

MINISTRY OF HEALTH OF UKRAINE
ZAPORIZHZHIA STATE MEDICAL AND PHARMACEUTICAL
UNIVERSITY

Department of Pathological Physiology with a Course of Normal Physiology

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GENERAL PHYSIOLOGY (PART I)

WORKSHOP FOR THE STUDENTS OF THE 2nd COURSE

field of study 22 «Health Care» specialty 222 «General Medicine»

educational qualification «Master of Medicine»

professional qualification «Physician»

Zaporizhzhia

2023

UDC 612(075.8)

T 99

*Recommended for publication by Central methodical Council
of Zaporizhzhia State Medical and Pharmaceutical University as a study guide
(Protocol № of 2023)*

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T99 **Tykhonovska M. A.**

General Physiology (Part 1) : workshop for the students of the 2nd course field of study 22 «Health Care» specialty 222 «General Medicine» educational qualification «Master of Medicine» professional qualification «Physician» / M. A. Tykhonovska, A. V. Krashevskiy, O. V. Khorolets ; ed. O. V. Hancheva. – Zaporizhzhia: [ZSMPhU], 2023. – 123 p.

UDC 612(075.8)

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Preface

The workshop was compiled in accordance with the standard program in physiology for higher medical educational institutions of Ukraine III and IV levels of accreditation for the specialty "Medicine" 7.12010001, approved by the Ministry of Health of Ukraine in 2015 ., which is drawn up in accordance with the following regulatory documents: the curriculum developed on the principles of the European Credit Transfer System (ECTS) and approved by the order of the Ministry of Health of Ukraine dated 10.19.2009 No. 749 and changes to the curriculum approved by the Ministry of Health of Ukraine (letter No. 08.01- 47/8986 dated 24.03.2015), the instruction on the evaluation of students' educational activities in the context of the implementation of the European credit transfer system for the organization of the educational process, approved by the Ministry of Health of Ukraine on 15.04.2014.

The workshop is built on the basic topics and topics of classes that are included in part #1, in accordance with the requirements of the "Recommendations regarding the development of programs of educational disciplines" (order of the Ministry of Health of Ukraine dated October 12, 2004, No. 492) and is focused on studying the course of normal physiology during III (autumn) of the semester of the 2nd year of study (Part No. 1 when studying the discipline "Physiology").

The workshop is intended for use during practical classes by students of medical universities studying the specialty "Medicine",

Physiology is the most important subject in basic medical education. Human physiology is the study of the mechanical, physical, and biochemical processes that support the body's function. The subject matter of physiology is the foundation of the practice of medicine, and a firm grasp of its principles is essential for the physician. Physiology studies the species and individual development of functions and their alteration and adaptation to the continuously changing conditions of their environment.

The purpose of training the discipline "Physiology" is:

- Learn to draw conclusions about the state of physiological functions of organs, systems and the body as a whole.
- Analyze physiological parameters and draw conclusions about the mechanisms of nervous and humoral regulation of the physiological functions of the body and its systems.
- Analyze the state of human health under various conditions based on physiological criteria.
- Interpret the mechanisms and regularities of the functioning of excitatory structures of the body.
- To analyze the state of sensory processes in ensuring human vital activity.
- Explain the physiological basis of the methods of researching body functions.
- Explain the mechanisms that ensure the integration activity of the organism.
- Analyze the age-related features of body functions and their regulation.

This Manual is based on many years of experience in teaching physiology at the Zaporizhzhia State Medical University, as well as methodological materials for studying the subject in the system of higher medical education. The discipline program is structured into sections (logically completed parts of the curriculum), which include thematic sections represented by topics of practical classes.

Wishing you success in Physiology studying and hope that this knowledge will be useful to you in your future professional activities!

Maryna Anatoliivna Tykhonovska,
Associate Professor of Pathophysiology
with Course of Normal Physiology Department

-LECTURE PLAN (PART 1, 3th semester)

3th semester - 165 hours: lectures – 32, pr.classes – 51, independent work - 82

#	Topic names	Hours
1.	General physiology of the excitable tissues.	2
2.	The conduction of a nerve impulse. The structure of nerve fibres.	2
3.	Neuromuscular synapses. The mechanism of impulse transfer from nerve to skeletal muscle. Physiology of the muscles.	2
4.	Nerve centers. Synaptic and Junctional transmission. Central inhibition.	2
5.	Motor function of the central nerve system. Proprioceptors.	2
6.	Motor function cerebral cortex.	2
7.	Nervous regulation of vegetative function.	2
8.	Internal secretion. Basic concepts. Pituitary hormones and their control by the hypothalamus.	2
9.	Internal secretion. The thyroid gland. Parathyroid glands. Pancreatic hormones. The adrenal cortex and medulla. Pineal gland.	2
10.	General physiology of receptors system. Somatic sensations: the Tactile and Position Senses, Pain, Headache and Thermal sensation.	2
11.	Physiology of the Vision.	2
12.	Physiology of Hearing and Equilibrium.	2
13.	Higher intellectual functions. Neural basis of instinctual behavior and emotions. Conditioned reflexes.	2
14.	Higher intellectual functions. Learning, memory phenomena, speech. Physiology of sleep. Electroencephalogram.	2
15.	Physiology of Blood system. The physical-chemical qualities of the blood, erythrocytes and hemoglobin of the blood	2
16.	Physiology of Protectional functions of the blood. The white blood cells. Immunity.	2
	TOTAL	32

PRACTICAL CLASSES PLAN (PART 1, 3TH semester)

№	Topic	Hours
1.	General and Cellular Bases of Medical Physiology. The methods of physiological experiments.	3
2.	Excitable tissue: The ionic basis of Membrane potential and Action potential.	3
3.	Excitable tissue: Nerve. Conduction of the action potential.	3
4.	Excitable tissue: Muscle. Synaptic and Junctional Transmission.	3
5.	Processes of excitation and inhibition in the central nervous system. Physiological characteristics of nerve centers.	3
6.	The CNS control of posture and movements by spinal cord, brainstem,	3

	thalamus, hypothalamus.	
7.	The CNS control of posture and movements by spinal basal ganglia, cerebellum and cerebral cortex. Integration mechanisms in CNS	3
8.	The functions of Autonomic nervous system. Sympathetic division. The functions of Autonomic nervous system. Parasympathetic division.	3
9.	Credit lesson: Physiology of the excitable tissues. The role of CNS in the regulation physiological function.	3
10.	The introduction to Endocrinology. Pituitary Hormones and their control by the Hypothalamus. The Thyroid Gland and Thyroid metabolic hormones.	3
11.	The endocrine functions of the Pancreas, the Adrenal Medulla, and Adrenal Cortex. The hormonal control of Calcium metabolism. The endocrine functions of the Kidneys, the Heart, and the Pineal gland.	3
12.	Sense organs. Physiology of receptors system. Initiation of impulses in Sense organs. Somatic sensations: General organization, the Tactile and Position Senses. Pain, Headache and Thermal sensation.	3
13.	Physiology of Vision system.	3
14.	Physiology of Hearing and Equilibrium Sensation of Taste and Smell.	3
15.	Neural basis of instinctual behavior and emotions. Types of the “Higher nervous activity”. Conditioned reflexes, learning, memory phenomena	3
16.	Higher intellectual functions. Speech. Nervous control of speech. Physiology of sleep. Electroencephalogram.	3
17.	Credit lesson: Humoral regulation of physiological function. Higher integration functions. Physiology of human's ontogenesis.	3
	TOTAL	51

SECTION #1: *General physiology. The higher integration functions. Physiology of human's ontogenesis.*

Content Sections #1. Introduction to physiology. Physiology of the excitable tissues.

PRACTICAL LESSON 1

Theme: General and Cellular Bases of Medical Physiology. The methods of physiological experiments

THE GOALS:

Acquire the information about physiology as a science; get to know the equipment for research; study "Regulations of safety measures;" get to know the rules of registration of the reports. Study the nature of excitable tissues biocurrents.

The Initial level of knowledge

1. Structure and functions of the cellular membranes
2. The mechanism of transport of substances through the cell membrane.

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Subject, tasks and methods of physiology. Types and planning of the Physiology experiments.
2. Organization of the cell membrane. Structural Model of the Cell Membrane.
3. Lipid Layers of the Cell Membrane, Functions of Lipid Layer in Cell Membrane.
4. Protein Layers of the Cell Membrane, Functions of Proteins in Cell Membrane.
5. Types of Protein Channels or Ion Channels. Regulation of the Channels.
6. Carbohydrates of the Cell Membrane, Functions of Carbohydrates in Cell Membrane.
7. Functions the cell membrane has.
8. Transport through Cell Membrane. Basic mechanisms of transport.
9. Passive transport
 - a. Simple diffusion through lipid layer;
 - b. Simple diffusion through protein layer;
 - c. Facilitated or carrier-mediated diffusion.
 - d. Osmosis
10. Active transport
 - a. Primary active transport;
 - b. Secondary active transport.
11. Special types of active transport.
 - a. Endocytosis;
 - b. Exocytosis;
12. Explain what is meant by the "internal environment."

13. Differences between the extra cellular and intracellular fluids.

INDEPENDENT PRACTICAL WORK

TASK 1.

a). Draw the scheme of the Cell membrane structure.

b) Describe function of the Membranous component.

Table1.

