. This electricity is called "action electricity".
Equipment: stimulator, holder, dissection set, Ringer's solution. The object of the study is two neuromuscular frog preparations.
The content of the work. Two preparations are prepared from the posterior frog's legs. The muscles of the thigh are removed, and both feet are fixed by the femur to the holders. The nerve of first preparation is placed on the electrodes, and the nerve of the other one is placed along the gastrocnemius of the first preparation. Causing by rhythmic nerve irritations tetanic contraction of the muscles of the first preparation, to observe contractions of the muscles of the second.
The results of work and their design. 1. Draw a diagram of the experiment. 2. Explain why "action electricity" appeared.

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.

7. Bibliography: see appendix No. 1.

8. Assessment procedures

MCQ tasks

1. Excitable tissues are ....
a) nervous, muscular, glandular
c) nervous, cartilaginous, connective
c) muscular, epithelial, glial
d) glandular, bone, collagen fibers
e) tendons, muscular, bone
2. Accommodation of tissue occurs ....
a) with a slow increase of the stimulus strength
b) with a rapid increase of the stimulus strength and a prolonged action
c) with the rhythmic action of the stimulus of the superthreshold force
d) with the rectangular action of electricity, with a sinusoidal electricity
e) under the exposure of a strong electrical stimulus of rectangular shape
3. Membrane potential is formed due to ....
a) unequal permeability of the membrane for Na + and K +
c) lack of membrane permeability
c) permeability for ions CI- and Mg2 +
d) the permeability of the Ca2 + and Na +
e) membrane permeability for CI and Ca2 +
4. Membrane potential..., if you increase the concentration of sodium in the cell
a) decrease down to disappearing
c) does not change
c) will increase to a critical value
d) phase changing, then decrease
e) quickly fluctuates
5. Membrane potential..., if you increase the concentration of potassium in the cell.
a) increases to a critical value
c) does not change
c) decreases down to disappearing
d) phase changing and decrease
e) quickly fluctuates
6. Depolarization of the membrane occurs under the influence of ....
a) acetylcholine, epinephrine
b) gammaaminobutyric acid, glycine
c) light, adrenaline
d) atropine, acetylcholine
e) cholinesterase, serotonin
7. The action potential arises ....
a) under the irritator of a threshold stimulus with a single stimulus
b) under the irritator of a subliminal stimulus
c) under the irritator of a superthreshold and threshold inpulsed electricity
d) under the irritator of a superthreshold stimulus of any physical and chemical nature
e) under the irritator of electromagnetic waves of any intensity
8. Passive transport of substances through the membrane is the transport ....
a) by the concentration and electrochemical gradient
b) involving membrane channels and ATP

c) the energy provided by ion pumps and donors
d) with the participation of ATP and ion pumps
e) involving membrane channels and ion pumps
9. During a local response ....
a) the excitability of the tissue is increased and the ability to summation of excitations is recorded
b) the excitability of the tissue decreases, refractory period is recorded
c) the excitability of the tissue disappears, the absolute refractory phase develops
d) the excitability of the tissue does not change under the impact of threshold and superthreshold stimuli
e) the excitability of the tissue is increased only by superthreshold and subthreshold stimuli
10. Biopotentials of excitable tissues are recorded with....
a) a galvanometer, an oscilloscope
b) rheograph, sphygmograph
c) pneumograph, myograph
d) pulse tachometer, impulse generator
e) a blood pressure monitor, a manometer
11. Chronaxie is the shortest time during which the electricity ....
a) with voltage of two rheobasis causes excitation
b) with voltage of one rheobasis causes excitation
c) with the threshold strength causes excitation
d) with subthreshold strength causes a decrease in membrane potential
e) with voltage of three rheobasis causes excitation
12. Accommodation is a property of excitable tissue ....
a) to increase the threshold of excitability with a slow increase in the strength of stimulation
b) to lower the threshold of excitability with a slow increase in the strength of stimulation
c) to increase the speed of propagating the excitation in response to the threshold stimulus
d) to lower the threshold of excitability in response to a superthreshold stimulus
e) to increase the threshold of excitability in response to instant irritation
13. During repolarization phase...
a) inactivation of sodium permeability
b) activation of potassium permeability
c) inactivation of potassium permeability
d) an increase the sodium within the cell
e) an increase the chlorine within the cell
14. Under the active transport of substances through the membrane is understood transport ....
a) involving membrane ion pumps and ATP
b) involving an energy donor
c) by the concentration gradient
d) on the electric gradient
e) with the participation of oxygen
15. The membrane potential is the difference of charges between ....
a) the positive outer surface of the cell membrane and the negative inner one
b) the positive inner surface of the cell membrane and the negative outer one
c) the negative inner surface of the cell membrane and indifferent the outer one
d) the negative outer surface of the cell membrane and the indifferent the inner one
e) the positive outer surface of the cell membrane and the indifferent inner one
16. The depolarization phase corresponds to excitability ....

a) absolute refractoriness
b) primary relative refractoriness
c) secondary relative refractoriness
d) a slight increase
e) exaltation
17. The phase of repolarization corresponds to excitability ....
a) absolute refractoriness
b) primary relative refractoriness
c) secondary relative refractoriness
d) a slight increase
e) exaltation
18. The phase of hyperpolarization corresponds to excitability ....
a) relative refractoriness
b) primary absolute refractoriness
c) secondary relative refractoriness
d) a slight increase
e) exaltation
19. The action potential corresponds to ....
a) increase of permeability for Na + and membrane depolarization
b) repolarization and hyperpolarization of the membrane
c) local change in permeability, local response
d) residual depolarization and negative trace potential
e) local change in membrane permeability and hyperpolarization
20. The local answer is understood ....
a) local non-spreading excitation under the influence of a subliminal stimulus
b) change in permeability under the influence of superthreshold and threshold stimuli
c) change in permeability under the influence of a single and pulsed stimulus
d) change in permeability under the influence of tissue irritation, current under the anode
e) change in permeability of the membrane when stimulated by direct current under the cathode

Methodical Recommendations No. 2

1. Theme: "Laws" of Prorogating the Excitement through Nervous Fibers. Parabiosis.

2. Learning goals: to study structure and physiologic properties of different types of nerve fibers.

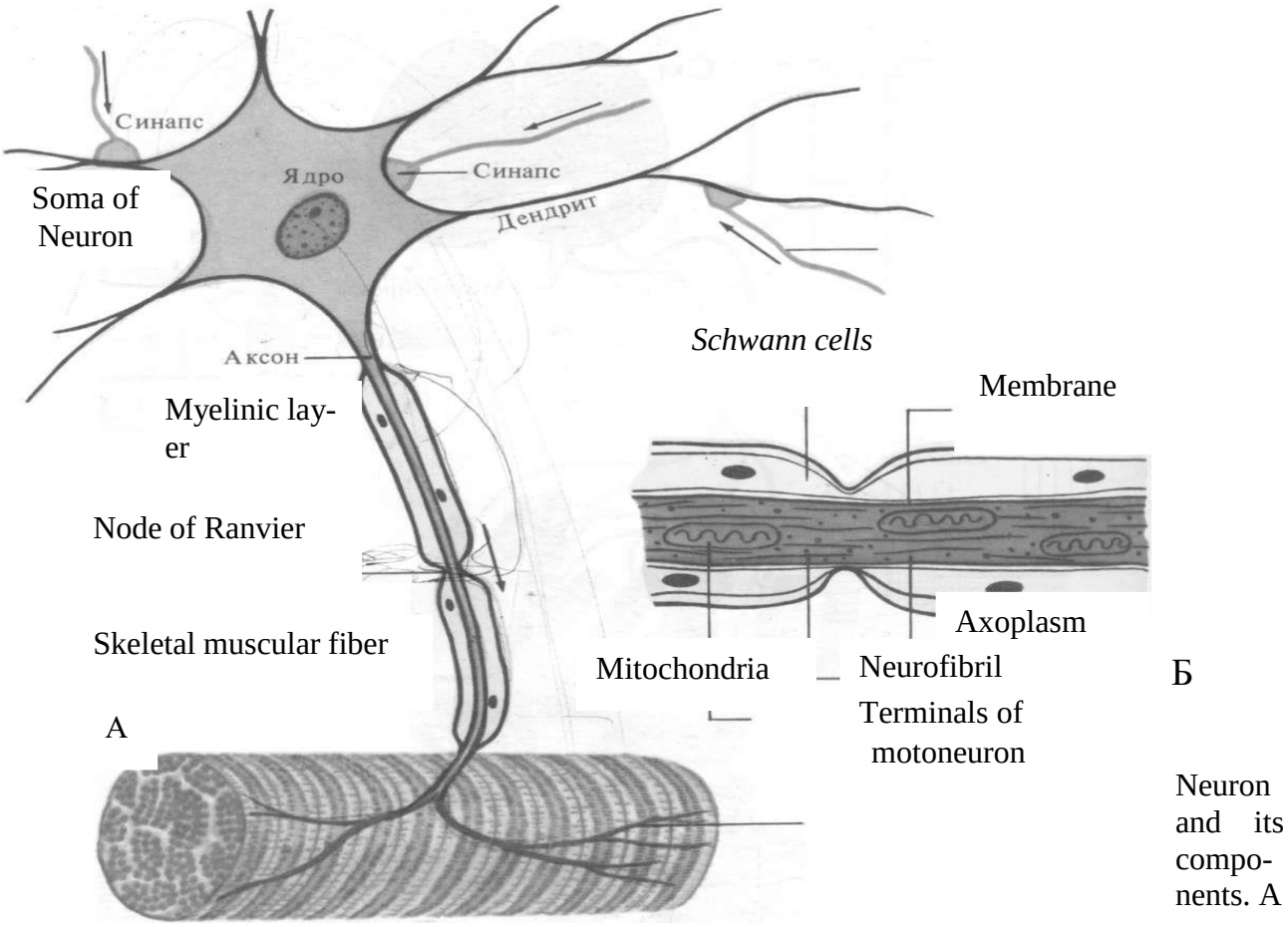
3. Learning objectives: to explain mechanism of propagation of the excitation through myelinated and unmyelinated nerve fibers.

4. Questions relating to the theme:

1. Structure and classification of neurons.
2. Structure and properties of unmyelinated nerve fibers.
3. Structure and properties of myelinated nerve fibers.
4. A mechanism of propagation of the excitation through nerve fibers.
5. Nerve fibers (afferent and efferent).
6. Nerves (sensitive, motor, and vegetative).
7. Features of propagating the excitations through mixed nerve.
8. Parabiosis. Phases of parabiosis.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of situational cases.

Laboratory work No. 1
Structure and properties of neuron and nerve fibre.



Neuron and its components. A – nerve cell, axon, muscle; B – structure of nerve fiber.

Laboratory work No. 2.
Blockade of propagating the excitation through a nerve fiber

Work content: To prepare a nerve-muscle preparation and to fix it in a myograph. A sciatic nerve to be placed on a table with bipolar irritating electrodes, the key to be switched in the "Nerve" position. To select the submaximal value of the electricity and to record the contraction of the muscle on the moving tape of the kymograph. To moisten a filter paper or cotton swab in alcohol or a solution of novocaine and to put it on the nerve site between the irritating electrodes and the muscle. With an interval of 1 min, to repeat the nerve irritation. To note, in what time the contraction stops. Then to remove the tampon and thoroughly wash the nerve with Ringer's solution. In 5 minutes, to repeat the nerve irritation and record the result on the tape of the kymograph. At the end of the experiment, to apply a dense ligation to the nerve between the muscle and the irritating electrodes. To irritate and to fix the result. The obtained kymogram to be compared with the standard.

The results of the work and its design. 1. To record the course of the experiment, to stick the resulting kymogram in a exercise-book and make a designation. 2. To explain the origin of the blockade of excitation with the use of pharmacological substances.

Laboratory work No. 3
Parabiosis. Phase character of parabiotic phenomena.

N.E. Vvedensky on a neuromuscular preparation established that nerve being exposure to chemical or narcotic substances on a site between stimulating electrodes and the muscle after a while leads to the termination of muscle contractions in response to irritation. This is due to a change in the lability, excitability and conductibility of the nerve. At the end of the exposure, the nerve slowly returned its original functional properties. This phenomenon was called the "parabiosis" by N.E. Vvedensky. Parabiosis is characterized by gradual development, in which three phrases follows each other: equalizing, paradoxical and inhibitory.

Equipment: horizontal myograph, kymograph, stimulator, universal tripod, electrodes, dissection set, cotton wool, ligature, 1% KCl solution, Ringer's solution. The object of research is a frog.

Work content. To prepare a nerve-muscle preparation and to fix it in a horizontal myograph. By irritating the nerve with single stimuli, the curves of muscle contraction are recorded on the kymograph. Then, to define the parameters of stimulation to obtain a weak and strong muscle contraction.

A parabiotic focus is created by applying a piece of cotton wool soaked with a 1% solution of KCL (other substances can be used: 2% solution of chloroform, ether, alcohol, etc.). In the settings of the exposure of alterating substances, the nerve is stimulated with electrodes located above the altered area. After a while, it can be found that as the stimulation force increases and decreases, the same contractions in amplitude are recorded. This indicates the onset of an equalizing phase of parabiosis. Then follows the paradoxical phase, when weak stimuli cause high-amplitude contractions, and vice versa. Finally, the muscle generally ceases to contract and with strong and weak weak stimuli, which is characteristic of the inhibitory stage of parabiosis.

The results of the work and its design. 1. To draw a protocol of the experiment. 2. To stick in the exercise-book the obtained curves with accordance of phases of parabiosis.

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.

7. Bibliography: see apendix No. 1.

8. Assessment procedures

MCQ Tasks

1. Adequate irritants of the nervous tissue are ...
a) electrical, neurotransmitters
b) electrical, osmotic
c) thermal, chemical
d) osmotic, electrical
e) magnetic

2. Lability of the nerve, muscle, synapse of warm-blooded animals (accordingly for nerve, muscle, and synapse)…
a) 1000, 300, and 100 imp / sec
b) 500, 300, and 50 imp / sec
c) 600, 200, and 1000 imp / sec
d) 400, 100, and 70 imp / sec
e) 1000, 100, and 200 imp / sec

3. Lability is higher, and refractoriness is less for ....
a) nerve fibers
c) the nerve center
c) synapse
d) skeletal muscle

e) smooth muscle
4. In unmyelinated nerve fibers, excitation is spread by ....
a) the fiber membrane
b) axoplasma
c) myelin sheath
d) the soma of a neuron
e) nodes of Ranvier
5. In myelinated nerve fibers, excitation is spread by....
a) nodes of Ranvier
b) axoplasma
c) myelin sheath
d) the soma of a neuron
e) the fiber membrane
6. Phases of parabiosis happen through the following sequence:
a) equalizing, paradoxical, inhibitory.
b) inhibitory, equalizing, paradoxical
c) paradoxical, equalizing, inhibitory.
d) equalizing, inhibitory, paradoxical.
e) inhibitory, paradoxical, equalizing.

Methodical Recommendations No. 3

1. Theme: Physiologic characteristics of synapses.

2. Learning goals: to study structure and physiological properties of the synapses.

3. Learning objectives: to understand mechanism of propagating the excitation in excitatory and inhibitory synapses.

4. Questions relating to the theme:

1. Notions "synapse" and "synaptic transmission of excitation".
2. Anatomic, neurochemical, and functional classifications of synapses.
3. Morfologic classificaction of nerve endings.
4. Types, structure, and properties of receptors.
5. Types, structure, and properties of effectors.
6. Ultrastructure of a synapse.
7. Physiologic properties of a synapse.
8. Stages and mechanism of a synaptic transmission.
9. Notion about ambivalence of neurotransmitters and causes of ambivalence.
10. Pathways of synthesis and inactivation of acetylcholine and norepinephrine.
11. Mechanism of excitation transmission in excitatory and inhibitory synapses.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of situational cases.

Laboratory work No. 1

Ultrastructure of a synapse (scheme)

Laboratory work No. 2

Comparison between labilities of a synapse and a muscle

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.

7. Bibliography: see apendix No. 1.

8. Assessment procedures

MCQ Tasks

1. The transmission of excitation in the chemical synapse occurs with the help of ....
a) the mediator
b) electricity current
c) enzyme
d) hormone
e) magnetic wave

2. Lability of the nerve, muscle, synapse of warm-blooded animals ....
(nerve, muscle, and synapse accordingly)
a) 1000 300 100 imp / sec
b) 500 300 50 imp / sec
c) 600 200 1000 imp / sec
d) 400 100 70 imp / sec
e) 1000 100 200 imp / sec

3. Lability is higher, and refractoriness (refractory period) is less for ....
a) nerve fibers
c) mixed nerve
c) synapse
d) skeletal muscle
e) smooth muscle

4. In the chemical synapse, excitation is spread from ....
a) the presynaptic membrane to the postsynaptic membrane
b) axoplasm of the neuron to the postsynaptic membrane of the effector
c) myelin sheath to Ranvier interceptions
d) the soma of the neuron to the presynaptic membrane
e) the postsynaptic membrane to the presynaptic membrane

5. In the neuromuscular synapse, excitation is spread ....
a) by one direction
b) bilaterally
c) no synaptic delay
d) without fatigue
e) using various mediators

6. Stages of synaptic transmission proceed in the following sequence:
a) neurotransmitter synthesis, neurotransmitter secretion, neurotransmitter interaction with chemoreceptors, inactivation of the neurotransmitter.
b) neurotransmitter secretion, neurotransmitter synthesis, neurotransmitter interaction with chemoreceptors, inactivation of the neurotransmitter.
c) interaction of the neurotransmitter with chemoreceptors, neurotransmitter synthesis, neurotransmitter secretion, inactivation of the neurotransmitter.
d) activation of the neurotransmitter, neurotransmitter synthesis, neurotransmitter secretion, neurotransmitter interaction with chemoreceptors.
e) neurotransmitter synthesis, neurotransmitter activation, neurotransmitter secretion, neurotransmitter interaction with chemoreceptors.

7. The inhibitor of acetylcholine is ....
a) catecholoxymethyltransferase (COMT)
b) monoamine oxidase (MAO)
c) cholinesterase

d) atropine
e) muscarine
8. The inhibitor of norepinephrine and adrenaline are ....
a) catecholoxymethyltransferase (COMT), monoamine oxidase (MAO)
b) monoamine oxidase (MAO), nicotine
c) catecholoxymethyltransferase (COMT), cholinesterase
d) atropine, nicotine
e) muscarine, cholinesterase
9. In the electric synapse, excitation is spread ....
a) in one way direction
b) bilaterally
c) with synaptic delay
d) with chemical specificity
e) using a neurotransmitter
10. Ultrastructure of the synapse ....
a) presynaptic membrane, postsynaptic membrane, synaptic cleft
b) presynaptic membrane, synaptic cleft, postsynaptic membrane
c) postsynaptic membrane, presynaptic membrane, synaptic cleft
d) synaptic cleft, presynaptic membrane, postsynaptic membrane
e) postsynaptic membrane, synaptic cleft, presynaptic membrane

Methodical Recommendations 4.

1. Theme: Reflex activity of the central nervous system (CNS). Spinal Reflexes

2. Learning goals: to be acquinted with basics of reflex activity of the Central Nervous System.

3. Learning objectives:

***** to study structure of reflex arc;
* its analyze;
* to be evoke main human spinal reflexes.

4. Questions relating to the theme:

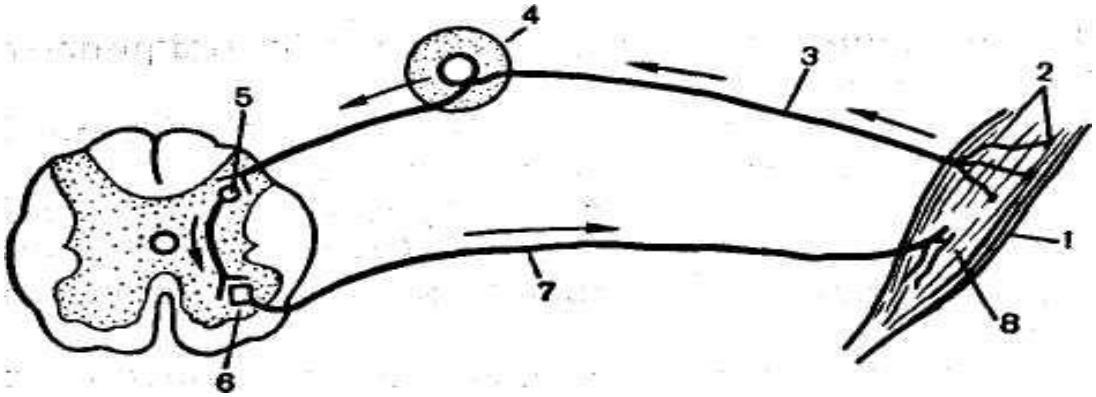
1. Notion on central and peripheral nervous system.
2. General characteristic of CNS.
3. Notion on a reflex.
4. Classification of the reflexes.
5. Reflex time.
6. Structure of the reflex arc.
7. Simple and complex reflex arcs.
8. Notion on receptive field of a reflex.
9. Blood-Brain Barier.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of case tasks.

Laboratory work No. 1

A Reflex. Analysis of a reflex arc.

The content of the work. To study scheme of a reflex arc of a somatic reflex.



1 — muscle (effector organ); 2 — sensitive receptors; 3 — afferent fiber; 4 — spinal ganglion; 5 — intercalary neuron of the spinal cord; 6 — soma of an efferent neuron of the spinal cord; 7 — efferent (motor) nerve fiber; 8 — neuromuscular synapse. Arrows show directions where an excitation spreads.

A reflex arc is a structural basis of a reflex.

Laboratory work No. 2

Analysis of a reflex arc of the defensive motor reflex. Determining a reflex arc (by Turk)

Equipment: dissection set, Ringer's solution for cold-blooded animals, cotton wool, ether, 0.5% solution of novocaine, solution of sulfuric acid (0.5% and 1%). The laboratory work is undertaken on a frog.

Work content. The experience is carried out on the frog with the destroyed brain, but with retained the spinal cord ("spinal frog"). To do this, it is necessary with scissors cut upper jaw by cutting head behind eye mounds of an anesthetized with ether frog with following fixing it on the hook of a tripod. By submerging the foot of the frog in 0.5% sulfuric acid solution, it is possible to observe the protective motor reflex (flexion or withdrawal of the feet). To determine the time of reflex, i.e., the period from the moment of the submerging of the foot to the acid prior to its withdrawal. Record the result. Then to make a circular cut through the skin on the lower part of the frog calf and then to remove skin from the leg. When naked frog leg is submerged into acid, foot protective motor reflex is absent. To uncover sciatic nerve of a hip of the other frog foot and bring it under the ligature. By the ligature the nerve to be slightly pulled out and be placed on a cotton wool soaked in 0.5% solution of novocaine. At intervals of 1 min the foot to be submeged in a solution of sulfuric acid (0.5% and 1%), and to note the presence or absence of the reflex withdrawal. Note how long after the applying novocaine swab on the nerve protective reflex disappears. Remove the cotton wool to wash the nerve with ringer solution. After 10-15 minutes to check for the reflex. In a case, if it recovers, to break the spinal cord by a dissecting needle and repeat the irritation. Note the presence or absence of the reflex. To bring under the sciatic nerve irritating electrodes and producing a control stimulation (3V, 5Hz). Note the presence or absence of contractions of the foot.

The results of the work and its design. 1. Describe the process of the experiment. 2. Describe experiment results.

Laboratory work No. 3

Somatic spinal reflexes of a human.

A great number of reflex arcs have contacts with the spinal cord. Owing to these reflex arcs as somatic, as vegetative functions of organism are controlled. The tendon and tension reflexes are the simplest reflex reactions. They are elicited by irritation of tension receptors of the muscle which produce reflex contraction.

The reflex name	Type of irritation	Type of a reflex reaction	Localization of neurons taking part in a reflex
Tendon proprioceptive reflexes:			
Biceps reflex	Hit by neuromuscular hammer on the tendon of m.biceps brachii (hand slightly bent at the elbow)	Contraction of m.biceps brachii with hand flexion	V – VI cervical segments of the spinal cord
Patellar reflex	Hit by neuromuscular hammer on the tendon of m.quadriceps below patella	Contraction of m. quadriceps with leg extension	II – IV lumbar segments
Achilles reflex	Hit by Achilles tendon	Foot flexion	I – II sacral segments
Abdominal reflexes:	Irritation of the skin (by a pencil)	Contraction of corresponding areas of abdominal musculature	
Upper	In parallel with lower ribs		VIII – IX thoracic segments
Medium	At the level of a navel (horizontally)		IX – X thoracic segments
Down	In parallel with inguinal fold		XI – XII thoracic segments
Plantar Sole Reflex	Weak irritation of the sole by a pencil	Flexion of fingers and a foot Extension of fingers and the foot	I – II sacral segments
	Strong irritation of		

	the sole by a pencil		

Conclusion: somatic spinal reflexes of a human possess great diagnostic meaning for assessing functional state of central nervous system including the spinal cord.

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.

7. Bibliography: see apendix No. 1.

8. Assessment procedures

MCQ Tasks

1. The morphological basis of the reflex is ....
a) a reflex arc
b) nerve fibers
c) nerve trunks
d) neurons
e) neuroglia
2. The time of the reflex reaction when the irritant strength decreases ...
a) increase
c) does not change
c) decrease
d) is stabilized
e) does not change
3. The reflex arc includes ....
a) receptor, sensitive neuron, center, motoneuron, organ
c) centripetal neuron, center, effector organ
c) sensitive neuron, receptor, center, synapses
d) the nerve center, motoneurons, synapses
e) receptor, centrifugal neuron, synapses, effector organ
4. CNS has ....influence on the organism tissues.
a) functional, trophic, vasomotor
c) functional, inhibitory, subordinate
c) trophic, regulatory, summary
d) vasomotor, functional, humoral
e) nervous, humoral, trophic
5. The Bell-Magendie law states that the spine roots ....
a) posterior roots are sensitive, anterior roots are motor
b) posterior and anterior roots are sensitive
c) posterior roots are sensitive, lateral ones are motor
d) posterior and anterior roots are motor
e) posterior roots are motor, anterior roots are sensitive
6. Motor disorders during the cerebellum is damaged with time disappear due to ....
under the action of a threshold single stimulus
a) the plasticity of the nerve centers of the cortex
b) the enhanced function of the vestibular analyzer
c) inhibition of the red nucleus
d) excitation of a black substance
e) the connections of the pale sphere to the striated body
7. When making thin movements, the muscle tone is regulated by.

a) black substance
b) medulla oblongata
c) the varioli bridge
d) red nucleus
e) quadruple on concentration and electrochemical gradient
8. Neurons providing the patellar reflex are localized in ....
a) II-IV lumbar segments
b) sacral region of the spinal cord
c) thoracic part of the spinal cord
d) X-XII thoracic segments
e) cervical part of the spinal cord
9. The motor pathways of the spinal cord are:
a) spino-cortical, thalamic, cerebellar, and proprioceptive
b) vestibulo-, tectospinal, spinocortical, thalamic
c) cortico-, rubro-, vestibulospinal, spinalomatic
d) cortico-, rubro-, vestibulo-, reticulospinal
e) cerebellar, spinotalamic, reticulospinal, cortical

Methodical Recommendations No. 5

1. Theme: Features of the propagating the excitation in the CNS. Nerve center, properties of the nerve centers. Inhibition in the CNS.

2. Learning goals: to be familirized with the features of propagating the excitation and the inhibition in the CNS, be familirized of notion of "nerve centre" and its proprties.

3. Learning objectives:

*****to study process of central inhibition on frog;
* to master features of propagating excitation on the CNS.

4. Questions relating to the theme:

1. The process of excitation in the CNS.
2. Notion of "nerve center".
3. Properties of the nerve centers:
   a) summation of the excitation;
   b) transformation of the excitation rate;
   c) irradiation;
   d) convergence;
   e) reverberation.
4. Process of inhibition in the CNS.
5. Central (Sechenov's) inhibition.
6. Types of inhibition in the CNS:
   a) presynaptic;
   b) postsynaptic;
   c) recurrent (antidromic);
   d) inhibition after excitation;
   e) pessimal.
7. Principles of a coordinative activity of the CNS.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of case tasks.

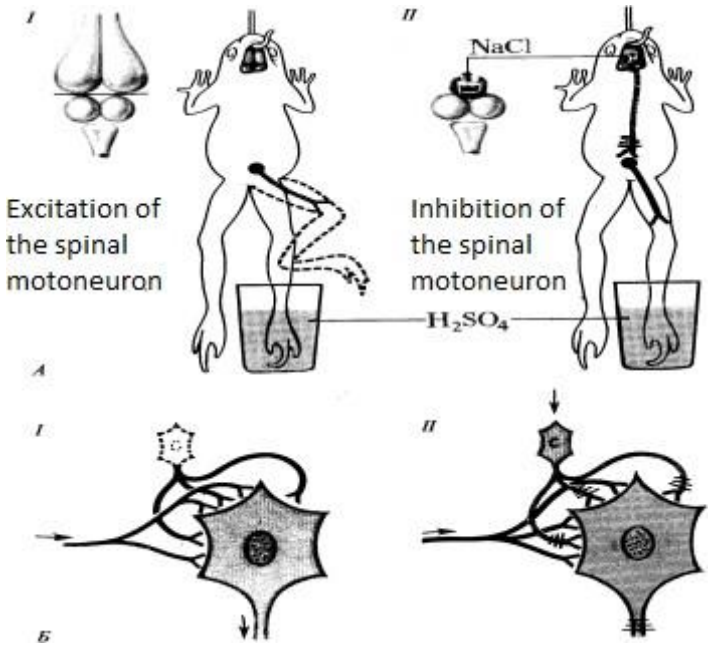
Laboratory work No. 1

Central (Sechenov's) inhibition

In an experiment on a frog, I.M. Sechenov observed increasing time of a flexor reflex in the leg, when the thalamus of this frog had been irritated with the crystals of sodium chloride (NaCl). This type of inhibition is caused by excitation of Renshaw cells contacting with motoneurons. Neurotransmitter gamma-aminobutyric acid (GABA), which is released in synaptic contacts between these cells, elicits a decrease in excitation and conduction of excitation in motoneurons.

Equipment: a dissection set, a supporter, sodium chloride crystals, Ringer's solution, a stopwatch, 0.1% hydrochloric acid solution, water, 2 medical cups, ether. The work is undertaken on a frog.