	Membranous components	functions
1.	Cell membrane Proteins:	
a	integral Proteins	
b	peripheral Proteins	
2.	Cell membrane Carbohydrates	
3.	Cell membrane Lipids	

TASK 2. Describe the transport through the cellular membrane in the table

substances	Mechanism of Active transport	Mechanism of Passive transport
<i>proteins</i>		
<i>fats</i>		
<i>carbohydrates</i>		
<i>water</i>		
<i>ions</i>		

TASK 3. Get to know regulations of safety measures to students' practical work

1. The general rules of the safe work in the laboratories with the students during the practical studies.

- 1.1. The responsibility of the accidents prevention during the educational process is charged on the teacher, which leads the study in the group. During the carrying out the scientific work with the students it is charged on the teacher, which leads the scientific work.
- 1.2. All students have to pass the instruction at the working place with the registration and the signature in the instruction register.
- 1.3. For preventing the accidents in the laboratories the students have to:
 - 1.3.1. To carry out all rules of accidents prevention and fire safety in the laboratories of the chair and to carry out the rules of conduct.
 - 1.3.2. Do not smoke in the laboratories.
 - 1.3.3. Do not use the chemicals without labels.
 - 1.3.4. Do not taste any substances.
 - 1.3.5. Do not pour out drastic and combustible substances and metallic mercury in the sink.
- 1.4. The permission for carrying out the laboratory work is given by the teacher after study the rules of accidents prevention according to the specificity of the work.

- 1.5. Students, which did not master the rules of accidents prevention of work with electrical devices with metallic mercury, are not admitted to works.
- 1.6. Working in the laboratory student must to carry out only that work which is charged him by a teacher.
- 1.7. Student is forbidden to work in the laboratory alone. Presence of the teacher is necessary for giving the first aid by the accident or the crash.
- 1.8. Excepting this Rules students have to carry out other teacher's instructions of accidents prevention and fire safety.

2. The rules of accidents prevention of working with electrical equipment

- 2.1. Students are forbidden to engage electrical devices without a teacher's permission.
- 2.2. The engaging the devices are allowed only after preliminary check-up and teacher's permission.
- 2.3. It is forbidden to change something in the devices, which are engaged
- 2.4. For prevention the accidents students are forbidden to open the dashboards, closed knife-switches and repair them, use the electrical flexes with damaged insulation for engaging the electrical devices.
- 2.5. It is forbidden to engage the electrical devices near the highly inflammable and combustible liquids.
- 2.6. After contact breaking of electrical voltage all electrical devices must be turned off.

3. The rules of working with glass and a glass dishes.

- 3.1. All kinds of works with thermal or machining treatment of glass, heating substances in soldered dishes are made in goggles.
- 3.2. All operations with the glass are made very carefully, slow, without pressure.
- 3.3. Heating the test-tubes with the solutions above the gas-burner it is necessary to hold the test-tube by a special clamp and turn away from people.

THE CONTROL OF THE LEVEL OF KNOWLEDGE

The signature of the report by teacher

Thematic module #1. Introduction to physiology. Physiology of the excitable tissues.
Content Sections #2. Introduction to physiology. Physiology of the excitable tissues.

PRACTICAL LESSON2

Theme: Excitable tissue: The ionic basis of Membrane potentials and Action potentials.

THE GOALS: Study the nature of excitable tissues' biocurrents.

The Initial level of knowledge

1. The characteristic of the permeability of a cell membrane for different ions
2. The morphology of the excitable tissues
3. The principle of work of an oscillograph

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

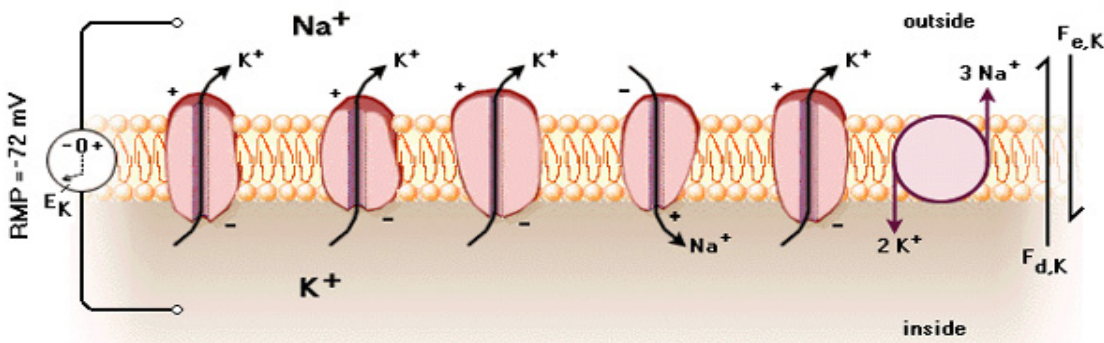
1. Homeostatic Components of homeostatic system. Mechanism of action homeostatic system.
2. Control system of the Body.
3. Differences between the extra cellular and intracellular fluids.
4. Membrane potential. Genesis of Resting Membrane Potentials.
5. Measuring the Membrane Potential.
6. Origin of the normal Resting Membrane Potential.
7. Describe and explain the ionic basis of Local response.
8. Explain the biphasic of the Action Potential.
9. Explain the ionic fluxes during the Action Potential.
10. Initiation of the action potential
11. "Refractory period" after an action potential, during which a new stimulus cannot be elicited.
12. Describe the role of Sodium-Potassium pump for origin of Resting Membrane Potential and Action Potential.

INDEPENDENT PRACTICAL WORK

TASK 1. a) Complete the table about the factors necessary for the Resting Membrane Potential.

#	factors	factors' action
1.	The transmembrane ion distribution	
2.	The selective conductance of the membrane	
3.	The transmembrane ion diffusion	
4.	Na/K pump	

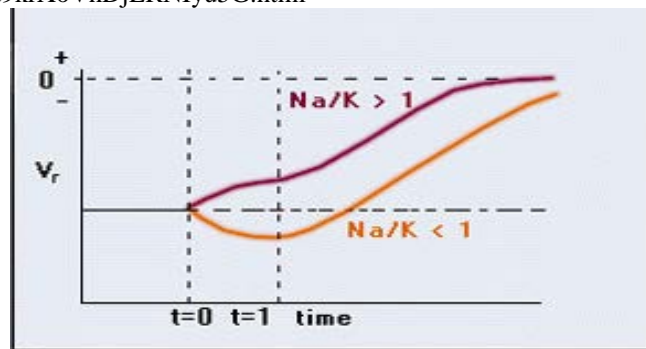
b) Look at this figure and write the ionic basis of the Resting Membrane Potential



source: <https://courses.lumenlearning.com/wm-biology2/chapter/resting-membrane-potential/>

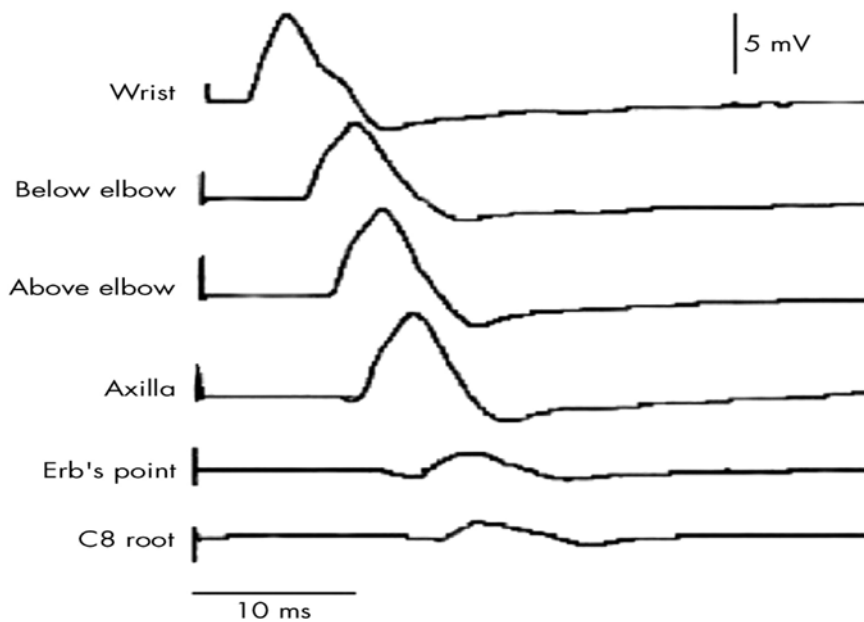
TASK 2 How can you explain effects of Inhibition of an Electrogenic Na/K Pump. Write an explanation.

Source: https://www.physiologyweb.com/lecture_notes/resting_membrane_potential/figs/effect_of_ouabain_on_membrane_potential_jpg_UfObRaPQwesAL9d9krXoVhDjERNIyu5G.html



TASK 3. Recordings of action potentials from the adductor digiti minimi muscle in a patient.

A) Recording of action potentials from single nerve fibers by microneurography is an important tool to investigate peripheral neural functions in human neuropathies. However, the interpretation of microneurography recordings can be difficult because axonal membrane potential is not revealed by this method. Recordings of action potentials from the adductor digiti minimi muscle in a patient with multifocal motor neuropathy gave the next results (the ulnar nerve has been stimulated at six sites from the wrist to the C8 root). Focal conduction block is present between Erb's point and the axilla.



Source: https://www.researchgate.net/publication/7781223_Specialised_electromyography_and_nerve_conduction_studies

How can Muscle Response change to nervous stimulation after Inhibition of an Electrogenic Na/K Pump by a special drug?

Draw the curve of Action Potential for one. Write an explanation.

TASK 4. Solving the clinical tasks. Write an explanation.

1. The ions from the intracellular fluid and ATP molecule bind to the carrier protein on the inside of the cell membrane. What are these ions?

2. The sodium potassium exchange pump moves three potassium ions out of the cell and two sodium ions into the cell with each cycle. Is it right?

3. If the delay between the first and second stimulus is reduced to 15 msec. Can the second stimulus be unable to bring the membrane to threshold?

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #1. Introduction to physiology. Physiology of the excitable tissues.
Content Sections #2. Introduction to physiology. Physiology of the excitable tissues.

PRACTICAL LESSON3

Content Sections #2. Introduction to physiology. Physiology of the excitable tissues.
tissues.

Theme: Excitable tissue: Nerve. Conduction of the action potential.

THE GOALS:

Study the nature of the bio currents of excitable tissues.