Work content. Firstly, frog must be narcotized by ether. Then open the frog's cranium to uncover the diencephalon. Cut the skin flap on the frog's head, uncover the bones of the skull. Dissect with a scalpel along the median suture, then enter the scissors into cranial cavity more anteriorly. When cutting the bones of the skull, locate the scissors in parallel with bone in order to not to damage the brain. After bleeding has stopped, look at the frog's brain parts. Make a transverse Sechenov incision above the area of the thalamus. In order to dry wound put a cotton swab on it. Fix the frog on the holder by the lower jaw. After 15 minutes determine the time of the reflex by Turk by submerging the fingers of the leg in a 0.1% solution of hydrochloric acid. After washing the foot with water, repeat the determination of the reflex time with an interval of 2-3 minutes until the repeating values are obtained. Thoroughly drain the cut surface of the brain with small cotton balls. After this, put the sodium chloride crystal on the brain incision. After 1-2 minutes again, determine the time of the reflex. Then remove the crystal of sodium chloride and carefully wash the surface of the brain with Ringer's solution. After 5 minutes, re-measure the reflex time.



The results of the experiment and its design. 1. Write course of the experiment. Obtained data should be in the form of the table below.

Stage of an experiment	Reflex time, sec
After Sechenov's cut Af-	

ter putting crystal of sodium chloride After removing the crystal of sodium chloride	

2. Draw frog's brain, indicate the area of cutting and applying the crystals of sodium chloride. 3. Draw scheme of Sechenov's inhibition. 4. Explain mechanism of Sechenov's inhibition.

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.

7. Bibliography: see apendix No. 1.

8. Assessment procedures

Tests

1. Inhibition of the motor neurons of muscles - antagonists is called ....
a) reciprocal
c) presynaptic
c) postsynaptic
d) antidromic
e) pessimal

2. The inhibitory neurotransmitter are ....
a) GABA, glycine
b) endorphins, GABA
c) enkephalins, substance P
d) acetylcholine, epinephrine
e) acetylcholine, GABA

3. The inhibition in the central nervous system was first discovered by....
a) Sechenov I.M.
c) Pavlov I.P.
c) Anokhin P.K
d) Descartes P
e) Sherrington Ch

4. The main nerve processes that characterize the function of the central nervous system ....
a) excitatory, inhibitory
b) functional rest, lability
c) excitatory, refractory
d) inhibitory, equalizing
e) equalizing, paradoxical

5. The reflex principle on the function of higher departments of the central nervous system was spread by....
a) Sechenov
c) Sherrington
c) Holtz
d) Pavlov
f) Anokhin

6. One of the main properties of nerve centers is the dominance, which was discovered by....
a) Ukhtomsky A.A.
b) Vvedensky N.E.
c) Bykov K.M.

(d) V.V. Parin
e) Anokhin P.K
7. The tonus of the nerve centers ... when cutting the centripetal tract.
a) disappear
b) increase
c) decrease
d) does not change
e) phase change
8. Sechenov's inhibition is characterized by ....
a) lengthening of the acid reflex time, excitation of Renshaw cells
b) hyperpolarization of the postsynaptic membrane of motoneurons, excitation of Renshaw cells
c) excitation of Renshaw cells, membrane depolarization
d) shortening of the acid reflex time, excitation of Renshaw cells
e) inhibition of Renshaw cells, hyperpolarization of the postsynaptic membrane
9. The principle of coordination of reflexes, according to which the impulse from the working organ enters the center after the reflex act, is called ....
a) reverse afferentation
b) the transformation of the rhythm
c) divergence
d) irradiation of excitation
e) aftereffect
10. Excitation in the central nervous system
a) spreads one-sidedly, summarizes, irradiates
b) summarized, transformed, distributed bilaterally
c) converts, lags, accommodates
d) irradiates, decelerates, is blocked
e) distributed bilaterally, delayed in synapses
11. Post-tetanic potentiation is characterized by
a) increased reflex response, increased neurotransmitter release in synapses
b) increased reflex response, decreased neurotransmitter release in synapses
c) weakening the reflex response, increasing the release of the neurotransmitter at the synapses of the subthreshold force causes a decrease in the membrane potential
d) occurrence of inhibitory post-tetanic potential and accumulation of calcium ions
e) weakening the reflex reaction, reducing the neurotransmitter release by presynaptic endings
12. The phenomenon of the dominance is ....
a) the predominant focus of excitation in the central nervous system
b) summation of excitations
c) a change in the excitation rhythm
d) circulation of excitation along a closed circle of neurons
e) plasticity of the nerve center
13. The spread of excitation and inhibition in the cerebral cortex is called ....
a) irradiation
b) concentration
c) by induction
d) Occlusion
e) Convergence
14. Self-regulation of body functions is based on the principle of ....

a) reverse afferentation
b) of a locational afferentation
c) afferent synthesis
d) dominant motivation
e) reciprocal innervation
15. The activity of the cerebral cortex is controlled by the laws ....
a) concentration, irradiation, mutual induction
b) concentration, adaptation, induction
c) irradiation, dominance, lability
d) mutual induction, protraction, summation
e) irradiation, reverberation, convergence

Methodical Recommendations No. 6

1. Theme: Types of the higher nervous activity. First and Second Signal System.

2. Learning goals: to master physiologic basics of mental activity.

3. Learning objectives:

* to master the study of thinking - attribution of phrases to proverbs (Zeigarnik test);
* to determine the temperament of a person;
* to determine the type of working capacity of a person ("owl-lark" test).

4. Questions relating to the theme:

1. The significance of the works of I.M. Sechenov and I.P. Pavlov for the development of the doctrine of mental activity and human behavior.
2. Types of temperament, their characteristics.
3. The first and second signaling systems. Speech.
4. The notion of thinking and consciousness. Significance of the works of Z. Freud.
5. Determination of the properties of the nervous system by psychomotor indicators.
6. Types of personality: classification, definition.
7. What methods of psychophysiological testing do you know?

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of case tasks.

Laboratory work No. 1

The connection between reactivity and personality traits - extraversion, introversion and neuroticism.

Equipment: H. Eysenck personal questionnaire, eyedropper, measuring tube, lemon juice.

The content of the work. This work can be conducted simultaneously on the students of the whole group. The teacher by not giving much time for thinking reads 57 questions from the H. Eysenck personal questionnaire. Students after listening to the question should answer it – "yes" or "no". Then, using the questionnaire code, the number of positive responses is count by the scale: extra- version, interversion, neuroticism, and mendacity. To determine the degree of reactivity, a method that was conditionally called a "lemon test" is used. The teacher drips 4 drops of lemon juice on each student's tongue. After 10 seconds, the student collects saliva in a test tube and measures the amount of saliva. Recommendations for the design of work. After counting the number of positive reports for each scale of the personal questionnaire, an analysis of the data should be performed.The assessed quality is considered to be pronounced, if on the scale extraversion, introversion, and neuroticism is given 8 positive answers, and extremely prominent if positive answers were 11. The expression of mendacity can be judged if the number of matching answers is 7 or more. The re- vealed degree of reactivity should be compared with personality traits.

Laboratory work No. 2

The role of verbal stimuli in creating the emotional state of a person

Equipment: a set of texts emotionally significant and indifferent for students and a stopwatch.

The content of the work. Students are divided into experiment subjects (tested students) and experimenters. The experimenters measure the heart rate (HR) in 10 seconds, i.e. background measurements. Then the teacher begins to read the texts (7-8 texts). The interval between reading each following texts should be 1.5 min. After listening the texts, the experimenters measure heart rate in subjects for 10 seconds. *Recommendations for the design of the work.* The results of measuring the heart rate for 10 sec during and after reading each text should be drawn as a plot. At the "0" point, the background HR values are set aside for 10s; at the point "1", the HR value for 10 sec afterbeginning of reading the first text is set; at the point "2", HR for 10 sec after the beginning of read- ing the second text is set, etc. On the basis of the heart rate, make a conclusion about the emotional significance of individual texts. It should be borne in mind that not all texts are equally emotionally significant for different students. The reactions of students for emotionally significant stimuli can be either sympathetic or parasympathetic types.

Laboratory work No. 3.

Second signaling system and conditioned blinking reflex

In humans, unlike animals, a conditioned reflex can be developed not only on specific phenomena and objects of the surrounding world (the first signal system) but also on the semantic meaning of the word, which indicates this phenomenon or stimulus (the second signal system).

Equipment: the source of the sound stimulus (you can use a cell phone buzzer, a bell, a children toy – a buzzer), a small rubber bulb with a flexible tube. The research is conducted on a human subject.

The content of the work. Offer the subject of the experiment to sit on a chair. Standing on the side of him/her, direct the tube of the rubber bulb into the angle of the subject's eye. Apply a jet of air to the sclera and cornea (the rubber bulb should be squeezed slightly so that the air stream does not cause pain). Note the presence of a blinking reflex. Then apply a sound stimulus; note the presence or absence of an orienting reaction and a blinking reflex.

Having checked the effect of the sound and the air stream separately, proceed to the formation of a conditioned reflex. To do this, make close the sound source to the ear and produce a sound, and then apply a jet of air until a stable conditioned reaction is formed. Combinations of irritants should be repeated 10 - 15 times with an interval of at least 5 seconds.

Suddenly, give a sound to the subject, but without irritation with air. The observed blinking indicates the formation of a conditioned reflex and the normal formation of temporary connections in the cerebral cortex. If there is no blinking (this may indicate an incorrect experiment or some inertness in the CNS activity), repeat the combination a few more times and try the isolated sound action again.

Then loudly pronounce the word "sound". If the second signalling system operates correctly, there is blinking reflex observed.

Drawing of the protocol. 1. Describe the experiment results and make a conclusion. 2. Draw the arch of the conditioned blinking reflex.

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.

7. Bibliography: see apendix No. 1.

8. Assessment procedures

Tests

1. Higher emotions are associated with ... .

a) satisfaction of social needs and needs related to intellectual activity
b) satisfaction of intellectual needs and needs related to the maintenance of homeostasis
c) satisfaction of moral needs and needs related to sexual instinct
d) satisfaction of aesthetic needs and needs related to self-preservation
e) satisfaction of aesthetic needs and needs related to intellectual activity
2. Processes that most fully characterize memory ... .
a) fixation, storage, reproduction of information
b) information storage
c) storage of information in DNA
d) circulation of excitation
e) storage of information in DNA, RNA and circulation of excitation
3. According to Hippocrates, a strong, motile, and unbalanced type of nervous system is ... .
a) choleric
b) sanguine
c) melancholic
d) phlegmatic
e) introvert
4. Aphasia is called ... .
a) violation of speech
b) recognition disorder
c) violation of purposeful action
d) visual disorder
e) motor acts disorder
5. Humans who are more prone to neurotic breakdowns of higher nervous activity are ... .
a) choleric and melancholic
b) phlegmatic and melancholic
c) sanguine and choleric
d) phlegmatic and sanguine
e) melancholic and sanguine
6. Violation of purposeful action in the damage of the cerebral cortex is called ... .
a) apraxia
b) agnosia
c) aphasia
d) agraphy
e) amnesia
7. Note the reaction connected with the second signaling system ...
a) tachycardia of the patient to whom the doctor reported the results of the tests
b) the saliva secretion during feeling the smells
c) narrowing of the pupils in bright light
d) crying of the child who sees a syringe in the hands of a doctor
e) pulling back the hand when touching the hot plate
8. The transition from deep sleep to wakefulness can be caused by irritation of ... .
a) the reticular formation
b) the red nucleus
c) medulla oblongata
d) the thalamus
e) basal nuclei

9. The first signaling system is the system of ... .
a) unconditioned and conditioned reflexes
b) conditioned reflexes
c) unconditioned reflexes
d) abstract thinking
e) verbal communication
10. The higher nervous activity includes the function of ... .
a) the cortex of the cerebral hemispheres
b) the spinal cord
c) the reticular formation
d) the limbic system
e) the thalamus and hypothalamus

Methodical Recommendations No. 7

1. Theme: Metabolism. Nutrition.

2. Learning goals: to study the processes of methabolism for proteins, fats, carbohydrates, minerals, and water as well as energy methabolism and nutrition standards (normal eating patterns).

3. Learning objectives:

- To study energy methabolism of an organism;
- To define, explain, and assess an energy comnsumption of a human depending on his functional state.

4. Questions relating to the theme:

1. Metabolism of the body.
2. The plastic and energy role of proteins.
3. The plastic and energy role of carbohydrates.
4. The plastic and energy role of lipids.
5. Assimilation and dissimilation of substances.
6. Nitrogen balance.
7. Methods for determining the energy consumption.
8. Respiratory coefficient and its value for the calculation of energy consumption.
9. What is the basal metabolism? What factors impact on the amount of basal metabolism? What methods do you know about it?
10. How does the energy metabolism change during physical labor and mental work?
11. What is the specific dynamic action of food?
12. What enzymes break down the main nutrients?
13. Describe the physiological basis of rational nutrition.
14. Balanced nutrition (adequate nutrition, rational nutrition).
15. Role of microelements and vitamins in nutrition.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of case tasks.

Laboratory work No. 1

Elaboration of food rations

Tables of chemical compound of food products and their calorific value are necessary for the work.

Work content. The food ration is made up using special tables, which indicate the percentage of protein, fat and carbohydrate in food products and the calorific value of 100 g of the product. If the amount of proteins, fats and carbohydrates in the daily ration does not meet the standards, then, respectively, it is necessary to either increase or to decrease the amount of nutrients.

Recommendations for the work. The information on the diet should be entered in the table:
Compound of daily food ration

Type of food	Name of foods	Weight of the foods, g	Compound of the proteins, fats, and carbohydrates in the given food amount, g	Percentages of a daily rations	Caloricity, kcal
Breakfast Second breakfast Dinner Supper Totals					

Make a conclusion.
The tables below could be useful.

BEANS

FOOD	AMOUNT	CALORIES	PROTEIN	CARBS	FAT
Black beans	1/2 cup cooked	113	7.6	20.4	.5
Garbanzo (chickpeas)	1/2 cup cooked	134	7.3	22.5	2.1
Kidney beans	1/2 cup cooked	112	7.6	20.1	.4
Lentil beans	1/2 cup cooked	115	8.9	19.9	.4
Lima beans	1/2 cup cooked	108	7.3	19.6	.4
Navy beans	1/2 cup cooked	129	7.9	24.0	.5
Soybeans (edamame)	1/2 cup cooked	127	11.1	10.0	5.8
Tofu	1/2 cup fresh	94	10.0	2.3	5.9

DAIRY

FOOD	AMOUNT	CALORIES	PROTEIN	CARBS	FAT
Cheddar cheese	1 ounce	114	7.1	.4	9.4
Cottage cheese	1/2 cup	110	14.0	3.1	5.0
Cottage cheese, lowfat	1/2 cup	90	16.0	3.0	1.0
Egg	1 large	75	6.3	0	5.0
Milk, lowfat	1 cup	121	8.1	11.7	4.7
Milk, skim	1 cup	86	8.4	11.8	.4
Muenster cheese	1 ounce	104	6.7	.3	8.5
Swiss cheese	1 ounce	107	8.1	1.0	7.8
Yogurt, lowfat	1 cup	144	11.9	16	3.5
Yogurt, nonfat	1 cup	127	13.0	17.4	.4

FISH

FOOD	AMOUNT	CALORIES	PROTEIN	CARBS	FAT
Anchovies, in water	1 ounce	37	5.8	0	1.4
Halibut	3 ounces	93	17.7	0	2.0
Mackerel	3 ounces	180	15.8	0	11.8
Salmon	3 ounces	121	16.9	0	5.4
Sardines, in water	1 can	130	22.0	0	5.0
Tuna, tongol	1/4 cup	70	16.0	0	0

GRAINS

FOOD	AMOUNT	CALORIES	PROTEIN	CARBS	FAT
Oatmeal, rough cut	1 cup	145	6.0	25.2	2.4
Pancake, buckwheat	1 4" diameter	54	1.8	6.4	2.2
Pancake, whole wheat	1 4" diameter	74	3.4	8.8	3.2
Popcorn, dry	1 cup	54	1.8	10.7	.7
Quinoa, cooked	1/2 cup	115	4.3	21.5	2
Rice, brown, cooked	1/2 cup	108	2.4	22.8	.8
Rye bread	1 slice	56	2.1	12	.3
Whole wheat bread	1 slice	56	2.4	11	.7

POULTRY

FOOD	AMOUNT	CALORIES	PROTEIN	CARBS	FAT
Chicken breast	4 ounces	193	29.3	0	7.6
Chicken, light meat, no skin	4 ounces	196	35.1	0	5.1
Chicken, dark meat, no skin	4 ounces	232	31.0	0	5.1
Turkey, light meat, no skin	4 ounces	178	33.9	0	3.7
Turkey, dark meat,	4 ounces	212	32.4	0	8.2

Meat and meat derivatives, fish and eggs			
Food	Measure	Weight (g)	Calories
Bacon	one slice	25	142
Baked sardine	one unit	100	120
Beef	one portion	100	140
Beef hamburger	one unit	100	248
Beef liver	one steak	130	157
Beef ribs	one unit	100	380
Beef steak in breadcrumbs	one unit	160	580
Caviar	one tablespoon	20	40
Cheeseburger	one unit	150	600
Chicken	one portion	100	235
Chicken	one portion	100	107
Chicken hamburger	one unit	100	234
Chicken drumstick	one medium drumstick	50	221
Chicken fillet	one portion	120	128
Chicken pie	one unit	23	256
Cod	one medium steak	100	169
Cooked ham	one medium slice	25	85
Dried meat	one portion	100	213
Egg white	one unit	30	13
Egg yolk	one unit	20	71
Fish hamburger	one unit	100	74
Fish in breadcrumbs	one medium fillet	115	305
Fried beef steak	one unit	130	330
Fried chicken	one top of the leg	65	94
Fried chicken	one medium drumstick	40	58
Fried chicken	one medium breast	180	280
Fried egg	one unit	50	102
Fried fish	one medium fillet	120	436
Fried pork steak	one unit	130	365
Hake	one fillet	100	97
Horse steak	one unit	140	196
Hotdog sausage	one unit	50	165
Lobster	one portion	100	84
Marinated fish	one fillet	120	219
Marinated fish	one medium steak	200	366
Meat ball	one unit	50	60
Meat croquette	one unit	25	86
Mortadella	one slice	15	42
Plaice	one fillet	100	87
Poached fish	one medium steak	200	196
Pork	one portion	100	285
Pork loin	one portion	100	363
Roast beef	one slice	40	66
Roast chicken	one top of the leg	65	78
Roast chicken	one medium drumstick	40	48
Roast chicken	one medium breast	180	217
Rump steak	one slice	100	250
Salmon	one portion	100	211
Sausage	one fillet	100	87
Shrimp	one unit	25	21
Soy meat	one portion	100	106
Squids	one portion	100	87
Trout	one fillet	100	89
Tuna	one medium steak	130	150
Tuna in oil	one can	184	483
Turkey	one medium breast	100	155
Turkey	one drumstick	80	124
Turkey	one portion	100	153
Turkey hamburger	one unit	100	148

Fruits and horticultural products			
Food	Measure	Weight (g)	Calories
Apples	one unit	100	64
Apricot	one unit	30	19
Avocado pear	half a unit	200	324
Banana	one unit	100	120
Bean soup	one dish	300	289
Beet	one dessert dish	35	17
Black banana	one unit	70	62
Black plum	one unit	50	22
Broccoli	one saucer	60	22
Brussels sprouts	one saucer	100	59
Cabbage	one dessert dish	30	8
Canned peaches	one unit	40	67
Carrot	one medium carrot	50	25
Cauliflower	one saucer	80	25
Cucumber	one unit	150	22
Eggplant	one tablespoon	30	6
Figs	one unit	100	68
Fruit salad	one goblet	150	230
Garlic	one clove	5	7
Grape	one small bunch	150	118
Green beans	one tablespoon	20	10
Guavas	one unit	100	57
Hazelnut	one unit	3	19
Kale	one dessert dish	50	13
Lemons	one unit	60	22
Lentils	one medium ladle	120	152
Lettuce	one dessert dish	35	6
Mangos	one unit	260	182
Melon	one slice	100	30
Mushroom	one saucer	80	15
Olive	one unit	5	11
Oranges	one unit	100	43
Passion fruit	one unit	100	90
Peaches	one unit	100	52
Pears	one unit	100	63
Peas	one tablespoon	20	18
Pine nuts	one unit	10	22
Pineapple	one slice	100	52
Pineapple in syrup	one goblet	150	184
Pumpkin	one saucer	100	40
Radish	one unit	10	2
Raisin	one teacup	100	298
Red plum	one unit	50	27
Spinach	one dessert dish	80	18
Strawberries	one unit	10	4
Sweet pepper	one unit	50	15
Tangerine	one unit	100	50
Tomato	one unit	100	25
Turnips	one unit	100	35
Vegetable soup	one dish	300	215
Walnuts	one unit	5	35
Watercress	one dessert dish	25	6
Watermelon	one slice	100	31

Physiological standards of nutrients.

Diet

Standards of nutrition are the daily amounts of nutrients which correspond to a balanced content in the diet of protein, fat and carbohydrates, as well as vitamins, minerals and water.

Nutrition standards are determined based on gender, age, as well as on physical and mental load and other factors. An adult with a small muscular load should intake with food per day: proteins - 100-120 g, fats - about 100 grams, carbohydrates - 400-500 g. The energy consumptions under these

conditions is 50-60 kcal per 1 kg of mass per day.

Nutrition mode is an adaptation of the nature of nutrition, its frequency to the daily rhythms of work and rest, to the physiological patterns of digestive tract. The most rational is the four meals a day at the same hours of the day with an interval of 4 to 5 hours. It is recommended to have supper containing digestible food no later than 3 hours before going to sleep.

It is advisable to distribute the total calorific value of the daily diet as follows:

With four meals a day: Breakfast - 25%

Second breakfast - 15%

Dinner - 35%

Supper - 25%

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.

7. Bibliography: see apendix No. 1.

8. Assessment procedures

Tests

1. The role of carbohydrates in the body is ...
a) mainly energetic.
b) mostly plastic.
c) equally plastic and energy.
d) humoral.
e) regulatory.
2. Negative nitrogen balance is observed ...
a) in a significant decrease of the protein in food.
b) during pregnancy.
c) during the growth period.
d) in a significant increase in the protein in food.
e) during the convalescence
3. A positive nitrogen balance can happen ...
a) during the period of growth, during pregnancy, at the moment of the convalescence.
b) in old age, when temperature is increased, abundant food to intake.
c) during starvation, hypothermia, low temperature of the environment.
d) in intensive physical loads, in children, in old age.
e) during pregnancy, infectious diseases, starvation
4. Positive nitrogen balance in the human body is observed ...
a) during the growth period.
b) in old age.
c) during starvation.
d) in intensive physical loads.
e) with a significant intake of carbohydrates
5. The greatest increase in basal metabolism is caused by the hormone ...
a) thyroxine.
b) epinephrine.
c) norepinephrine.
d) somatotropin.
e) glucagon
6. When 1 g of water evaporates from the surface of the skin, a body loses warmth equal to ...
a) 0.56 Kcal

b) 56 Kcal
c) 5.6 Kcal
d) 0.056 Kcal
e) 0.68 Kcal
7. Caloric fat factor is equal to ...
a) 9.3 kcal (38.9 kJ)
b) 4.1 kcal (17.2 kJ)
c) 5.4 kcal (22.7 kJ)
d) 7.6 kcal (31.9 kJ)
e) 10.3 kcal (44 kJ)
8. To determine the energy consumption by the indirect calorimetry method, the following methods of studying gas exchange are used ...
a) the Krog spirometer, according to Douglas-Haldane.
b) using the Shaternikov respirator chamber.
c) Etuater and Benedict chambers.
d) using the cameras of Shaternikov and Likhachev.
e) with the use of electronic instruments, the camera of Etuotera-Benedict.
9. The following hormones strengthen the basic metabolism...
a) adrenaline, thyroxine.
b) aldosterone, cortisone.
c) calciotonin, glucagon.
d) thyroxine, vasopressin.
e) insulin, vasopressin.
10. Heat production in a body is strengthened by the hormone ...
a) thyroxine.
b) insulin.
c) glucagon.
d) mineralocorticoid.
e) parathyroid hormone.
11. Assimilation is…
a) a breakdown of complex substances
b) a synthesis of simple substances
c) a breakdown of acids
d) a breakdown of bases
e) a synthesis of complex substances
12. In pregnancy the following state is observed
a) a negative nitrogen balance
b) a positive nitrogen balance
c) absence of nitrogen balance disorders
d) multiphase changes in the nitrogen balance
e) two-phase changes in the nitrogen balance
13. In a young healthy woman of 25 years, 16 g of nitrogen per day is excreted with urine after she consumed 120 g food protein. What assumption about the state of the woman could be done?
a) Negative nitrogen balance, protein starvation
b) Positive nitrogen balance, pregnancy
c) Positive nitrogen balance, rehabilitation after severe illness
d) Positive nitrogen balance, active formation of cellular structures

e) Negative nitrogen balance, pregnancy
14. Energy expenditures of an organism in conditions of physiological rest, in a supine position, with an empty stomach, at a temperature of comfort make up an … exchange:
a) Worker
b) Specific-dynamic
c) Basal
d) Thermal
e) Energy
15. The main source of energy during the strenuous activity of the body is…
a) breakdown of fats
b) breakdown of proteins
c) protein synthesis
d) synthesis of enzymes
e) oxidation of carbohydrates
16. A positive nitrogen balance is observed in…
a) pregnancy
b) protein and fatty starvation
c) specific amino acids deficiency in food
d) absence of physical training
e) fat and carbohydrate starvation
17. In an experimental animal, the sympathetic nervous system was irritated. What changes in metabolism could this lead to?
a) increasing the carbohydrate consumption
b) increasing the fat breakdown
c) formation of a micelle
d) protein deposition
e) fat deposition
18. A person consumed 100 grams of protein per day. At the same time he had a nitrogen balance. Then he switched to a ration with a daily protein content of 500 g. If in the third week of such a diet, to determine his nitrogen balance, how to change the release of nitrogen:
a) increased 5-fold; nitrogen balance
b) increased, but still not corresponding to consumption; positive nitrogen balance;
c) has not changed; positive nitrogen balance
d) decreased, the positive nitrogen balance
e) increased 5-fold; negative nitrogen balance.
19. To determine the basic metabolism, from the listed below indicators, one should be measured:
a) caloricity of food consumed
b) absorption of O2
c) digestibility of consumed food
d) physiological heat of combustion of proteins, fats and carbohydrates
e) physical activity

Methodical Recommendations No. 8

1. Theme: Thermoregulation.

2. Learning goals: to study physiologic basics of termoregulation.

3. Learning objectives:

- To know meaning of the termoregulation

- To be able to measure body temperature
- To explain mechanisms of heat production and heat transfer.

4. Questions relating to the theme:

1. Constant temperature of the body internal environment.
2. Daily fluctuations of the body temperature.
3. Thermoregulation, its notion, and types.
4. Heat production: metabolism as a source of heat generation.
5. The role of organs and tissues in heat production.
6. Heat transfer: types and regulation.
7. Thermoreception. Peripheral and deep, cold and warm thermoreceptors.
8. Thermoregulation at a high and a low temperatures of environment.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of case tasks.

Laboratory work No. 1

Thermometry

Usually, body temperature is measured 2 times a day (at 7-9 o'clock in the morning and at 17-19 o'clock in the evening). As a rule, a systematic measurement of body temperature 2 times a day gives an opportunity to get an idea of its daily fluctuations.

The body temperature can be measured in many ways (there are normal temperature values for a given site):

• in the armpit: 36.3-36.90 C
• in the inguinal fold: 37.00 C
• in the oral cavity: 36.8-37.30 C
• in the ear canal: 37.5-37.70 C
• in the rectum: 37.3-37.70 C
• in the vagina: 36.7-37.50 C

Thermometry has the great diagnostic meaning.

Laboratory work No. 2

Adaptation of skin temperature receptors to the effect of high and low temperature.

Three reservoirs are filled with water of different temperatures: 10, 25 and 40 ° C accordingly. The right hand of a person is placed in a reservoir with water of a temperature of 10 ° C, the left one is placed in water of temperature of 40 ° C. Then, determine the time of adaptation of the thermoreceptors, i.e. the time when feeling of warmth or cold disappears. Then, both hands are simultaneously transferred to a reservoir with water of temperature of 25 ° C. The person reports a change of the sensations in the left and right hands (a phenomenon of contrast). The obtained results are added to the table. Make a conclusion.

Object	**Feeling during submerging in the water temperature of…**		
	10° C	**25° C**	**40° C**

Right hand Left hand	coldness	warmth coldness	 warmth

It is observed contrast between feelings in the left and the right hands, what is caused by a receptor adaptation to cold or warm irritations.

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.
7. Bibliography: see apendix No. 1.
8. Assessment procedures
MCQ Tasks
1. The center of thermoregulation is located in ...
a) the hypothalamus.
b) the medulla oblongata.
c) the midbrain.
d) the pons.
e) thalamus
2. Heat production is increased by the hormone ....
a) thyroxine
b) insulin
c) glucagon
d) mineralocorticoid
e) parathyroid hormone
3. When 1 g of water evaporates from the skin surface, the body loses .... heat.
a) 0.56 Kcal
b) 56 Kcal
c) 5.6 Kcal
d) 0.056 Kcal
e) 0.68 Kcal
4. Caloric fat factor is equal to....
a) 9.3 kcal (38.9 kJ)
b) 4.1 kcal (17.2 kJ)
c) 5.4 kcal (22.7 kJ)
d) 7.6 kcal (31.9 kJ)
e) 10.3 kcal (44 kJ)
5. With an increasing the temperature of the environment, in homoiothermal animals, heat production…, heat loss… .
a) decreases; increases
b) increases; decreases
c) decreases; decreases
d) increases; increases
e) increases; stays at a constant level
6. The main centers of thermoregulation are located in ....
a) the hypothalamus

b) the thalamus
c) the cerebellum
d) subcortical ganglia
e) spinal cord
7. Chemical thermoregulation includes the following processes ....
a) changes in the intensity of metabolism
b) heat conductivity
c) heat radiation
d) convection
e) evaporation
8. The main role in heat production is played by ....
a) muscles, liver, gastrointestinal tract
b) muscles, liver, skin
c) liver, heart, lungs
d) liver, gastrointestinal tract, lungs
e) muscles, connective tissue, fatty tissue
9. Isothermia is a… .
a) fever
b) inconstant body temperature
c) constant body temperature
d) metabolic changes
e) decrease of body temperature
10. Hyperthermia is a… .
a) increasing body temperature
b) inconstant body temperature
c) constant body temperature
d) metabolic changes
e) decrease in body temperature
11. Heat production and heat loss in homoiothermal animals with increasing temperature of environment (heat production and heat transfer accordingly)
a) increases; decreases
b) decreases; decreases
c) decreases; increases
d) increases; increases
e) does not change; does not change
12. Heat balance is:
a) a heat production during metabolism
b) dissipating heat to the surrounding space
c) violation of the thermoregulation mechanism
d) stationary state of heat exchange with the external environment without changing the heat content in the body
e) exchange of thermal energy of the organism with the environment
13. In artificial (medical) hypothermia, body temperature is reduced to 30 ^{o} C. In this state of the body:
a) oxygen consumption increases to compensate the cooling
b) oxygen consumption decreases and tissue resistance to oxygen deficiency increases
c) the excitability of the nervous and muscular tissues increases

d) the heart rate increases
e) sympathetic nervous system increases its tone
14. Contractile thermogenesis is associated largerly:
a) with the change in tone and physical contractions of skeletal muscles
b) with a change in the activity of the smooth muscles of the gastrointestinal tract
c) with cutaneous blood circulation
d) with the work of the respiratory muscles
e) with the work of internal organs
15. What process provides the greatest output of heat production?
a) non-contractile thermogenesis
b) contractile thermogenesis
c) chemical thermoregulation
d) vasodilation of vessels
e) muscle relaxation
16. What structures of the hypothalamus regulate the magnitude of heat production?
a) front
b) medium
c) rear
d) rear and front
e) medium and front
17. A group of tourists is going to have to cross a significant distance of the Betpak-Dala desert on foot in mid-July. Air temperature is 38 ° C, windless.
How will the thermal homeostasis be maintained in such conditions?
a) by increased liver metabolic processes
b) by evaporation of sweat from the surface of the body
c) by narrowing of the skin vessels
d) by thermal radiation
e) by convection

Methodical Recommendations No. 9

1. Theme. The Physiological Properties of the Cardiac Muscle. Methods for the studying the Cardiac Activity. ECG

2. Learning goals: to master physiological properties of cardiac muscle;

3. Learning objectives:

* to know the physiological properties of the cardiac muscle
* to study the autonomic innervation of the heart
* to be able to decipher the ECG

4. Questions relating to the theme:

1. Physiological properties and features of the cardiac muscle;
2. Cardiomyocytes, their structure;
3. The functions of the heart;
4. Autonomic innervation of the heart;
5. Research methods of cardiac activity;
6. Significance of ECG.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of case tasks.