The Initial level of knowledge

1. The characteristic of the permeability of a cell membrane for different ions
2. The morphology of the nerve cells

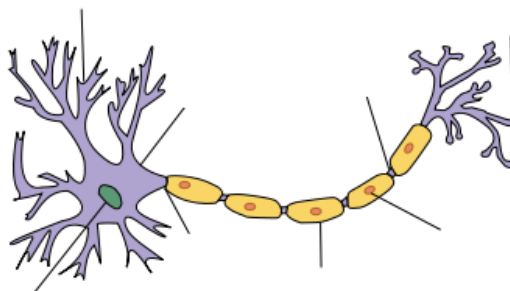
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Morphology parts of neuron.
2. Axonal transport.
3. Glial cells
4. Nerve fiber types & function
5. Resting Membrane Potential of the Nerve Fibers.
6. Ionic fluxes during the action potential.
7. All-or-none action potentials.
8. Electrotonic potentials, local response, & firing level.
9. Changes in excitability during electrotonic potentials & the action potential.
10. Conduction of the action potential
 - a. Myelinated and Unmyelinated Nerve Fibers.
 - b. Mechanism of Action Potential conduction along the Myelinated and Unmyelinated Nerve Fibers.
11. Orthodromic and antidromic of Action Potential conduction.
12. Anatomy and physiology of a neuromuscular junction
13. Mechanism transmission of active potential through neuromuscular junction.
14. Physiological mechanism of End Plate potential.

INDEPENDENT PRACTICAL WORK

TASK 1. Look at this figure and note the morphology parts of neuron. Complete the table about the functions of ...



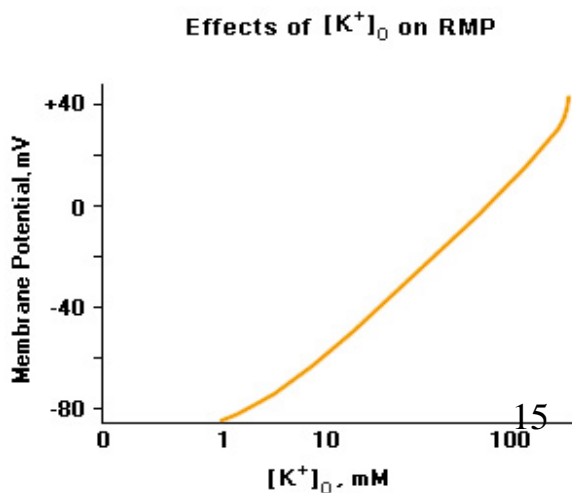
morphology structure	functions
Dendrite	
Axon	
Node of Ranvier	
Schwann cell	
Myelin sheath	

TASK 2. Complete the table about the ...

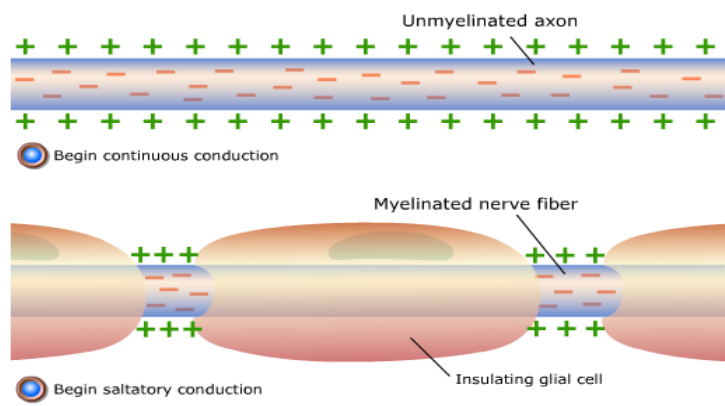
nerve fiber	the regions of innervations
Unmyelinated Nerve	
Myelinated Nerve	

TASK 3. Look at this figure. How can you explain an effect of K ions on the Resting membrane potential of Neuron? Write an explanation.

Source: https://www.physiologyweb.com/lecture_notes/resting_membrane_potential/resting_membrane_potential_maintenance_of_the_membrane_potential.html



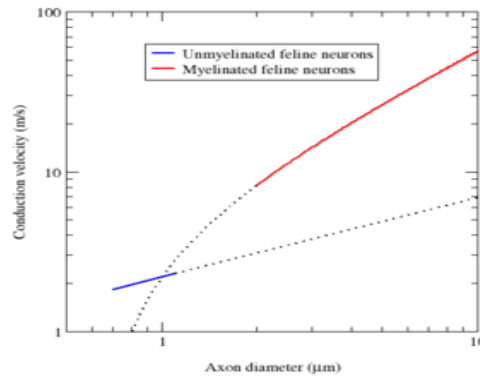
TASK 4. Look at this figure. How can you explain the mechanism of Action Potential conduction along the Myelinated and Unmyelinated Nerve Fibers? Write an explanation.



Source: https://opencourses.emu.edu.tr/pluginfile.php/59788/mod_resource/content/0/CENTRAL%20NERVOUS%20SYSTEM.pdf

nerve fiber	ionic mechanism of AP conduction
Unmyelinated Nerve	
Myelinated Nerve	

TASK 5. Look at this figure. How can Axon diameter and Myelin sheath impact in velocity of nerve impulses conduction? Write an explanation.



Source: https://en.wikipedia.org/wiki/File:Conduction_velocity_and_myelination.png

TASK 6. Solving the clinical task. Write an explanation.

1. Which can a factor influence on quantity of a membrane potential of nerve fiber?
2. What plays an important role in mechanism of depolarization phase of nerve fiber?

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #1. Introduction to physiology. Physiology of the excitable tissues.

Content Sections #2. Introduction to physiology. Physiology of the excitable tissues.

PRACTICAL LESSON 4.

Theme: Excitable tissue: Muscle

THE GOALS:

Study the mechanism of transfer the excitation from a nerve to a muscle. Study the physiological properties of muscles. Study a method of dynamometry, familiarize with electromyography.

The initial level of knowledge

1. Structure of a muscle fibers.
2. Structure of a neuromuscular junction

THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Types of muscle.
2. Organization of the muscle.
3. Muscle action potential.
4. Sarcotubular System of muscle.
5. Molecular basis of muscle contraction.
6. Role Ca^{++} ions in the physiology of muscle contraction.
7. ATP and Muscle Contraction.
8. Sliding Filament Mechanism of Muscle Contraction.
9. Types of muscle contraction.
10. Summation of contractions.
11. Relation between muscle length, tension, & velocity of contraction
12. Explain the energy sources and metabolism during of muscle contraction.
13. Heat production in muscle.
14. Function does Motor Unit.
15. Dynamometry and electromyography.
16. Smooth muscle morphology
17. Electrical & mechanical activity smooth muscle.
18. Molecular basis of contraction smooth muscle.
19. Relaxation smooth muscle.
20. Function of the nerve supply to smooth muscle
21. Force generation & plasticity of smooth muscle

INDEPENDENT PRACTICAL WORK

TASK 1. Determine the force of hand muscles with the help of manual dynamometer

- a) Before the beginning of research fix the pointer of the device on "0". The person should be in "standing" position. He stretches a hand with a dynamometer aside under a right angle in relation to a body. Then compresses a spring of dynamometer with the maximal force. After that he retains to the initial position. Test the force of both hands` muscles.

b) Put the results of each research in the table; calculate the average indices for girls and boys of your group.

№	name of a student	Force of hand boys		Force of hand girls		Force of hand boys sportsmen		Force of hand girls sportsmen	
		right	left	right	left	right	left	right	left
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

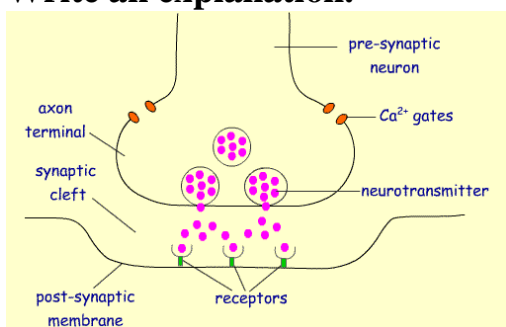
TASK 2. Registration of electromyography of a person.

a). You should fix a superficial electrode on the skin of one hand, and on the second hand fix an electrode for grounding Register on electromyography with the help of an oscillograph at rest and during the physical loading (for example, fingers move).

b). Draw the biopotentials and compare the results before the physical loading and after it

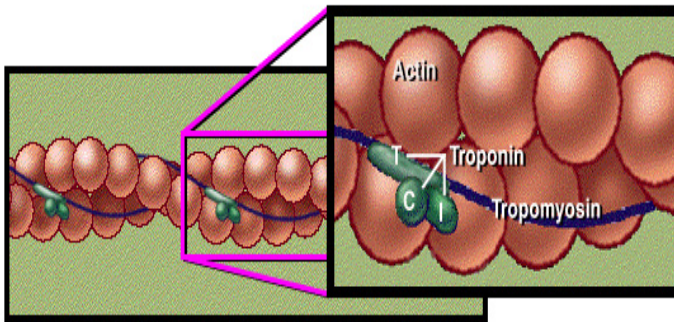
c). make conclusions.

TASK 3. Look at this figure and explain how does neuromuscular junction work? Write an explanation.



Source: <https://www.sciencefacts.net/synapse.html>

TASK 4. Look at this figure and explain the Sliding mechanism of muscle contraction. Write an explanation.