Laboratory work No. 1

ECG recording for standard leads

Set a tested person lying on his / her back in a couch. Apply special gel on those areas of skin where electrodes are going to be fixed. In the absence of the gel, wipe these skin areas with a swab soaked by isotonic sodium chloride solution (0.9%).

Apply four electrodes to the lower thirds of the limbs in the area of their internal surfaces (red electrode – to the right arm, yellow electrode – to the left arm, green electrode – to the left leg, black electrode – to the right leg).

ECG recording is conducted by switching on the electrodes by the following order:

I standard lead – left arm and right arm;

II standard lead – left leg and right arm;

III standard lead –left arm and left leg.

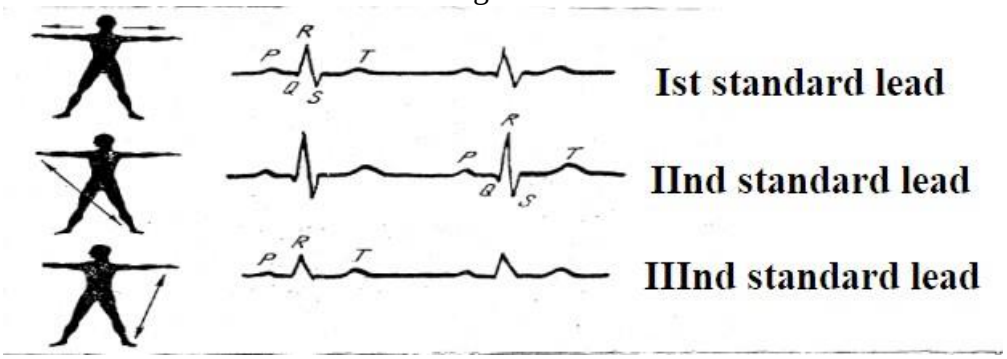


Fig. Positions of the standard leads

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.

7. Bibliography: see apendix No. 1.

8. Assessment procedures

MCQ Tasks

Methodical Recommendations No. 10

1. Theme: Physiologic features of the muscles. Type of muscular contractions.

2. Learning goals: to study different types of muscle tissue and their physiological properties, to learn to determine the types of muscle contractions and identify their basic physiological characteristics.

3. Learning objectives: to prepare a neuromuscular frog preparation, learn the methods of research of muscle contraction, to study the regimes and types of muscle contraction, to draw types of contraction and explain the mechanism of this process.

4. Questions relating to the theme:

1. Types of muscle tissues;
2. Properties of skeletal muscles;
3. Mechanism of muscle contraction;
4. Single contraction;
5. Summarized contractions (*unfused and fused tetanus*);
6. Types of muscle contraction;
7. Modes of muscle contraction;
8. Muscular response to passive stretching;
9. Work and strength of muscles;

10. Fatigue of muscles;
11. Features of the contraction of smooth muscles.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of case tasks.

Laboratory work

Direct and indirect irritation of a muscle

Under experimental conditions, muscle contraction can be produced both by stimulation of the muscle itself (direct stimulation) and by stimulation of the motor nerve that innervates the given muscle (indirect stimulation).

Equipment: horizontal myograph, kymograph, stimulator, electrodes, universal tripod, dissection set, switch, Ringer's solution, ligatures, pipette. The object of research is a frog.

The content of the work. Check the readiness of the equipment to work. Then immobilize the frog by destroying the brain and spinal cord. Remove the skin from the thigh and calf of one of the frog legs. Uncover the calf muscle and take out the Achilles tendon without cutting the muscle in the region of the knee joint. Fix the frog back up on the dissection table with the pins. Achilles tendon to be firmly bound with a ligature and then cut it below the sesamoid bone. The free ends of the ligature are thrown through a block of the horizontal myograph and then are fixed on the scribbler's lever so that the latter is strictly horizontal. The muscles of the thigh to be extended with the sciatic nerve being uncovered. Trying to minimize trauma of the nerve, the ligature is brought below it. Apply one pair of electrodes on the muscle, the other one – on the sciatic nerve. Through the switch, the electrodes are connected to the output of the stimulator. Gradually increasing the ampli- tude of the stimulating pulses, determine the magnitude of the threshold stimulation for the nerve. Then the switch is put in a position so that the irritation is applied to the muscle, and the thresholdof muscle irritation is determined. This work can also be done using a vertical myograph.

The results of work and their design. 1. Draw the diagram of the experiment. 2. Cut out the records of contraction curve and stick them into the protocol. 3. Under each contraction record, note the object of irritation and the parameters of the irritating electricity.

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.

7. Bibliography: see appendix No. 1.

8. Assessment procedures

Tests

1. Skeletal muscles are capable of ... contraction.
a) tetanic
b) tonic
c) single
d) phasic
f) the spastic
2. Smooth muscles are capable of ... contraction.
a) tonic
b) tetanic
c) single
d) phasic
f) the spastic
3. Physiological properties of smooth muscles:
a) excitability, conductivity, contractility, automatism
b) high speed of reduction, fatigue, automatic

c) conductivity, high speed of propagating the excitation and high frequency of contruction
d) inability to single cuts
e) plasticity, automatism and not subordination to the effects of the central nervous system

Methodical Recommendations No. 11

1. Theme: Endocrine glands. General characteristics of endocrine glands.

2. Learning goals: to study the mechanism of influence of endocrine glands hormones on organs, tissues, and cells of the body, the chemical nature of the hormones and their role in the metabolism.

3. Learning objectives:

* to study basic notions of endocrinology;
* to study a classification of hormones, synthesis of the main hormones;
* to explain influence of the hormones on different phases of methabolism;
* to assess data of biochemical and immunological analyses of the blood and urine for the content of hormones;

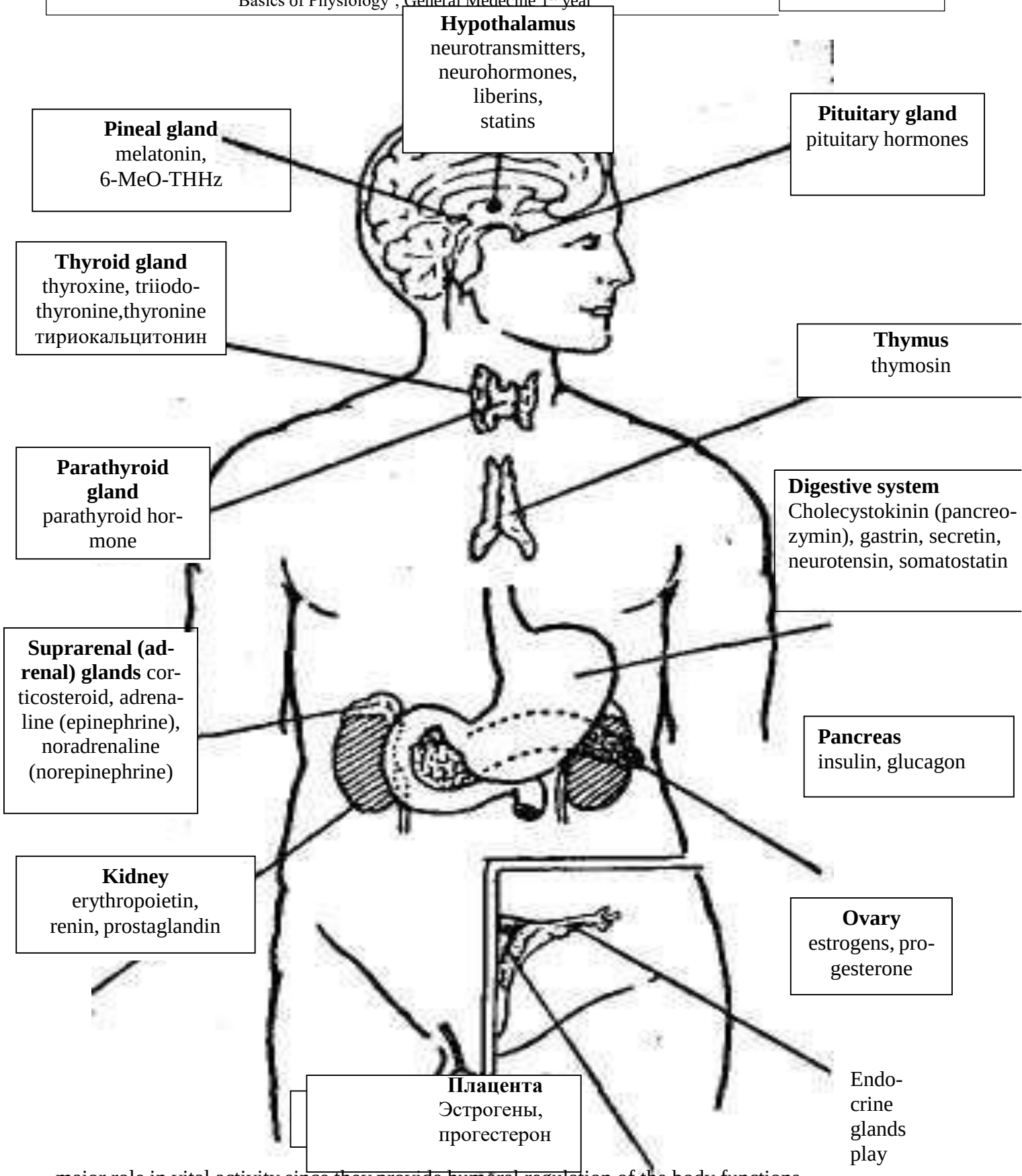
4. Questions relating to the theme:

1. General characteristics of humoral (endocrine and non-endocrine) regulatory factors;
2. Endocrine functions of non-endocrine organs (kidneys, heart, lungs, muscles, and skin);
3. Structural and functional organization of the endocrine system;
4. Classification of hormones;
5. Mechanisms of the hormonal action;
6. Trans- and para-pitiutary regulation of the endocrine glands;
7. Relations between the endocrine glands and the nervous system;
8. Studying methods for the endocrine glands;
9. Local and systemic hormonal self-regulation;
10. Hypothalamic-pituitary system. Neurosecretes of the hypothalamus: liberins and statins.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of case tasks.

Laboratory work No. 1

Topography of the endocrine glands and their hormones



Endo-crine glands play major role in vital activity since they provide humoral regulation of the body functions.

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.
7. Bibliography: see apendix No. 1.
8. Assessment procedures
MCQ Tasks
1. The parathyroid hormone is ...
a) parathyroid hormone.
b) thyrocalcitonin.
c) insulin.
d) glucagon.
e) aldosterone.
2. The secretion of parathyroid hormone causes ... in the blood.
a) increase of calcium
b) decrease of calcium
c) increase of amino acids
d) decrease of amino acids
e) increase of phosphorus
3. Hormones that control the menstrual cycle ...
a) FSH, estrogens, LSG, progesterone.
b) melanotropin, androgens, LSG, progesterone.
c) STH, FSH, progesterone, estrogens.
d) FSH, glucagon, STH, parathyroid hormone.
e) FSH, insulin, progesterone.
4. Insulin ...
a) causes hypoglycemia, increases the absorption of glucose by cells, causes the synthesis of glycogen in the liver, muscles from glucose.
b) increases the permeability of cell membranes to glucose, causes hyperglycemia and glycogenolysis in liver cells, inhibits glycogenogenesis.
c) reduces permeability for amino acids and glucose, inhibits the conversion of glucose into glycogen, causes hyperglycemia.
d) stimulates glycoeogenesis, enhances the oxidation of glucose, reduces the formation of ketone bodies.
e) reduces protein catabolism, causes hyperglycemia, increases permeability of cells for glucose and amino acids.
5. Hormones of the gastrointestinal tract ...
a) bombesin, secretin, and motilin.
b) gastrin, secretin, ACTH, FSH.
c) Willikinin, bombesin, thyroxine, melatonin.
d) ACTH, bombesin, FSH, secretin.
e) motilin, adrenaline, thyroxine, gastrin.
6. Female gender hormones ...
a) estrone, estriol, estradiol.
b) parathyroid hormone, serotonin, thyrocalcitonin.
c) serotonin, estriol, bradykinin.
d) thyroxine, estrone, testosterone.
e) testosterone, thyroxine, serotonin.
7. After removing the adrenal cortex, death occurs because of ...

a) violation of water-salt metabolism.
b) disorders in protein metabolism.
c) disorders of fat metabolism.
d) disorders of carbohydrate metabolism.
e) metabolic disorders of vitamins.
8. The fat content in the depot ... under the influence of the thyroxine hormone.
a) decreases
b) does not change
c) increases
d) increases, then decreases
e) decreases, then increases
9. Myxedema develops with hypofunction ...
a) of the thyroid gland.
b) the adrenal glands.
c) the pancreas.
d) gonads.
e) neurohypophysis.
10. The hormones of the adrenal medulla include:
a) Glucocorticoids.
b) Pitiutary hormones.
c) Mineralocorticoids.
d) Adrenaline and noradrenaline.
e) Releasing factors.

Methodical Recommendations 12.

1. Th eme: General characteristics of body fluids. The physiology of the blood. ESR. Hemolysis.

2. Learning goals: to study constituents and main indicators of the blood, to correctly estimate functional state of an organism.

3. Learning objectives:

• to master the technique of taking blood from the finger;
• to study the estimation of the hemoglobin (Hb) amount in the blood by a colorimetric method;
• to master the basic clinical and hematological methods of blood investigation.

4. Questions relating to the theme:

1. General characteristics of body fluids. Intracellular and extracellular fluids.
2. Functional systems that provide the constancy of osmotic pressure and the acid-base homeostasis of blood.
3. The main functions of blood.
4. Depot of blood, and their significance.
5. Composition and functions of plasma.
6. Proteins of blood plasma, their significance.
7. Blood elements: red blood cells, leukocytes, platelets.
8. Life cycle of erythrocyte (erythropoiesis).
9. Types of hemolysis.
10. Erythrocyte sedimentation rate.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of case tasks.

Laboratory work No. 1

The technique of taking blood from the finger

Equipment: Sterile scarifier, alcohol, ether, 5% alcohol solution of iodine, cotton wool, capillary.

Work content: It is necessary to follow all the rules of asepsis; before the work is started, students should wash their hands well with soap. Blood is usually taken from the fourth finger of the left hand. The skin of the finger should be disinfected, degreased and dried. To do this, the finger should be wiped with cotton wool soaked with a mixture of alcohol and ether. Then the finger from the back and palmar side should be somewhat squeezed. The finger should be fixed on the table with the experimenter's left hand. By a scarifier to sharply prick the skin of the distal phalanx to a depth of 2.5-3.0 mm. The first drop of blood should be wiped off with a dry cotton swab. Then wait for another one to appear. When a new drop of blood appears, a capillary is brought under the blood drop. Hold it horizontally and press it against the skin trying not to destroy the domed shape of the drop. The blood fills the capillary according to the law of capillarity. When taking blood, make sure that the tip of the capillary is always immersed in a drop (otherwise capillary would contain air bubbles), but not too much press against the skin (in order not to close the capillary ending). Withdraw the blood quickly up to the label of capillary. If it would excess the limit, surplus should be withdrewn with cotton wool, slightly touching it to the end of the capillary. After taking blood, apply a cotton swab soaked with 5% alcohol solution of iodine to the injection site of finger, and press it to the palm with the finger.

Design of a protocol: to write down main points of taking blood from the finger.

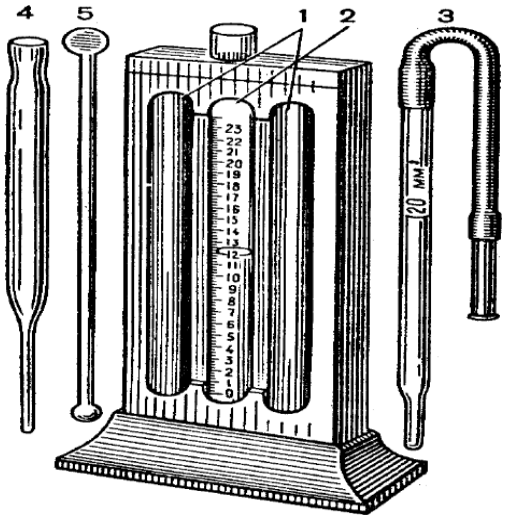
Laboratory work No. 2

Measuring amount of haemoglobin (Hb) in the blood by a colourimetric method (by means of the hemometer Sahli).

Equipment: Equipment: Sterile scarifier, alcohol, ether, 5% alcohol solution of iodine, cotton wool, capillary, haemometer Salhi.

Work content. Amount of Нь is measured by the colourimetric method, based on the comparing the colour of the studied solution with the colour of a standard solution which contains the known concentration of the haematinum chloride (Hb + HCl). For these purposes, the haemometer Sahli is used (*see figure below*); the haemometer consists of dark glass (during the analysis it should be faced to the light). There are three test-tubes of the same diameter to be inserted in a holder. The tube which is placed in the middle should be empty, then studied solution will be placed there. Both outside test-tubes are sealed. There is the standard solution of hematinum chloride (the equiva-lent of haemoglobin in the concentration of 167 g/l (16.7%)). This is the standard solution.

The middle test-tube should be filled with 0.1 N solution of hydrochloric acid (HCl). The solution must be placed with a pipette up to the label "0". Then with a scarifier prick the skin of a finger and withdraw blood into a pipette for withdrawing blood up to mark (20 ml). Then the pipette should be submerged on the bottom of the test-tube by blowing out the blood so that the upper layer of hydrochloric acid remained intact (unpainted). It must be made quickly in order to avoid blood coagulation. Then this test-tube needs to be shaken by hitting its ending with a finger and by stirring with a stick. Turning of Hb into haematinum chloride occurs slowly, therefore the tube with the studied blood should be placed in the haemometer for 5-10 minutes. After this period, the solution of haematinum should be diluted with distilled water. Water should be added by dropping from the pipette until the colour of the studied solution would be equal to the colour of the standard solutions. Last drops should be added very carefully. Each time, after a water drop is added, fluid in the test-tube should be intermingled with a glass stick. When the colour of haematine chloride becomes equal to the one of a standard solution, note the level which was achieved by the studied solution (for example 12 ml). Then this level should be multiplied by 10 (12*10=120 g per L). This is the studied



amount of haemoglobin per litre.

Haemometer Salhi.

1 – outside tubes with the reference (standard) solution of haematinum chloride; 2 – central tube for measuring the level of haemoglobin of tested blood; 3 – pipette for the blood; 4 – pipette for wa-ter; 5 – glass stirring stick.

For more clear understanding you could see video on Youtube: https://www.youtube.com/watch?v=mWAEIvu1mV8

Laboratory work No. 3.

Measuring the erythrocyte sedimentation rate (ESR) by the Panchenkov's method.

ESR is determined with the help of Panchenkov's device. The device is a support stand, in which thick-walled capillary pipettes with a diameter of 1 mm are set vertically. Capillary pipettes are graduated by millimetres from 0 to 100 and have 3 marks: "B" (Blood) and "0" (set at 100 mm from the lower end) and "R" (Reagent, set at 50 mm). Blood with sodium citrate is taken without bubbles in the pipette to the mark "0".

The lower end of the capillary is sealed by a soft rubber piece (bung) so that the blood does not pour out. After 1 hour, the height of the formed upper transparent plasma layer (in millimetres) is measured. It corresponds to the value of ESR. (ESR changes within 1 hour).

There are also Westergen и Wintrobe methods for measuring ESR (*https://www.medicine.mcgill.ca/physio/vlab/bloodlab/ESR.htm*)

About norms of ESR, it possible to read on:
https://www.practo.com/tests/erythrocyte-sedimentation-rate-westergren-blood/p

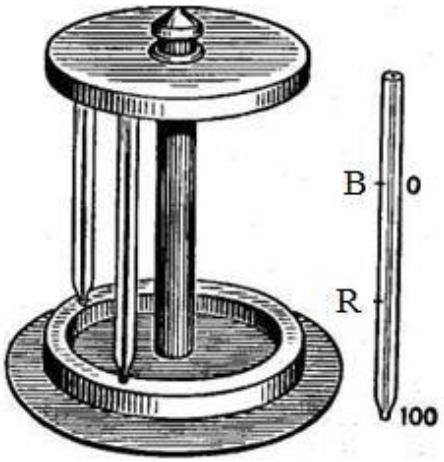


Figure. Panchenkov's device

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.

7. Bibliography: see apendix No. 1.

8. Assessment procedures

Tests

1. The blood plasma contains the folowing types of proteins ...
a) albumins, globulins, fibrinogen.
b) globulins, myoglobin, fibrin.
c) fibrinogen, carbhemoglobin, albumin.
d) myoglobin, oxyhemoglobin, globulins.
e) albumins, methemoglobin, fibrinogen.
2. Oxyhemoglobin is a hemoglobin which contains...
a) oxygen.
b) Carbon dioxide.
c) Carbon monoxide.
d) glucose.
e) water.
3. Biological hemolysis occurs when ...
a) infusion of incompatible blood.
b) the action of acids, alkalis, ether.
c) the effect of heat.
d) decrease in the osmotic pressure of the plasma.
e) the effect of electricity.
4. Substances that prevent blood clotting ...
a) heparin.
b) epinephrine.
c) adrenaline.
d) Calcium.
e) Pepsin.
5. The blood system includes ...
a) hemopoiesis and blood destruction, circulating blood,
apparatus for the regulation of their functions.

b) circulating blood, heart, vessels, apparatus for their regulation functions.
c) organs of hematopoiesis and blood loss, blood vessels, blood.
d) circulating blood, organs of hematopoiesis and blood distribution.
e) circulating blood, blood depot, bone marrow, vessels.
6. The color index of the blood characterizes ...
a) degree of saturation of erythrocytes with hemoglobin.
b) the degree of saturation of erythrocytes with iron.
c) hemoglobin that is contained in blood.
d) the ratio of the erythrocytes to the leukocytes.
e) the ratio of the plasma to the blood cells.
7. Erythropoietins are formed in ...
a) kidney, liver, spleen.
b) heart, spleen, adrenal glands.
c) the spleen, pituitary, muscles.
d) lungs, stomach, intestines.
e) intestines, hypothalamus, bone marrow.
8. The volume of circulating blood in adults ...
a) 6.5-7% of body weight - 4-5 liters.
b) 3-5% of body weight - 1.5-2 liters.
c) 9-10% of body weight - 7-8 liters.
d) 11-12% of body weight - 8-9 liters.
e) 13-15% of body weight - 10-12 liters.
9. Platelets ...
a) secrete retractoenzyme, serotonin, promote the formation of thromboplastin.
b) have blood group determinants, release antibodies, transfer O2.
c) secrete serotonin, participate in allergic reactions, transfer water.
d) promote the formation of thromboplastin, are antagonists of mast cells.
e) secrete serotonin, heparin, prevent blood clotting.
10. Carboxyhemoglobin is a hemoglobin that contains...
a) Carbon monoxide.
b) Carbon dioxide.
c) Oxygen.
d) glucose.
e) water.
11. The percentage distribution of the specific forms of leucocytes is called:
a) color index
b) a hematocrit
c) leukocyte formula
d) nuclear index
e) osmotic resistance
12. The substance possessing the most strong influence on the colloid and osmotic pressure
a) fibrinogen
b) globulins
c) albumins
d) sodium

e) Potassium

Methodical Recommendations 13.

1. Theme: Conditioned reflex activity (classical conditioning), types of conditioned reflexes. The mechanism of the formation of temporary connections. Cortical inhibition.

2. Learning goals: to study the structural basis of the conditioned and unconditioned reflex mechanisms, formation of a temporary neuron connection

3. Learning objectives: using training tables, to study a scheme for the formation of an arc of conditioned reflex.

4. Questions relating to the theme:

1. The structural organization of the cerebral cortex and the relationship of its various divisions with each other.
2. Reflex theory and its principles.
3. The scheme of the reflex arc.
4. The concept of the unconditioned and conditioned reflex.
5. Characteristics of conditioned reflexes.
6. Acquired conditioned reflexes: types, classification, properties.
7. Neurophysiological mechanisms of the formation of temporary connections in the brain.
8. The role of the cortex and subcortical formations in the development of conditioned reflexes.
9. Inhibition of conditioned reflexes: unconditional (external), conditional (internal): mechanisms, physiological significance.
10. Research methods for the Higher Nervous Activity.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of case tasks.

Laboratory work No. 1.

Conditioned defensive (blinking) reflex

In humans, unlike animals, a conditioned reflex can be developed not only on specific phenomena and objects of the surrounding world (the first signal system) but also on the semantic meaning of the word, which indicates this phenomenon or stimulus (the second signal system).

Equipment: the source of the sound stimulus (you can use a cell phone buzzer, a bell, a children toy – a buzzer), a small rubber bulb with a flexible tube. The research is conducted on a human subject.

The content of the work. Offer the subject of the experiment to sit on a chair. Standing on the side of him/her, direct the tube of the rubber bulb into the angle of the subject's eye. Apply a jet of air to the sclera and cornea (the rubber bulb should be squeezed slightly so that the air stream does not cause pain). Note the presence of a blinking reflex. Then apply a sound stimulus; note the presence or absence of an orienting reaction and a blinking reflex.

Having checked the effect of the sound and the air stream separately, proceed to the formation of a conditioned reflex. To do this, make close the sound source to the ear and produce a sound, and then apply a jet of air until a stable conditioned reaction is formed. Combinations of irritants should be repeated 10 - 15 times with an interval of at least 5 seconds.

Suddenly, give a sound to the subject, but without irritation with air. The observed blinking indicates the formation of a conditioned reflex and the normal formation of temporary connections in the cerebral cortex. If there is no blinking (this may indicate an incorrect experiment or some inertness in the CNS activity), repeat the combination a few more times and try the isolated sound action again.

Then loudly pronounce the word "sound". If the second signalling system operates correctly, there is blinking reflex observed.

Drawing of the protocol. 1. Describe the experiment results and make a conclusion. 2. Draw the arch of the conditioned blinking reflex.

Laboratory work No. 2

The formation and disappearing of the conditioned vegetative pupillary reflex for bell in humans

*Equipment***:** a bell, dark dense sheet of paper.

The content of the work. All students of the group take part in the work at the same time. One half of the students are the subjects of the experiment (tested students), the second one is the experimenters. The experimenters check the lack of the pupil dilatation in the light when the bell is switched on. Then they begin to develop a conditioned vegetative pupillary reflex to the bell. When the bell is turned on, the tested students close their eye with a dense dark sheet of paper. When the bell is turned off, the subjects open their eye. The experimenters observe a gradual narrowing of the pupil in the tested person in the light. If the call is provided 10 times in combination with a coveringwith paper of the eye, then for the 11th time only the call without covering the eye causes dilatation of the pupil, which is the conditioned reflex. For disappearing the conditioned vegetative pupillary reflex, the following calls are not associated with an unconditional stimulus (covering the eye). In different subjects, the conditioned vegetative pupillary reflex to the bell fades through a different number of isolated actions of the conditioned stimulus. The rate of fading the conditioned reflex is determined by the strength of the internal inhibition.

Recommendations for the drawing of work: The results should be described in the table.

Serial Number of the irritation	Irritator – Call of the Bell	Unconditioned irritator	Unconditioned Reaction	Conditioned Reaction
1	+	-		
2	+	+		
.				
.				
.				
10	+	+		
11	+	+		
12	+	-		
13	+	-		
14	+	-		
15	+	-		

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.