Source: <https://www.onlinebiologynotes.com/sliding-filament-model-of-muscle-contraction/>

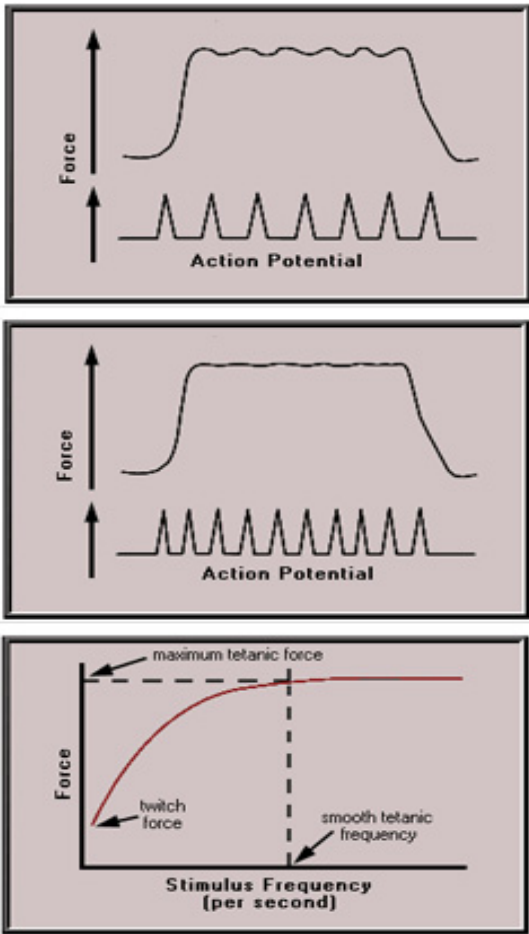
TASK 5. Solving the clinical tasks.

Duration of the period of a single muscle contraction of a frog is about 0,01 sec.

a). What should be an interval between the first and the second irritation for developing an incomplete tetanus ?

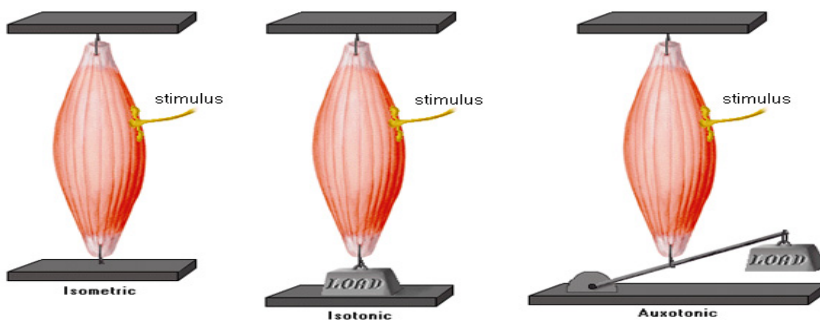
b). What should be an interval between the first and second irritation for development of a complete tetanus?

c). Choose and draw a complete type and an incomplete type of muscle contraction. Write an explanation.



Source: https://www.researchgate.net/figure/Parameters-analysed-in-the-unfused-tetanic-contractions-evoked-at-regular-and-irregular_fig1_5411794

TASK 6. Look at this figure and explain the types of muscle contraction. Write an explanation.



Nosek, T.M. (ed) (1996) *Essentials of Human Physiology*. Retrieved from <http://books.google.com>

THE CONTROL OF THE LEVEL OF KNOWLEDGE
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Thematic module #1. Introduction to physiology. Physiology of the excitable tissues
Content Sections #3. Nervous regulation of the organism functions. Synaptic transmission.

PRACTICAL LESSON 5

Theme: Processes of excitation and inhibition in the central nervous system. Physiological characteristics of nerve centers. Synaptic and Junctional Transmission.

THE GOALS:

Study the mechanism of Synaptic and Junctional Transmission; study Processes of excitation and inhibition in the central nervous system; study the properties of the nervous centers

Initial level of knowledge

1. Structure of a neuron.
2. Structure of a neuromuscular junction

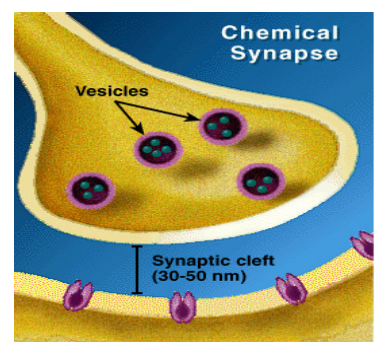
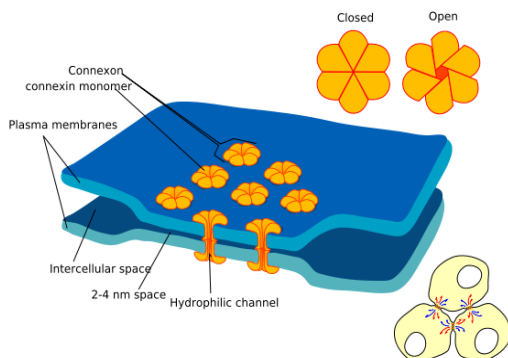
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Describe the Types of Synapses
2. Describe the presynaptic and postsynaptic structure, explain its function.
3. Explain how does chemical synapse work?
4. Explain how does electrical synapse work?
5. What do you know about the Chemistry of neurotransmitters and Receptors? (classification of neurotransmitters and receptors)
6. Explain the mechanism of generation of the Action Potential in the Postsynaptic neuron
7. Explain the mechanism of Excitatory Postsynaptic Potentials and Synaptic Delay
8. What do you know about the mechanism of Inhibitory Postsynaptic Potentials?
9. Describe the mechanism of Postsynaptic Inhibition in the CNS: 1. Lateral. 2. Reciprocal. 3. Renshaw.
10. Describe the mechanism of Presynaptic Inhibition in the CNS.
11. The property of nerve centers: the Summation; convergence; divergence and occlusion in the CNS

INDEPENDENT PRACTICAL WORK

TASK 1. Look at these figures and explain how do these junctions work? Write the explanations.



Source: <https://www.sciencefacts.net/synapse.html>

<i>an Electrical synapse</i>	<i>a Chemical synapse</i>

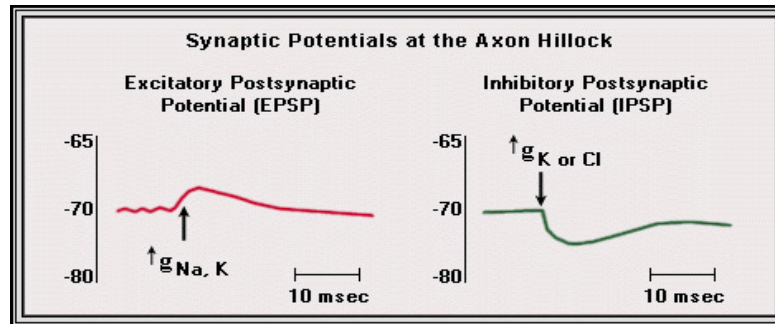
TASK 2. What is the difference between electrical and chemical Synapses? Put the information about difference in the table.

<i>The description</i>	<i>an Electrical synapse</i>	<i>a Chemical synapse</i>
<i>Location</i>		
<i>Synaptic Delay.</i>		
<i>Unilateral transmission</i>		
<i>Transfer of Excitation.</i>		
<i>Transfer of Inhibition.</i>		
<i>Neurotransmitters</i>		

TASK 3. Put the information about Neurotransmitters in the table

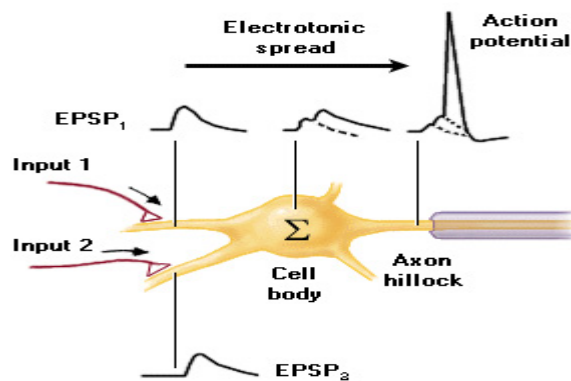
<i>substance</i>	<i>location</i>	<i>inhibition</i>	<i>excitatory</i>
Acetylcholine			
Dopamine			
Norepinephrine			
Glutamate			
GABA			

TASK 4. Look at this figure and explain the mechanism of Excitatory Postsynaptic Potential and Inhibitory Postsynaptic Potential in the Postsynaptic neuron. Write the explanations.



Source: <https://quizlet.com/ca/599719918/brain-behaviour-mod-4-44-an-epsp-an-ipsp-and-an-epsp-followed-by-a-typical-action-potential-diagram/>

TASK 5. Look at this figure. What kind of mechanism can you see in one? Write an explanation.



Source: <https://www.sciencedirect.com/topics/medicine-and-dentistry/temporal-summation>

TASK 6. Put the information about Presynaptic inhibition and Postsynaptic inhibition in this table.

	<i>action</i>	<i>synapse</i>	<i>neurotransmitter</i>	<i>mechanism</i>
1.	Presynaptic inhibition			
2.	Postsynaptic inhibition			

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Content Sections #4. The role of CNS in the regulation of movement.

PRACTICAL LESSON 6

Theme: The CNS control of posture and movements by spinal cord

THE GOALS: Study the regulation of movements on the different CNS levels: the Spinal Cord

Initial level of knowledge

1. Anatomy structure of Spinal Cord.

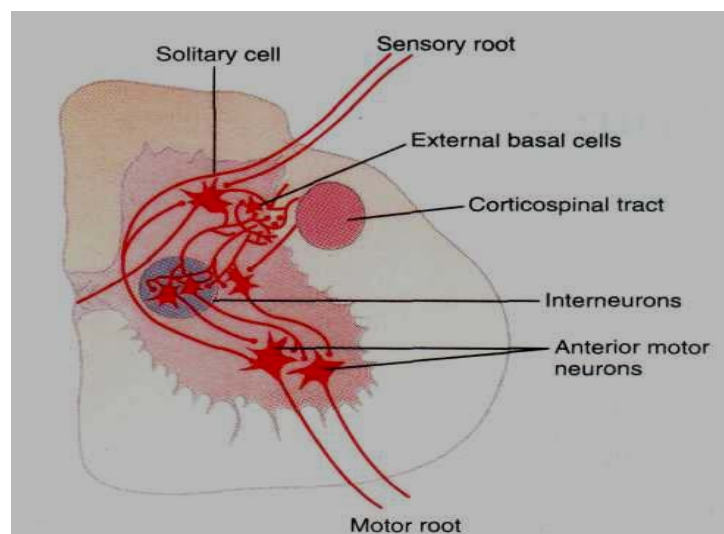
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. What is Motor Control?
2. Some Necessary Components of Proper Motor Control.
3. Organization of the Spinal Cord for Motor Functions.
4. Proprioceptors: Muscle spindles, Golgi tendon organs, Joint kinesthetic receptors.
5. Muscle Spindles.
6. Muscle stretch reflex.
7. Golgi tendon reflex
8. The Tendon Reflex Prevents Excessive Tension on the Muscle.
9. Function of the Muscle Spindles and Golgi Tendon Organs in Motor Control by Higher Levels of the Brain.
10. Flexor reflex and the withdrawal reflexes.
11. Crossed extensor reflex.
12. Control of motor functions by the brain stem.
13. Role of the Medullary Components in movement and origin of Tonic Labyrinthine Reflexes and the Tonic Neck Reflexes.
14. Role of the Midbrain Components in movement and origin of Righting Reflexes, the Grasp Reflex and other Midbrain Responses.

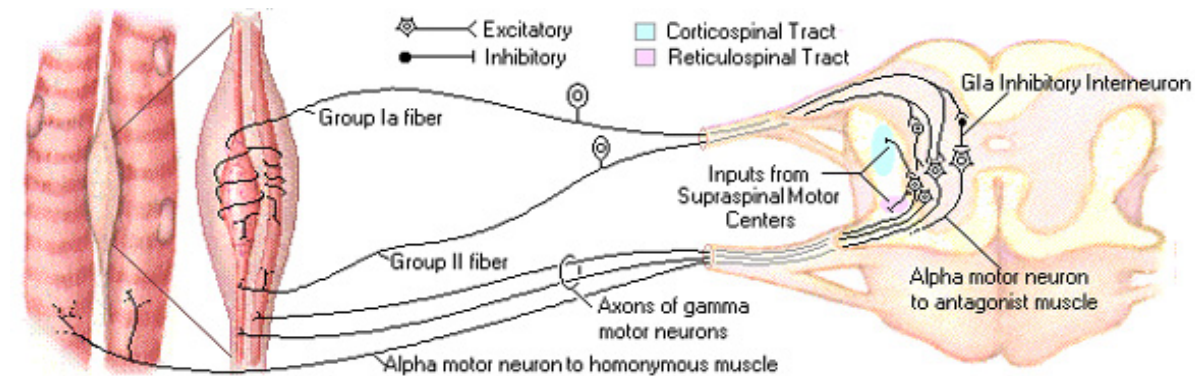
INDEPENDENT PRACTICAL WORK

TASK 1. Look at this figure. Write the explanations about Organization of the Spinal Cord for Motor Functions



Source: https://www.brainkart.com/article/Organization-of-the-Spinal-Cord-for-Motor-Functions_19713/

TASK 2. Look at these figures. What kind of Spinal reflex do you see? What is the pathway for one? Describe the reflex ark.



Source: https://www.brainkart.com/article/Muscle-Stretch-Reflex_19716/

TASK 3. Clinical examinations of Knee jerk reflex in a person. Draw the reflex ark. Describe the pathway for one.

Supine position. The subject is asked to relax his legs, and is reassured that the patellar hammer will not cause injury. His legs are semiflexed, and the observer supports both knees by placing a hand behind them. The patellar tendon is then struck midway between the patella and the insertion of the tendon on the tibial tuberosity. (The tendon is located by palpation before striking it. The hammer should be held between the fingers and thumb, and the swing should be at the wrist and not at the elbow or shoulder). The response is extension of the knee due to contraction of the quadriceps femoris muscle. Afferent and efferent paths: Femoral nerve; Centre: Lumbar 3,4 segments.

Sitting position .

The subject is seated in a chair and is asked to cross one leg over the other, and then the reflex is elicited. The leg can be seen to kick forwards; the muscle can also be felt to contract if the observer places his hand on the lower front of the thigh. A better way to elicit this reflex is to ask the subject to sit with both legs dangling loosely over the edge of the chair. It permits a more rapid comparison of the two knee jerks.

The knee jerk may be pendular in acute cerebellar disease and present on the side of the lesion. It may be sustained in chorea. In hypothyroidism, there may be delayed return of the leg to the resting position. In hyperthyroidism, the jerks are brisk.

TASK 4. Clinical examinations of Elicit the ankle jerk in a person. Draw the reflex ark. Describe the pathway for one

The subject lies supine, the knee is semiflexed, and the hip externally rotated. Then with one hand, the examiner slightly dorsiflexes the foot so as to stretch the Achilles tendon (tendo calcaneus), and with the other hand, the tendon is struck on its posterior surface. The response is plantar flexion of the foot due to contraction of the calf muscles.

Another method is to ask the subject to kneel over a chair so that he faces the back of the chair and his ankles lie over its edge. The ankle jerks are then tested as described above. Afferent and efferent: Tibial nerve; Center: Sacral 1,2 segments.

TASK 5. Test the biceps jerk in the subject provided. Draw the reflex ark. Describe the pathway for one.

The subject's elbow is flexed to a right angle and the forearm semipronated and supported on the examiner's arm. The examiner then places his thumb on the biceps tendon and strikes it with the hammer. The response is contraction of the biceps causing flexion and slight pronation of the forearm (If the patient is in bed, his forearm may rest across his chest). The afferent and efferent paths are musculocutaneous nerve and the center is in 5th and 6th cervical segments.

TASK 6. Elicit the triceps reflex. Draw the reflex ark. Describe the pathway for one

The arm is flexed to a right angle and is supported on the examiner's arm. The triceps tendon is then struck just proximal to the point of the elbow. The response is extension at the elbow. Afferent and efferent paths: Radial nerve; Center: C-6,7.

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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**Content Sections #4. The role of CNS in the regulation of movement.
PRACTICAL LESSON 7.**

Theme: The CNS control of posture and movements by Cerebrum

THE GOALS:

Study mechanisms of regulation movements on the different levels: the Cortical Motor Areas, the Cerebellum, the Medullary Components, the Midbrain Components, the Basal Ganglia.

Initial level of knowledge

1. Anatomy and histology structure of Cortical Motor Areas, the Medullary Components, the Midbrain Components, the Basal Ganglia, and the Cerebellum.

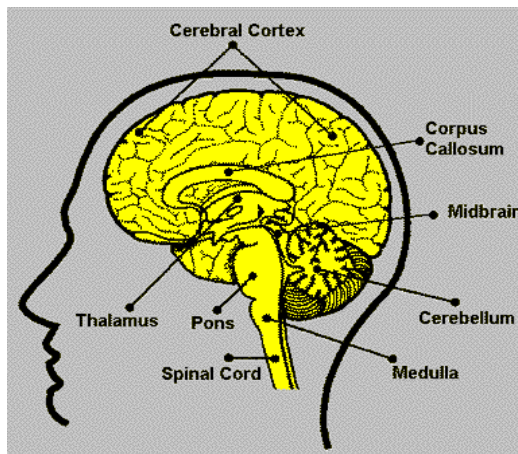
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. The cerebellum and its motor functions.
2. Anatomical and Functional Areas of the Cerebellum.
3. Output Signals From the Cerebellum.
4. Functional Unit of the Cerebellar Cortex—The Purkinje and Deep Nuclear Cells.
5. Function of the cerebellum in overall motor control.
6. The basal ganglia and their motor functions
7. Functions of specific neurotransmitter substances in the basal ganglial system.
8. Motor cortex and corticospinal tract
9. Integration of the many parts of the total motor control system.

INDEPENDENT PRACTICAL WORK

TASK 1. Look at this figure and put the explanations about motor functions of Cerebrum in this table.

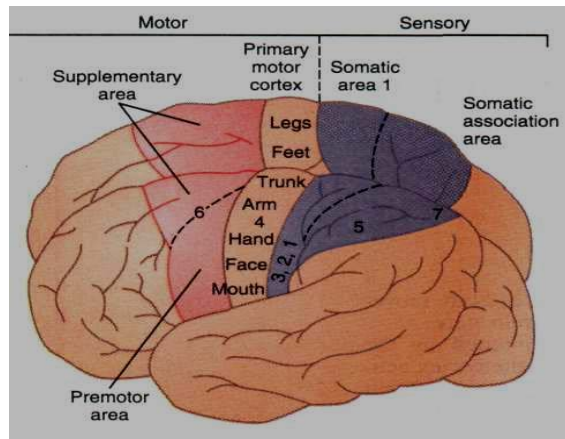


Source: <https://www.cancer.gov/publications/dictionaries/cancer-terms/def/brain>

#	Part of cerebrum	Motor functions
1.	Medulla	

2.	<i>Pons</i>	
3.	<i>Midbrain</i>	
4.	<i>Reticular formation</i>	
5.	<i>Thalamus :</i>	
5.1	<i>relay nuclei</i>	
5.2	<i>association nuclei</i>	
6.	<i>Hypothalamus</i>	
7.	<i>Cerebellum</i>	

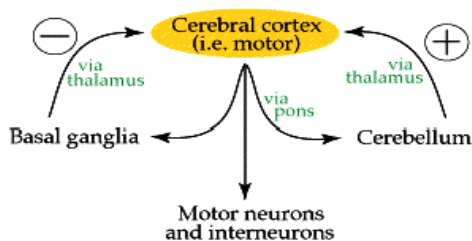
TASK 2. Look at this figure and write the explanations about motor functions of Cortex in this table.