7. Bibliography: see apendix No. 1.

8. Assessment procedures

MCQ Tasks

1. Types of the higher nervous system which are inherent only to humans ... .
a) thinking, artistic, miscelaneus
b) unrestrained, calm, weak
c) artistic, weak, calm
d) calm, sanguine, choleric
e) thinking, strong, mixed
2. The Wernicke Center, which provides the perception of speech, is localized in ... .
a) temporal part of the cortex

b) the third frontal gyrus of the cortex
c) anterior central gyrus of the cortex
d) occipital cortex
e) motor nuclei of the cranial nerves
3. Instincts are ... .
a) complex unconditioned reflexes
b) simple conditioned reflexes
c) conditioned reflexes of the first order
d) well-based conditioned reflexes
e) trace conditioned reflexes
4. Cortical inhibition is examined with the help of ... .
a) Anfimov's tables
b) nomograms
c) Rubkin's tables
d) Golovin chart
f) Sivtsev charyt
5. The Broca's area, which provides motor programming of speech, is localized in ... .
a) the third frontal gyrus of the cortex
b) anterior central gyrus of the cortex
c) motor nuclei of the cranial nerves
d) occipital cortex
e) temporal part of the cortex
6. The first signaling system is the system of ... .
a) unconditioned and conditioned reflexes
b) conditioned reflexes
c) unconditioned reflexes
d) abstract thinking
e) verbal communication
7. The second signaling system is the system of ... .
a) verbal communication
b) instincts
c) conditioned reflexes
d) unconditioned reflexes
e) analyzers
8. Vascular conditioned reflexes are studied by the method of ... .
a) plethysmography
b) oscillography
c) rheography
d) sphygmography
e) phlebography
9. By biological significance, conditioned reflexes are divided into ... .
a) food, defense, sexual
b) simple, complex, sexual
c) artificial, natural, food
d) chain, complex, defensive
e) visceral, orienting, exteroceptive
10. The higher nervous activity includes the function of ... .

a) cortex of the cerebral hemispheres
b) the spinal cord
c) the reticular formation
d) limbic system
e) thalamus and hypothalamus
11. The manifestation of the higher nervous activity are ... .
a) emotions, attention, memory
b) chronaxie, memory, adaptation
c) memory, fatigue, irradiation
d) lability, emotions, dominance
e) accommodation, lability, emotions
12. The manifestation of the higher nervous activity are ... .
a) chronaxie, memory, adaptation
b) memory, fatigue, irradiation
c) lability, emotions, dominance
d) accommodation, lability, emotions
e) speech, thinking, consciousness
13. The manifestation of the higher nervous activity are ... .
a) chronaxie, memory, adaptation
b) memory, fatigue, irradiation
c) sensation, perception
d) lability, emotions, dominance
e) accommodation, lability, emotions
14. When bell is calling to a lesson, pupils run to a class - this is:
a) conditioned reflex.
b) second signaling system.
c) unconditioned reflex.
d) a sum of knowledge, skills and abilities.
e) reflex arc.
15. What kind of inhibition is due to the appearance of the phenomenon of the simultaneous negative contrast of processes in the cerebral cortex:
a) differentiation
b) induction
c) lagging
d) the conditioned brake
e) extinction
16. The principle of the Pavlov's reflex theory explaining the cause of any phenomenon is:
a) analysis
b) structure
c) synthesis
d) determinism
e) convergence
17. When recording the EEG, the subject had a carotid spindle and vertex potentials. In what phase of sleep was the subject?
a) 1
b) 3
c) 2

d) 4
e) a nap
18. In a person who had a stroke, the posterior third of the upper temporal gyrus of the left hemisphere was damaged. In this case, most often, the expected result is:
a) violation of the reproduction of oral speech
b) violation of the understanding of oral speech
c) violation of the account
d) violation of the written language
e) violation of the understanding of written language
19. In a person due to damage of a brain area, there was a tactile agnosia. What part of the cerebral cortex is damaged:
a) upper parietal
b) occipital
c) upper frontal
d) left temporal
e) right temporal
20. The manifestation of the synthetic activity of the brain cortex is:
a) irradiation of excitation processes in the cortex
b) strengthening the tone of the extensor musculature during decerebration
c) maneuvers with removal of half of the cerebellum
d) the activating effect of the reticular formation
e) the formation of a temporary connection during formation of a conditioned reflex
21. The involvement of the cerebral cortex is necessary for the formation of ... .
a) instinct
b) conditioned reflex
c) tendon reflex
d) statokinetic reflex
e) food unconditioned reflex
22. Unlike the unconditioned refex for the conditioned one, it is intrinsic...
a) species nature
b) strength of nerve connections
c) individual nature
d) complexity of the organization of the reflex arc
e) connection closure mainly in subcortical centers
23. During the formation of a reflex in animals, it was used several conditioned stimuli in a strict sequence with reinforcement by a single unconditioned stimulus. What reflex was developed?
a) II order
b) integrated
c) summarized
d) generalized
e) differentiated
24. In animals with conditioned reflex, after the conditioned stimulus has been repeatedly provided, the unconditioned stimulus is ceased to be used. What would happen?
a) fading inhibition
b) summation of conditioned reflexes
c) consolidation of the conditioned reflex
d) development of a dynamic stereotype

e) development of a differentiated conditioned reflex
25. On the electroencephalogram, the β-rhythm was recorded. What does it mean?
a) pathological processes
b) mental work
c) deep anesthesia
d) resting state
e) state of sleep
26. When a stranger appears, the guard dog stops eating. What kind of inhibition causes this?
a) differentiation
b) a conditional brake
c) lagging
d) reciprocal
e) external
27. The EEG method allows:
a) record the total activity of neurons in the brain
b) conduct only stimulation of the deep structures of the brain
c) record the electrical activity of a single neuron
d) visual observation of the brain structures
e) detect the potentials of a specific area of the brain with stimulation of receptors
28. Monkey had different reactions on the sound of the beeping in different rooms regardless the time of visit. It was caused by:
a) unconditional reflex reaction to the type of experimenter
b) unconditional reflex reaction to the situation of rooms
c) conditioned reflex reaction to the type of experimenter
d) conditional-reflex reaction to the situation in the room
e) unconditional reflex response to the time of visiting rooms
29. In the case when an animal has no cortex of the hemispheres, does the conditioned reflex manifest?
a) the conditioned reflex will persist
b) the conditioned reflex disappears
c) the conditioned reflex will be weakened
d) will recover after a while
e) the conditioned reflex response will decrease
30. In the experiment on the basis of a positive conditioned reflex, an irritation is introduced that is close by parameters to the conditioned reflex, but is not reinforced. What type of inhibition is produced:
a) fading
b) lagging
c) differentiation
d) protective
e) beyond
31. You were brought to decipher the EEG. Looking at it, you found a delta rhythm in all leads. First of all you would be interested in:
a) have the patient seizures
b) what was the level of physical activity during registration
c) what mental task was presented to the patient during registration

d) whether the EEG was recorded after a meal
e) whether the EEG was recorded during sleep

Methodical Recommendations 14

1. Theme: General characteristics of analyzers.

2. Learning goals: to study structural and functional features of analyzers.

3. Learning objectives:

- To study photochemical processes in the retina;
- To define visual acuity by Sivtsev's table;
- To define field of view by means of Forster's perimeter.

4. Questions relating to the theme:

1. The I.P. Pavlov's doctrine about the analyzers
2. Notion of sensory systems
3. Classification of analyzers
4. General principles of the structure and function of analyzers
5. What is the structure and function of the outer layer of the eye?
6. What is the structure and functions of the middle layer of the eye?
7. Pupil and regulation of its sizes. M-cholino- and a-adrenergic receptors of muscles, which narrow and dilate the pupil. Pupillary reflex.
8. What are the adaptations of the eye?
9. Characteristics of the light refracting matters of the eye.
10. What is the refraction of the eye and what are its anomalies?
11. What is a visual acuity?
12. What is the field of view?
13. The accommodation of the eye and its mechanism.
14. Classification of skin receptors
15. Physiologic properties of receptors
16. Conductive pathways of the skin analyzer (tactile, painful, temperature) of the analyzer.
17. Cortical representations of the skin analyzer.
18. Nociception.

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of case tasks.

Laboratory work No. 1

Testing of visual acuity

Equipment: Sivtsev's tables for determining visual acuity, pointer, meter. The object of the research is a person.

Work content. During determining visual acuity, use a special table with a series of letters (Sivtsev or Snellen charts) or torn rings (Golovin chart), the sizes of which gradually decrease from top to bottom. On the left side of each row of the table, the maximal distance in meters or feet (D) is indicated, from which each element of a letter or other image should be visible at normal visual acuity. On the right side, the visual acuity (V) is indicated, which is calculated by the formula V = d / D, where (d is the distance from which the tested person reads the given line). The table should be fixed on a evenly illuminated wall. A tested person should be placed from the chart at a distance of 5 m (for Sivtsev chart) or 20 feet (6m) (for Snellen chart); one eye should be closed with a special opaque flap. The experimenter should stay near the table so that he does not obscure it. Then experimenter with white pointer shows the letters gradually passing from large to small. The last

line that a tested person calls correctly or with some errors (no more than 20%) serves as an indicator of visual acuity for a studied eye. For example, if the subject sees the 5th line at a distance of 5 m (d), but should see it from a distance of 12.5 m (D), then the visual acuity of the eye is V=5/12,5 = 0,4. By the same way the visual acuity is determined for other eye.

Normal visual acuity is equal to 1.0.

In practice of western doctors, the Snellen chart is also used. The principle remains the same. But the distance from which studied person read letters is increased by 1 meter (6 instead 5). Visual acuity is determined by the same ratio (d/D) indicated on the right edge of the chart (in feet).

Proportions between meters and feet would be helpful if you are used to work with meters (Snellen chart contains figures expressed by feet): 200 feet = 60 m, 100 feet= 36 m, 70 feet=24 m, 50 feet=18 m, 40 feet=12 m, 30 feet= 9 m, 25 feet = 6 m, 20 feet = 5m.

Drawing the protocol. 1. Record the results of determining the visual acuity for each eye. 2. Conclude with the results assessment.

Laboratory work No. 2

Measuring of the field of view.

*Work content***.** The field of view is an angle at which person perceive environment; it is measured using the Forster perimeter. The perimeter consists of a semicircle divided into degrees. The semi-circle is able to rotate around its axis. In front of the middle of the semicircle, there is a special sup-port for chin, it can move up and down. On the inside of the semicircle, there is a well-sliding frame into which the desired color of a mark is inserted. Put the perimeter against the light, set horizontal-ly the semicircle and insert a white mark in its frame. The subject (patient) should be placed back to the light; when examining the field of vision of the right eye, place the chin in the left recess of the support so that the edge of the sight plate lies to the lower edge of the orbit; fix with the right eye a white circle located in the center of the semicircle, and close the left eye with the palm of hand. The experimenter slowly moves the white mark from outside to the center and asks the subject, wether he sees the white mark or not. With a positive response, mark (for control) is returned back and re- peat the question. Having repeated results, note this point on the corresponding meridian drawn on paper. Then, measure the field of view from the other side of the arc. After this, turn the arc of the perimeter by 90 ° and similarly determine the field of view from above and below, as well as in oblique directions. Replace the white mark with a colorful, identify the fields of vision for green and red. The subject must accurately name the color of the mark, but not just the direction of its movement. Then make similar measurements for the left eye (chin at the same time put in the right side of the support recess). The obtained diagramm can be compared with the diagramm in the atlas of normal physiology.

The boundaries of the colorless (achromatic, i.e. for white mark) field of view are: outside - about 100, inside and up - 60 and down - 65 degrees. The color (chromatic) field of view is less than achromatic and differs for different colors: the narrowest is for green color.

Drawing the protocol: 1. The results of the investigation should be applied to the coordinate axis, marking them with dots; connect them by lines. 2. Compare the field of view for white, green and red colors. Explain the reason for the difference between them.

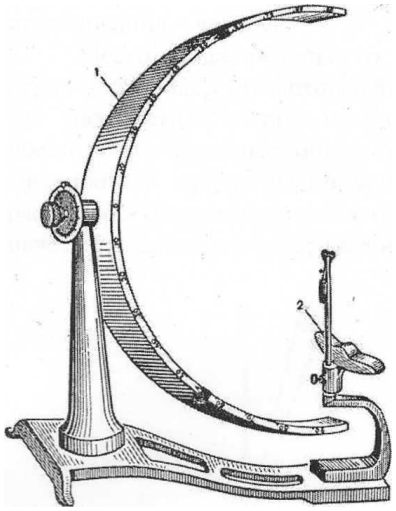


Fig. 1. Forster's Perimeter
1 — metallic graded semicircle; 2 — vertical axis with a support for chin and sight plate.

Laboratory work No. 3
Measuring of the spatial thresholds of cutaneous (tactile) sensitivity (estesiometry).
The studied person (subject) sits on a chair with closed eyes. The experimenter with an estesiometer (Fig. Weber's compass) with the maximal folded legs touches a certain area of the skin. It is ensured that both legs of the esteriometer are placed simultaneously and at the same pressure. Repeat the touches gradually moving apart the brushes of the esthesiometer (each time increase the distance by 1 mm) until the minimal distance at which there is a feeling of two separate touches is found. Determine the spatial thresholds on the skin of the shoulder, forearm, back and palmar surfaces of the hand, fingertips.
The results are tabulated and concluded.

Studied area	Spatial threshold of sensitivity, mm
The back surface of the hand	31
Shoulder	67,6
Forearm	40,5
The palm surface of the fingers	2,2
Mid-palm	8,9

The greatest sensitivity is observed in the area of the palmar skin surface of the hand.
6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.
7. Bibliography: see apendix No. 1.
8. Assessment procedures
MCQ Tasks
1. The … possess(es) maximal visual acuity.
a) yellow spot
b) blind spot

c) the periphery of the retina
d) cornea
e) the optic nerve
2. To determine visual acuity, … is (are) used.
a) Sivtsev-Golovin tables
b) Forster's perimeter
c) Anfimov's tables
d) ophthalmoscope
e) Rabkin's tables
3 A blind spot is a place of the most densely locations of…
a) axons of ganglion cells forming the optic nerve.
b) cone cells.
c) rod cells.
d) pigment cells.
e) bipolar cells.
4. To correct the refraction of the eye in astigmatism, the folowing glasses are needed ...
a) cylindrical.
b) biconcave.
c) biconvex.
d) horizontal.
e) square.
5 To determine the fields of view, the folowing instrument is used ...
a) perimeter.
b) audiometer.
c) an esthetician.
d) Weber's compasses.
e) an ophthalmoscope.
6. Visual acuity is the ability of the eye to see ...
a) two neighboring points separately.
b) at close range.
c) at a distant distance.
d) with a fixed gaze.
e) in the dark.
7. The sensitivity of photoreceptors in the dark ...
a) increases
b) does not change.
c) disappears.
d) decreases.
e) changes by phases.
8. The central part of the analyzer is represented by the...
a) cortical centers.
b) thalamic nuclei.
c) middle brain.
d) cerebellum.
e) limbic structures.
9. The sensitivity of photoreceptors in bright light ...
a) decreases.

b) doen not change.
c) disappears.
d) increases.
e) changes by phases.
10. Under the impact of light in the retina, photochemical processes occur resulting in Rhodopsin of rod cells are broken down to...
a) retinal and opsin.
b) iodopsin and retinal.
c) erythrolab and vitamin A.
d) chlorolab and opsin.
e) vitamin A and iodopsin.
11. To correct refraction in myopia, the following glasses are needed…
a) biconcave
b) biconvex
c) horizontally concave
d) cylindrical
e) vertically concave
12. Painful skin irritations are perceived by…
a) Golgi tendon organ.
b) end-bulbs of Krause.
c) Meissner's corpuscles.
d) taste buds.
e) free axons.
13. The least tactile sensitivity is possessed by…
a) the finger pads
b) the tip of the nose
c) the tip of the tongue
d) the back surface of the hand skin, the skin of the leg and the back
e) the lips
14. To identify the various signals acting on the sensory organ, information is coded. What characteristics of signals are used for coding?
a) Frequency and number of receptor potentials
b) Amplitude of the receptor potential
c) Duration of action potentials
d) Amplitude and duration of the generator potential
e) Amplitude and duration of the receptor potential
15. Two persons suffer from farsightedness and wear glasses. What question (the same) you need to ask them to make sure that the reason for their farsightedness is the same for them?
a) What kind of lens do you use for vision correction?
b) Which items you see more clearly: located near, or at a long distance from the eyes?
c) At what age did you begin to wear glasses?
d) Is there a hereditary predisposition to farsightedness?
e) Has there been an eye injury in the childhood?
16. Which site on the retina is the place of the best vision and why?
a) Yellow spot, since there is a convergence of information during the transmission of signals in the retina
b) Blind spot, since there the largest aggregation of photoreceptors

c) The peripheral part of the retina, since there are mainly rods localized
d) Yellow spot, since there is no convergence of information during the transmission of signals in the retina
e) The central part of the retina, since there are rods located mainly
17. If the hand is kept in water at a temperature of 27 ° C, then at the first moment, when it transfers to the water 25 ° C, it seems cold. How is called is observed phenomenon?
a) Accommodation
b) Temperature contrast
c) True estimate of absolute temperature
d) Hypersensitivity
e) Refraction
18. In the patient, a lack of perception of red color was identified. What kind of disorder is it?
a) protanopia
b) deuteranopia
c) tritanopia
d) achromatization
e) night blindness
19. The studied person raises a cargo weighing 3 kg. What is the minimum weight gain is required, so that the person can feel it change?
a) 10 g
b) 30 grams
c) 50 grams
d) 100 g
e) 300 g
20. In a patient, violations of the distance estimation and a clear vision of the landscape were found. What the disorder could explain this?
a) binocular vision
b) light adaptation
c) eye accommodation
d) visual acuity
e) spherical aberration
21. Thermal skin receptors are characterized by:
a) mechanical irritation
b) a high rate of excitation and a superficial location
c) the highest density on the back
d) low speed of excitation and deeper locations in the skin
e) no ability to adapt
22. If the visual pathways are cut till the cross of the optic nerve from the left side, then…
a) the medial field of vision of the right eye and the lateral field
of the left eye disapear
b) the medial field of vision of the left eye and the lateral field
of the right eye disapear
c) there could be complete blindness to the left eye
d) there could be complete blindness to the right eye
e) there could be complete blindness to both eyes