Source: <https://quizlet.com/573997894/lecture-143-motor-cortical-and-brain-stem-flash-cards/>

#	Part of cortex	Motor Functions
1.	Premotor area	
2.	Supplementary area	
3.	Primary motor area	

TASK 3. Look at this scheme and write the explanations about Anatomical relations of the basal ganglia to the cerebral cortex



Source: https://grants.hhp.uh.edu/clayne/6397/Unit5_files/BG.htm

TASK 4. Perform the Test of muscular coordination in the upper limbs of the subject provided. Explain your results.

Coordination of movements This term refers to the smooth interaction and cooperation of groups of muscles in order to perform a definite motor task. Coordination of movements depends on afferent impulses coming from muscle and joint receptors, integrity of dorsal columns of the cord, cerebellum and its tracts, and the state of muscle tone. Though vision can control and direct a motor act to some extent, it is not concerned in the coordination of most normal movements.

* If coordination of movements becomes impaired (*ataxia*), the carrying out of motor activities becomes difficult and sometimes even impossible.

1. "*Finger-nose*" test. The subject is asked to extend his arm to the side and then touch the tip of his nose with the tip of his index finger, first with the eyes open and then with the eyes closed. The other limb is tested similarly. A normal subject is able to perform these acts accurately, both slowly and rapidly.
2. The subject is asked to touch his each finger in turn with the tip of the thumb.
3. The subject is asked to draw a large circle in the air with his forefinger.
4. The subject is asked to make fists, flex the forearm to right angles, tuck the elbows into his sides, and then to alternately pronate and supinate his forearms as rapidly as possible. An inability to perform such rapid movements is called *dysdiadochokinesia*. It is an important sign of cerebellar disease where the movements on the affected side become very clumsy or even impossible to carry out.

Watching a patient dressing or undressing, picking up pins from a table, handling a book, etc can provide useful information about muscle coordination.

TASK 5. Perform the Test of muscle coordination in the lower limbs. Explain your results.

1. The subject is asked to walk along a straight line. The examiner watches carefully as the subject turns to walk back. The subject may also be asked to walk along a line, placing the heel of one foot immediately adjacent to the toes of the foot behind (tandem walking). If incoordination is present, the subject soon deviates to one or the other side and takes a zigzag course like that of a drunk.

2. "*Heel-knee*" test The subject lies on his back, and is asked to lift one foot high in the air, to place its heel on the opposite knee, and then to slide the heel down the leg towards the ankle. The test is done first with the eyes open and then with eyes closed, and it is repeated on the other side.

3. The subject is asked to draw a large circle in the air with his toe.

TASK 6. Perform the Test of subject provided for Romberg's sign. Explain your results. Romberg's sign. This sign is a test for the *loss of position sense* (sensory ataxia) in the legs. It is NOT a test for cerebellar function.

The subject is asked to stand with the feet as close together as possible, and if he can do it, which a normal person can, he is asked to close his eyes. A normal person can do so with ease.

However, if the Romberg's sign is present, the patient starts to sway from side to side as soon as he closes his eye. Thus, the patient is more unsteady when his eyes are closed than when his eyes are open. In *sensory ataxia* (lesion of dorsal columns of cord or dorsal roots, as in tabes dorsalis) the sensory information from the legs is lacking; therefore the patient becomes unsteady without the help of vision. In *cerebellar ataxia*, the patient is unsteady on his feet whether the eyes are open or closed.

TASK 7. Perform the Test of tone of the muscles in the upper limbs. Explain your results.

Muscle (or muscular) tone. This term refers to the continuously maintained state of slight tension or tautness in the healthy muscles even when they appear to be at rest. An increase in tone is called *hypertonia*, while a decrease in tone is called *hypotonia*.

Muscle tone is tested by noting the resistance offered to passive movements done by the examiner on various joints of the subject/patient. The examiner holds the limb on either side of a joint to be tested, and passively moves the joint through the full range of its movements. The ease or difficulty with which a joint can thus be moved is noted and compared with the similar joint on the opposite side.

Test The examiner holds the forearm of the subject with one hand, and alternately flexes and extends the wrist with the other hand. Tone at the fingers, elbow, and shoulder is tested in a similar manner. In the lower limbs, passive movements are done at the ankle, knee and hip comparing these on the two sides.

In hypertonia, the patient's muscles resist the passive movements, while in hypotonia the movements become free and the joints can be hyperextended.

Comments Muscle tone, ie, the slight tautness in a muscle, implies the contraction of a small number of motor units scattered throughout the muscle, but a number which is not enough to cause movement at a joint. (If the tendon of a muscle, say biceps, is cut from its insertion, the muscle shortens—a proof of tone).

Muscle tone is a spinal stretch reflex (static reflex) phenomenon, which results from a slight stretch of the muscle spindles scattered in between the ordinary (extrafusal) muscle fibers. Afferent impulses from the stretch receptors of the spindles enter the spinal cord where they reflexly excite anterior horn cells (alpha neurons). These neurons, in turn, discharge *out of step and at a low rate*, which leads to contraction of a certain number of muscle fibers; and this is manifested as muscle tone. Damage to any part of the reflex arc abolishes muscle tone.

Muscle tone does not produce fatigue because only a small number of muscle fibers contract at a time; these fibers relax and another group takes up activity. This process of rotation of activity prevents the occurrence of fatigue.

But what is the cause of stretching of the muscle spindles to start with? From the time of early growth, the bones grow longer at a rate faster than that of muscles. This maintains a slight stretch on the muscles, and therefore, on the spindles, throughout the lifetime of an individual, so that the muscles remain in a state of tone.

Though muscle tone is a spinal reflex mechanism, it is mainly regulated by supraspinal pathways—the pyramidal (corticospinal) and extrapyramidal tracts. The anterior cerebellum, via the subcortical structures, has a facilitatory effect on muscle tone.

Hypertonia This occurs in lesions of upper motor neuron (corticospinal) and extrapyramidal systems.

Spasticity The term refers to hypertonia resulting from *lesions of the corticospinal system*. The increased tone is of *clasp-knife type*, when the limb is moved, maximum resistance is offered at once, but it suddenly gives way after some effort on the part of the examiner. Spasticity is therefore a form of rigidity which is sensitive to stretch, ie, it is "*stretch-sensitive*". It is usually maximum in flexors of the arms and extensors of the legs.

Rigidity The hypertonia of rigidity results from *diseases of the basal ganglia* (eg, Parkinsonism), and is called extrapyramidal rigidity. It may be of *cog-wheel* type in which the resistance to passive movement decreases in jerky steps (probably a combination of tremor and rigidity), or of *lead-pipe* type in which resistance is felt throughout the passive movement. The rigidity of Parkinsonism is commonly accompanied by akinesia, ie, poverty of movement.

Hypotonia is seen in lower motor neuron disease and cerebellar lesions. Passive movement is unusually free and frequently through a greater range than normal.

TASK 8. Solving the clinical tasks

1. The patient lost the tendon reflexes of the lower limb after the damage in the cervical part of the spinal cord. .Can you explain “Why”? Write an explanation

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Content Sections #5. The autonomic nervous system.

PRACTICAL LESSON 8

Theme: The functions of Autonomic nervous system.

THE GOALS: Study functions of vegetative nervous system and its role in mechanisms of regulation.

Initial level of knowledge

1. Anatomy structure of Autonomic nervous system.

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

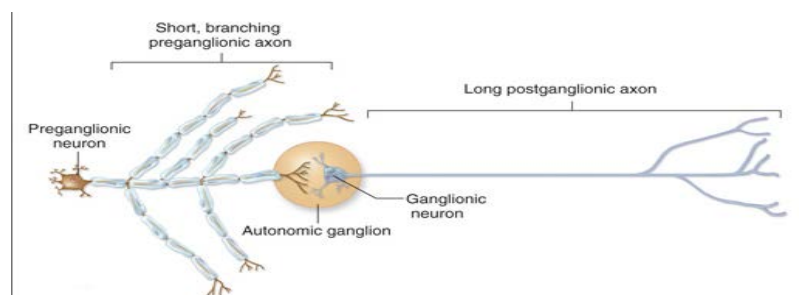
1. Introduction. General characteristic of autonomic nervous system.
2. General organization of the autonomic nervous system:
3. Physiological anatomy of the sympathetic nervous system
 - a. Preganglionic and postganglionic sympathetic neurons;
 - b. Segmental distribution of the sympathetic nerve fibers;
 - c. Special nature of the sympathetic nerve endings in the adrenal medullae.

- d. Sympathetic ganglia
- 4. Physiological anatomy of the parasympathetic nervous system:
 - a. Preganglionic and Postganglionic Parasympathetic Neurons;
 - b. Parasympathetic ganglia.
- 5. Cholinergic and adrenergic fibers—secretion of acetylcholine or norepinephrine
- 6. Receptors on the effector organs:
 - a. Receptor Action by Altering Intracellular “Second Messenger” Enzymes.
 - b. Two Principal Types of Acetylcholine Receptors—Muscarinic and Nicotinic Receptors
 - c. Adrenergic Receptors—Alpha and Beta Receptors
- 7. Excitatory and inhibitory actions of sympathetic and parasympathetic stimulation
- 8. Intramural Nerve Plexus of the Gastrointestinal System.
 - a. Cholinergic and adrenergic fibers—secretion of acetylcholine or norepinephrine
- 9. Sympathetic and parasympathetic “tone”.

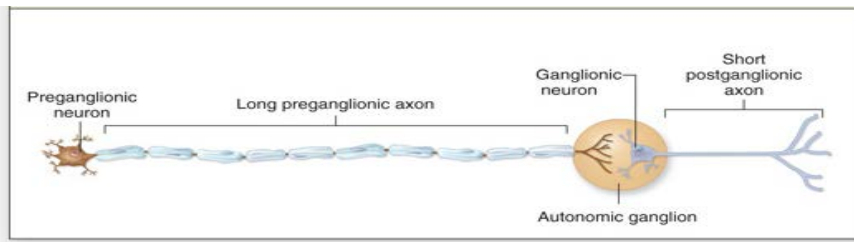
INDEPENDENT PRACTICAL WORK

TASK 1. Look at this figure and write the explanations about the organization of Sympathetic nerve system and Parasympathetic division.

TASK 2. Look at this figure and write the explanations about the bineuronal structure of Sympathetic and Parasympathetic division.



Source: <https://www.britannica.com/science/human-nervous-system/The-autonomic-nervous-system>



TASK 3. Put the information about the response of effectors organs to Sympathetic and and Parasympathetic division.

An effector organ	M - cholinoreceptor	α adrenoreceptor	β adrenoreceptor
<i>the eyes</i>			
<i>salivary glands</i>			
<i>bronchi</i>			
<i>systemic Blood Vessels</i>			
<i>heart</i>			
<i>stomach</i>			
<i>pancreas</i>			
<i>intestine</i>			

<i>colon</i>			
<i>rectum</i>			
<i>gallbladder</i>			
<i>urine bladder</i>			

TASK 4. The response of the skin to mechanical injury: the “triple response”. Explain results after person’s examination; draw the reflex arc and write an explanation.

The response of the skin to mechanical injury, described first by Lewis in 1927, is called the *triple response* or the *Lewis' response*. With light injury, only the "white line" is seen, while with a stronger stimulus, all the three stages of the "triple response" can be seen.

White Line (White Reaction)

Seat the subject on a stool with his forearm resting on the table. Draw a blunt-pointed object—a closed forceps, fingernail, a blunt pencil—lightly on the skin of the ventral forearm. The response, which appears in 8-10 seconds, is a pale or white line in the track of the stimulus. The mechanical stimulus causes contraction of the precapillary sphincters, squeezes out blood from the capillaries and small venules, leaving behind a white line.

Triple Response

After the white line disappears in about a minute, use a stronger stimulus with the forceps. The response will vary from person to person. A full-fledged triple response, especially in sensitive skins, consists of the following 3 stages:

1. *The red line (red reaction)*. It appears in about 10 seconds, and is due to relaxation of the precapillary sphincters resulting from histamine, kinins, polypeptides etc that are released locally from injured cells. Passive capillary dilatation and increased blood flow cause the red line.
2. *The flare*. The flare which follows in a few minutes, is an irregular, reddish, mottled area surrounding the red line. It is due to dilatation of arterioles resulting from a local reflex called the *axon reflex*. In this case, impulses originating in the sensory nerve

endings by the injury are relayed antidromically (ie, opposite to the normal direction) down other branches of the sensory nerve fibres which supply the arterioles. This appears to be the only example of a physiological effect due to antidromic conduction in nerve fibres. The axon reflex is not a true reflex as it does not involve some part of the central nervous system.

3. *The wheal.* The flare is soon followed by local edema (swelling) due to increased permeability of the capillaries and small venules, as a result of which fluid leaks out from these vessels. Histamine (released from local mast cells), kinins, substance P and other polypeptides all contribute to increased permeability and edema. Injection of histamine in the skin produces flare and wheal via the H₁ receptors. A common example of the triple response is the finger-marks left on the skin of the face following a hard slap.

TASK 5. Oculomotor and Pupillary Innervation-The 3rd (Oculomotor), 4th (Trochlear), 6th (Abducent) and Sympathetic Nerves.

The 3rd, 4th, and 6th cranial nerves are usually considered together because they function as a physiological unit in the control of the eye movements. The 6th nerve supplies the lateral rectus, the 4th nerve innervates the superior oblique, and the 3rd nerve supplies all the other external ocular muscles. It also sends fibers to the levator palpebrae superioris and through the ciliary ganglion, it supplies parasympathetic fibers to the sphincter pupillae and the muscle of accommodation, the ciliary muscle (contraction for near vision).

The sympathetic fibers emerge along the 1st and 2nd thoracic nerves, synapse in the superior cervical ganglion, from where postganglionic fibers pass upward along the internal carotid artery to supply dilator pupillae, the involuntary fibers in levator palpebrae superioris, and ciliary muscle contraction for far vision. Before testing these nerves, observe—

1. If there is any squint—the patient should also be asked if he/ she sees double (diplopia).
2. The condition of the pupils—whether they are equal in size and regular in outline, whether they are abnormally dilated or contracted, and their reaction to light and accommodation.

5.1. Demonstrate the light reflex in the subject provided. What is the pathway of this reflex? Write an explanation.

a).Direct light reflex Each eye is tested separately in a shady place. The subject is asked to look at a distance. A bright light from a torch, *brought from the side of the eye*, is shined into the eye—the result is a prompt constriction of the pupil. When the light is switched off, the pupil quickly dilates to its previous size.

b). Indirect or consensual light reflex A hand is placed between the two eyes, and light is shined into one eye, observing the effect on the pupil of the unstimulated side. There is a constriction of the pupil in the other eye—a response called the indirect or consensual light reflex. Thus, the pupils of both eyes constrict when light is thrown into any eye.

TASK 6. The Oculocardiac reflex. Explain results after person’s examination; draw the reflex arc and write an explanation.

While the examiner feels the pulse of the subject with one hand, a gentle pressure (during 20-30 sec) is applied on the eyeball with the thumb of the other hand. The response is a slowing of the heart. **Put your results in this table.**

	Before test (beats per minute)	After test (beats per minute)
Person’s pulse		

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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PRACTICAL LESSON 9

Credit lesson: Physiology of the excitable tissues. The role of CNS in the regulation physiological function.

1. Organization of the cell membrane. Structural Model of the Cell Membrane.
2. Transport through Cell Membrane. Basic mechanism of transport.
3. The ionic basis of Resting Membrane Potential.
4. The ionic basis of Local response.
5. The ionic basis of Action Potential.
6. Mechanism of Action Potential conduction along the Myelinated and Unmyelinated Nerve Fibers.
7. Mechanism transmission of active potential through neuromuscular junction.
8. Molecular basis of muscle contraction.
9. Molecular basis of contraction smooth muscle.
10. Role Ca^{++} ions in the physiology of muscle contraction.

11. ATP and Muscle Contraction
12. Sliding Filament Mechanism of Muscle Contraction.
13. Explain the energy sources and metabolism during of muscle contraction.
14. Function does Motor Unit
15. Excitatory Postsynaptic Potentials.
16. Inhibitory Presynaptic Potentials.
17. Inhibitory Postsynaptic Potentials.
18. Inhibition in the CNS: a. Lateral. b. Reciprocal. c. Renshaw.
19. The property of never centers.
20. Organization of the Spinal Cord for Motor Functions.
21. Proprioceptors: Muscle spindles, Golgi tendon organs, Joint kinesthetic receptors..
22. Muscle stretch reflex. Golgi tendon reflex.
23. Control of motor functions by the brain stem.
24. The cerebellum and its motor functions.
25. The basal ganglia and their motor functions.
26. Functions of specific neurotransmitter substances in the basal ganglia system.
27. Control of motor functions by the cerebral cortex and corticospinal tract.
28. General organization of the autonomic nervous system.
29. Physiological anatomy of the sympathetic nervous system.
30. Physiological anatomy of the parasympathetic nervous system.
31. Cholinergic and adrenergic fibers—secretion of acetylcholine or norepinephrine
32. Receptors on the effector organs.
33. Receptor Action by Altering Intracellular “Second Messenger” Enzymes.
34. Two Principal Types of Acetylcholine Receptors—Muscarinic and Nicotinic Receptors
35. Adrenergic Receptors—Alpha and Beta Receptors
36. The response of effectors organs to Sympathetic and Parasympathetic stimulation

Test tasks to control the source level of knowledge.

1. As a result of blockade of the ionic channels of the cell membrane its membrane resting potential diminished from -90 to -70 mV. What channels were blocked?
 - A. Sodium.
 - B. Potassium.
 - C. Calcium.
 - D. Magnesium.
 - E. Chloric.

2. As a result of activation of the ion channels of the external membrane the rest potential of an excitable cell has greatly increased. What channels were activated?
 - A. Potassium channels
 - B. Sodium channels

- C. Fast calcium channels
 - D. Slow calcium channels
 - E. Sodium and calcium channels
3. As a result of activating the ionic channels of external membrane of an excitable cell its resting potential was considerably increased. What channels were activated?
- A. Fast calcium.
 - B. Sodium.
 - C. Potassium.
 - D. Slow calcium.
 - E. Sodium and calcium.
4. The ionic channels of an excitable cell were blocked, as a result of which its resting potential disappeared completely soon after. What channels were blocked?
- A. Potassium and sodium.
 - B. Sodium.
 - C. Potassium.
 - D. Chloric.
 - E. Calcium.
5. Microelectrode analysis of nerve fiber bioelectrical activity revealed, that its membrane potential equals 90 mV. Its initial rest potential was 85 mV. What process occurs in this case?
- A. Hyperpolarization
 - B. Depolarization
 - C. Repolarization
 - D. Overshoot
 - E. Supernormality
6. It is necessary to get the increase of the membranous resting potential (hyperpolarization) in an experiment on an isolated excitable cell. What ionic channels will be activated for this purpose?
- A. Potassium and sodium.
 - B. Sodium.
 - C. Potassium.
 - D. Calcium.
 - E. Sodium and calcium.
7. The permeability of the irritable cell membrane for potassium ions has been increased during an experiment. What changes of membrane electric status can occur?
- A. Hyperpolarization
 - B. Depolarization
 - C. Action potential
 - D. Local response

- E. No changes
8. The irritation of what force is it necessary to inflict on a nervous fiber to cause excitation in the phase of relative refractory period?
- A. Under-threshold.
 - B. Above-threshold.
 - C. Threshold.
 - D. Under-threshold prolonged.
 - E. Threshold prolonged.
9. During the research of an isolated excitable cell it was stated that the threshold of the stimulation force of the cell diminished substantially. What was the reason for it?
- A. Blockade of energy production in the cell.
 - B. Inactivation of membrane sodium channels.
 - C. Inactivation of membrane calcium channels.
 - D. Activation of membrane potassium channels.
 - E. Activation of membrane sodium channels.
10. The ionic channels of an excitable cell were blocked. It did not change the level of the resting potential substantially, but the cell lost the capacity to the generation of action potential. What channels were blocked?
- A. Sodium.
 - B. Potassium.
 - C. Sodium and potassium.
 - D. Chloric.
 - E. Calcium.
11. The processes of energy production were completely blocked in an excitable cell. How will the membranous resting potential change as a result of it?
- A. Will increase insignificantly.
 - B. Will diminish insignificantly.
 - C. Will diminish substantially.
 - D. Will disappear.
 - E. Will increase substantially.
12. A tissue is acted on by an electric impulse of cathode direction with the amplitude of 70% threshold. What will the changes of membrane potential be as a result of it?
- A. Partial depolarization.
 - B. Hyperpolarization.
 - C. Action potential.
 - D. There will be no changes.
 - E. Inhibitory postsynaptic potential.