23. In the experiment, it was established that a person holding a 100 g load on his palm feels a gain in weight only if the weight of the load is increased by 3 grams or more. If the mass of the initial cargo is 300 g, then a noticeable increase in the load will be
a) 3 g
b) 6 g
c) 9 g
d) 15 g
e) 30g
24. The patient has a loss of pain and temperature sensitivity on the right side of the trunk and paralysis on the left. The lesion is present in the following section of the cutaneous analyzer…
a) peripheral
b) cortical
c) left neural pathways
d) right neural pathways
e) peripheral and cortical
25. To assess the degree of functional damage to the occipital lobe of the cerebral cortex, the folowing method should be applied:
a) audiometry
b) perimetry
c) evaluation of speech functions
d) EEG
e) psychological tests

Methodical Recommendations No. 15

1. Theme: Physiology of autonomic nervous system. Vegetative synapses, receptors, and blockers.

2. Learning goals: To study physiology of sympathetic, parasympathetic, and metasympathetic divisions of the vegetative (autonomic, involuntary) nervous system (VNS), to possess a clear notion on receptors, inhibitors, and blockers in vegetative synapses.

3. Learning objectives:

***** to draw a structure of a reflex arc of the VNS;

* to find on the schemes central part, preganglionic fibers, ganglion, and postganglionic fibers of sympathetic and parasympathetic divisions of the VNS.

4. Questions relating to the theme:

1. Physiology of autonomic nervous system.
2. Scheme of a vegetative reflex arc.
3. Notion on central and peripheral parts of sympathetic division of the VNS.
4. Notion on central and peripheral parts of parasympathetic division of the VNS.
5. Notion on metasympathetic division of the VNS.
6. Integrity of vegetative and somatic nervous system.
7. Meaning of the VNS.
8. Dependence between an effect of irritation of vegetative nerves and state of a innervated organ (effector).

5. Methods of teaching and learning: discussion of the main issues of the topic, the implementation of practical work, the implementation of MCQ tasks, the solution of case tasks.

Laboratory work No. 1

Oculocardiac reflex (Dagnini-Aschner reflex)

The work is performed on a human.

Initially, it is necessary to calculate pulse of a subject. After, index finger and thumb of one hand put on the closed eyeballs of a subject. Then soft and smoothly press on the eyeballs for 10- 30 seconds. Another hand must count the pulse rate. After 10-30 seconds from the beginning of pressure heart rate might decrease by 8-10 beats per minute. Pulse is recommended to calculate during 30 seconds 3-4 times. Calculation should be continued after pressure ceases.

Results and conclusion. Oculocardiac reflex might be positive (when pulse rate slows down); negative (pressures on the eyeballs don't cause any changes of the cardiac activity); inverse(when pulse rate get more frequent, by 15-20 per minute)

The reflex is caused by the connections of the trigeminal nerve and vagus nerve of the parasympathetic nervous system. Results obtained during the vegetative oculocardiac reflex indicate influence of parasympathetic part of vegetative nervous system on cardiovascular system.

Laboratory work No. 2

Symptom of respiratory arrhythmia (Hering reflex)

The work is performed on a human.

Work content. To calculate pulse of a subject. Then offer him to make a series of deep and strengthened respiratory movements (up to a sense of discomfort). During the whole time of observation, count the pulse, comparing it with the initial one.

Result and conclusion

This reflex is caused by irritation of stretch receptors of airways smooth muscles during large inspiration. This irritation stimulates the vagus which inhibit cardiac activity. In most people, this test results in the pulse rate being somewhat decreased. In vegetative disorders, the reflex can be sharply increased. Results obtained during the Hering reflex indicate influence of parasympathet-ic part of vegetative nervous system on cardiovascular system.

6. Evaluation methods: verbal questioning, evaluating the implementation of practical work, evaluating the implementation of MCQ tasks, evaluating the solution of case tasks.

7. Bibliography: see apendix No. 1.

8. Assessment procedures

MCQ Tasks

1. The sympathetic nervous system causes ....
a) increase in heart rate and strength of beats
b) increase secretory and motor function of the stomach
c) reduction in heart rate and strength of beats
d) widening of the tongue vessels, and salivary glands
e) pupil narrowing
2. The centers of the sympathetic nervous system are located in ....
a) thoraco-lumbar segments of the spinal cord
b) medulla oblongata
c) caudal segments of the spinal cord
d) the pons and the cerebellum
e) mesencephlon
3. With an increase in influence of the parasympathetic division of the nervous system, the size of the pupil ....
a) decreases
b) increases
c) increases, then decreases
d) does not change

e) decreases, then increases
4. With an increase in influence of the sympathetic nervous system, the size of the pupil
a) increases
b) decreases
c) narrows, then widens
d) does not change
e) expands, then narrows
5. Narrowing of the vessels are caused by an irritation ... of the nerve fibers.
a) sympathetic and adrenergic
b) sympathetic and cholinergic
c) parasympathetic and cholinergic
d) parasympathetic and serotonergic
e) somatic and cholinergic
6. When the peripheral end of the vagus nerve is irritated
a) cardiac activity slows, blood pressure increases
b) cardiac activity increases, blood pressure decreases
c) cardiac activity slows, blood pressure decreases
d) cardiac activity increases, blood pressure increases
e) cardiac function and blood pressure do not change
7. Local widening of the skin vessels in response to mustard plasters is provided by
a) Bainbridge reflex
b) axon reflex
c) aortic reflex
d) the Zion-Ludwig reflex
e) Parin reflex
8. With irritation of parasympathetic nerve fibers secretion of saliva…
a) increases
b) decreases
c) does not change
d) increases, then decreases
e) decreases, then increases
9. Widening of internal organs vessels...
a) is active with an increase in influence of sympathetic nerves
b) is active when influence of parasympathetic nerves is increased
c) passively with a decrease of the influence of the sympathetic nerves
d) passively with a decrease in the influence of parasympathetic nerves
e) is active in increasing the influence of somatic nerves
10. Reflex self-regulation of respiration (Gering-Breyer reflex) impulses coming from ....
a) mechanoreceptors of alveoli, proprioceptors
b) Vessel mechanoreceptors and proprioceptors
c) receptors of nasal mucosa and skeletal muscular proprioceptors
d) chemoreceptors of the medulla oblongata and interoceptors of internal organs
f) proprioceptors of skeletal musculature and vestibular receptors

Appendix 1

Bibliography: main and supplementary

In Russian:

main:

1. Косицкий Г.И.Физиология 1-2-3 том.- Эверо, 2014.
2. Нұрмұхамбетұлы, Ә. Орысша- қазақша медициналық (физиологиялық) сөздік = Русско-казахский медицинский - Алматы : Эверо, 2014.
3. Физиология человека: учебник / Л. З. Тель [и др.]. - Рек. Респ. центром инновационных технологий мед.образования и науки М-ва здравоохранения РК. - Алматы : Эверо, 2012. - 600 с.

supplementary:

1. Физиология человека: учебник / под ред. В. М. Покровского, Г. Ф. Коротько. - 2-е изд., перераб. и доп ; Рек. Департаментом образовательных мед.учр. и кадровой политики М-ва здравоохранения РФ. - М. : Медицина,2007. - 656 с.
2. Миндубаева, Ф. А. Руководство к практическим занятиям по физиологии: учеб.-методическое пособие / Ф. А. Миндубаева, А. М. Евневич, Т. И. Крекешева. - Алматы : Эверо, 2012. - 194 с.
3. Ситуационные задачи по курсу нормальной физиологии: учебно-методическое пособие / В. К. Касымбеков [и др.]. - Алматы : Эверо, 2016. - 144 с.
4. Нормальная физиология: Практикум : учеб. пособие / под ред. К. В. Судакова. - М. : МИА, 2008.

In Kazakh:

main:

1. Бабский Е.Б., Бабская Н.Е. Адам физиологиясы: Оқулық 1-2-3 том.-Эверо, 2015.
2. Қалыпты физиология: оқулық / РФ БҒМ ; ред. басқ. К. В. Судаков; қаз. тіліне ауд. және жауапты ред. Ф. А. Миндубаева. - ; И. М. Сеченов атындағы Бірінші ММУ ұсынған. - М. : ГЭОТАР - Медиа, 2015. - 864 бет. + эл. опт. диск

supplementary:

1. Қасымбеков, В. Қ. Қалыпты физиология бойынша ахуалдық есептер жиынтығы: оқу-әдістемелік құрал / В. Қ. Қасымбеков, Р. Е. Нұргалиева, А. Т. Қалдыбаева. - Алматы : Эверо, 2016. - 152 бет. с.
2. Қасымбеков, В. Қ. Физиологиялық зерттеу әдістері: оқу- әдістемелік құрал / В. Қ. Қасымбеков, Ф. К. Балмағанбетова, А. Т. Қалдыбаева. - Алматы : Эверо, 2016. - 176 бет. с.
3. Сәтбаева, Х. Қ. Адам физиологиясы: оқулық / Х. Қ. Сәтбаева, А. А. Өтепбергенов, Ж. Б. Нілдібаева. - 2-ші бас. түзетілген және толықтырылған. - Алматы : Эверо, 2010. - 664 бет. с.
4. Сайдахметова, А. С. Физиологиядан тәжірибелік сабақтарға нұсқаулар: оқу құралы / А. С. Сайдахметова, С. О. Рахыжанова. - Караганды : АҚНҰР, 2016. - 260 бет. с.
5. Қалыпты физиология: оқулық / РФ БҒМ ; ред. басқ. К. В. Судаков; қаз. тіліне ауд. және жауапты ред. Ф. А. Миндубаева. - ; И. М. Сеченов атындағы Бірінші ММУ ұсынған. - М. : ГЭОТАР - Медиа, 2015. - 864 бет. + эл. опт. диск
6. Нұрмұхамбетұлы, Ә. Орысша- қазақша медициналық (физиологиялық) сөздік = Русско-казахский медицинский (физиологический) словарь : словарь / Ә. Нұрмұхамбетұлы. - Алматы : Эверо, 2014. - 903 с.

6. Миндубаева, Ф. А. Физиология пәнінен практикалық сабақтарға арналған нұсқау: оқу-әдістемелік құрал / Ф. А. Миндубаева, А. Х. Абушахманова, А. Х. Шандаулов. - Алматы : Эверо, 2012. - 186 бет. с.

In English:

main:

1. Hall, John E. Guyton and Hall textbook of medical physiology: textbook / John E. Hall. - 13th ed. - Philadelphia : Elsevier, 2016. - 1145 p.
2. Babsky, Y. B. Human physiology. Volum 1.: textbook / Y. B. Babsky, Y. B. Babsky. - Almaty : "Evero" , 2017. - 308 p
3. Babsky, Y. B. Human physiology. Volum 2.: textbook / Y. B. Babsky, U. B. Babsky. - Almaty : "Evero" , 2017. - 296 p.
4. Babsky, Y. B. Human physiology. Volum 1.: textbook / Y. B. Babsky, Y. B. Babsky. - Almaty : "Evero" , 2017. - 308 p
5. Hall, John E. Guyton and Hall textbook of medical physiology: textbook / John E. Hall. - 13th ed. - Philadelphia : Elsevier, 2016. - 1145 p.
6. TannerThies, Roger Physiology- An IIIustrated Review: textbook / Roger TannerThies. - New York : Stuttgart, 2013. - 329 p

supplementary:

1. Smagulov , N. K.: textbook / N. K. Smagulov , N. M. Kharissova ; Ministry of public health of Republic of Kasakhstan; Karaganda state medical universitety. - Almaty : LLP "Evero", 2013.

Electronic resourses:

1. Нормальная физиология [Электронный ресурс] : учебник / под ред. Б. И. Ткаченко. - 3-е изд., испр. и доп. - Электрон.текстовые дан. (53,1Мб). - М. : ГЭОТАР - Медиа, 2017. - эл. опт.диск
2. Адам физиологиясы. Динамикалық сызбалар атласы [Электронный ресурс] : оқулық / К. В. Судаков [ж.б.] ; қазақ тіл. ауд. М. Қ. Қанқожа. - Электрон.текстовые дан. (105Мб). - М. : ГЭОТАР - Медиа, 2017. - 464б. с.
3. Қалыпты физиология [Электронный ресурс] : оқулық / қаз.тіл. ауд. Ф. А. Миндубаева ; ред. К. В. Судаков. - Электрон.текстовые дан. (1,42Мб). - М. : ГЭОТАР - Медиа, 2015. - 864 бет.эл. опт. диск
4. Камкин, А. Г. Атлас по физиологии. В 2 т. Т. 1 [Электронный ресурс] : учеб.пособие / А. Г. Камкин, И. С. Киселева. - Электрон.текстовые дан. (58,4 Мб). - М. : ГЭОТАР - Медиа, 2010. - 408 с. эл. опт.диск
5. Камкин, А. Г. Атлас по физиологии. В 2 т. Т. 2 [Электронный ресурс] : учеб.пособие / А. Г. Камкин, И. С. Киселева. - Электрон.текстовые дан. (58,7 Мб). - М. : ГЭОТАР - Медиа, 2012. - 448 с.
6. Физиология пәнінен электронды оқу құралы [Электронный ресурс] : медициналық колледждерге арналған оқу құралы / ҚР денсаулық сақтау министрлігі; Техникалық және кәсіптік білім; Медициналық мамандықтарға арналған. - Электрон. текстовые дан. (22,3 Мб). - Түркістан : ОҚО, 2012. - эл. опт. диск

Electronic Databases

No.	Name	URL
1	Electronic library	http://lib.ukma.kz

2	Electronic catalog - for internal users - for external users	 http://10.10.202.52 http://89.218.155.74
3	Republican interuniversity electronic library	http://rmebrk.kz/
4	'Student Advisor' Electronic Library of Medical University	http://www.studmedlib.ru
5	'Paragraph' information system 'Medicine' section	https://online.zakon.kz/Medicine
6	'Legal' electronic source of legal information	https://zan.kz
7	Scientific Electronic Library	https://elibrary.ru/
8	'BooksMed' Electronic Library	http://www.booksmed.com
9	'Web of science' (Thomson Reuters)	http://apps.webofknowledge.com
10	'Science Direct' (Elsevier)	https://www.sciencedirect.com
11	'Scopus' (Elsevier)	www.scopus.com
12	PubMed	https://www.ncbi.nlm.nih.gov/pubmed