13. An experiment is conducted on a spinal frog. The time of defense flexor reflex decreased from 10 sec. to 6 sec. after increasing the area of the skin surface, which is acted on with acid solution. What mechanism underlies the diminishing of the time of defense flexor reflex?
- A. Irradiation of excitation on divergent nervous chains.
 - B. Spatial summation of excitation.
 - C. Temporal summation of excitation.
 - D. Principle of dominant.
 - E. Recirculation of excitation.
14. It is required to evaluate the level of tissue excitability. For this purpose one should determine:
- A. Depolarization threshold
 - B. Resting potential
 - C. Critical level of depolarization
 - D. Action potential amplitude
 - E. Action potential duration
15. It is necessary to estimate the level of the excitability of tissue in an experiment. What parameter is it necessary to define for this purpose?
- A. Threshold of depolarization.
 - B. Resting potential.
 - C. Duration of action potential.
 - D. Amplitude of action potential.
 - E. Critical level of depolarization.
16. During an experiment the dorsal roots of the spinal cord of an animal have been cut. What changes will be observed in the innervation zone?
- A. Decrease in muscle tone
 - B. Sensitivity loss and loss of motor functions
 - C. Increase in muscle tone
 - D. Sensitivity loss
 - E. Loss of motor Functions
17. The effect of electric current on the excitable cell caused depolarization of its membrane. Movement of what ions through the membrane caused depolarization?
- A. Na^+
 - B. HCO_3^-
 - C. Ca^{2+}
 - D. Cl^-
 - E. K^+

18. Stimulation of an excitable cell by the electric current has led to the depolarization of its membrane. The depolarization has been caused mainly by the following ions penetrating into the cell through its membrane:
- A. Na^+
 - B. HCO_3^-
 - C. Ca^{2+}
 - D. Cl^-
 - E. K^+
19. A sensitive neural ganglion consists of roundish neurocytes with one extension that divides into axon and dendrite at a some distance from the perikaryon. What are these cells called?
- A. Pseudounipolar
 - B. Unipolar
 - C. Bipolar
 - D. Multipolar
 - E. Apolar
20. Microelectrode technique allowed to register a potential following "all-or-none" law and being able of undecremental spreading. Specify this potential:
- A. Action potential
 - B. Excitatory postsynaptic potential
 - C. Rest potential
 - D. Inhibitory postsynaptic potential
 - E. Receptor potential
21. Rest potential of a cell equals -80 mV. At what stage of action potential did the membrane potential equal $+30$ mV?
- A. Reverse polarization
 - B. After hyperpolarization
 - C. After depolarization
 - D. Depolarization
22. An isolated muscle fiber is under examination. It was established that the threshold of stimulation force became significantly lower. What is the cause of this phenomenon?
- A. Activation of sodium channels of membrane
 - B. Activation of potassium channels of membrane
 - C. Inactivation of sodium channels of membrane
 - D. Inactivation of potassium channels of membrane
 - E. Block of energy production in the cell
23. In course of an experiment there has been an increase in the nerve conduction velocity. This may be caused by an increase in the concentration of the following ions that are present in the solution around the cell:

- A. Na^+
- B. K^+ and Cl^-
- C. K^+ and Na^+
- D. Ca^{2+} and Cl^-
- E. Ca^{2+}

24. An experiment was aimed at testing flexor reflex in a spinal frog, which was initiated by simultaneous stimulation with isolated pre-threshold electrical impulses. The frequency of those impulses was such, that the reflex occurred. What process in the nerve centers can be observed during this experiment?

- A. Temporal summation
- B. Spatial summation
- C. Presynaptic summation
- D. Postsynaptic summation
- E. Threshold summation

25. Local anesthetics (novocaine, lidocaine and others) decrease pain sensitivity of tissues by blocking Na^+ and K^+ ions from permeating membranes of nerve fibers and endings. Such mechanism of drug action is called:

- A. Membrane ionic
- B. Receptor
- C. Enzyme
- D. Antienzyme
- E. Direct chemical

26. After a traffic accident a patient of 36 got paralysis of muscles of extremities on the right, the loss of pain and temperature sensitivity on the left, partial reduction of tactile sensation on both sides. These changes are most characteristic of the defect of some part of brain. What part is it?

- A. Motor cortex on the left.
- B. Right half of spinal cord.
- C. Left half of spinal cord.
- D. Anterior division of the anterolateral pathway of spinal cord.
- E. Dorsal columns of spinal cord.

27. During the pathologoanatomic research of the spinal cord of a 70-year-old man the destruction and diminishing of the quantity of anterior horns nuclei cells in cervical and thoracic spines were found. What functions were damaged during the man's life?

- A. Moving functions of the lower extremities.
- B. Moving functions of the upper extremities.
- C. Sensitiveness and moving functions of the upper extremities.
- D. Sensitiveness of the lower extremities.
- E. Sensitiveness of the upper extremities.

28. The ventral roots of 5 frontal segment of spinal cord were cut during experiment in the animal. What changes will take place in the innervation region?
- A. Loss of movements
 - B. Loss of touch sensitivity
 - C. Loss of temperature sensitivity
 - D. Loss of proprioceptive sensitivity
 - E. Hypersensitivity
29. In response to a muscle stretch its reflex contraction is observed. From the irritation of what receptors does this reflex reaction begin?
- A. Muscular spindles.
 - B. Tendon Golgi's receptors.
 - C. Articular.
 - D. Tactile.
 - E. Nociceptor.
30. In response to a strong rapid reduction of a muscle its reflex weakening is observed. With the irritation of what receptors does this reflex reaction begin?
- A. Muscular spindles.
 - B. Tendon Golgi's receptors.
 - C. Articular.
 - D. Tactile.
 - E. Nociceptor.
31. During an experiment the myotatic reflex has been studied in frogs. After extension in a skeletal muscle its reflectory contraction was absent. The reason for it might be a dysfunction of the following receptors:
- A. Muscle spindles
 - B. Nociceptors
 - C. Articular
 - D. Golgi tendon organs
 - E. Tactile
32. Brain tomography revealed a tumor in the region of red nucleus. What part of brain is damaged?
- A. Midbrain
 - B. Medulla oblongata
 - C. Cerebellum
 - D. Interbrain
 - E. Pons cerebelli
33. In course of an experiment a toad's right labyrinth was destroyed. It will cause amyotonia of the following muscles:
- A. Right extensors

- B. Left flexors
- C. Left extensors
- D. Right flexors
- E. Right and left extensors

34. Surface with an intact toad on it was inclined to the right. Tone of extensor muscles became reflectory higher due to the activation of the following receptors:

- A. Vestibuloreceptors of utricle and saccule
- B. Vestibuloreceptors of semicircular ducts
- C. Mechanoreceptors of foot skin
- D. Photoreceptors of retina
- E. Proprioceptors

35. Vestibular receptors of semicircular canals of an animal have been destroyed. What reflexes will disappear as a result?

- A. Statokinetic reflex during movements with angular acceleration
- B. Statokinetic reflex during movements with linear acceleration
- C. Head-righting reflex
- D. Body-righting reflex
- E. Primary orienting reflex

36. Red nuclei of a mesencephalic animal were destroyed in an experiment. Which reflexes disappear in this condition?

- A. Static postural vestibular.
- B. Static postural neck.
- C. Straightening and statokinetic.
- D. Myotatic tonic.
- E. Myotatic phasic.

37. A hemorrhage into the brainstem of a patient of 70 is diagnosed. The examination found out the increase of the tone of flexor muscles and the decline of the tone of extensor muscles. The irritations of what structures of brain can explain the changes in the tone of muscles?

- A. Substantia nigra.
- B. Vestibular nuclei.
- C. Quadrigeminal plate.
- D. Red nuclei.
- E. Reticular formation.

38. An animal has an increased tonus of extensor muscles. This is the result of intensified information transmission to the motoneurons of the spinal cord through the following descending pathways:

- A. Vestibulospinal
- B. Medial corticospinal

- C. Reticulospinal
- D. Rubrospinal

39. A research was carried out on a decerebrated animal. What structures of the animal should be ruined for rigidity to disappear?

- A. Substantia nigra.
- B. Red nuclei.
- C. Vestibular lateral nuclei.
- D. Medial reticular nuclei.
- E. Lateral reticular nuclei.

40. A supertension of extensor muscles of extremities and back (decerebrate rigidity) is observed in an experiment on a cat. What level is the section done at?

- A. Spinal cord.
- B. Between spinal cord and medulla oblongata.
- C. Below vestibular nuclei.
- D. Above red nuclei.
- E. Below red nuclei.

41. The section of a cat's brain lead to the decerebrate rigidity — the jump of tone of extensor muscles. What level of brain was the section made at?

- A. Between medulla oblongata and spinal cord.
- B. Between diencephalon and mesencephalon.
- C. Between mesencephalon and metencephalon.
- D. Between diencephalon and telencephalon.
- E. Between medulla oblongata and pons.

42. A woman of 25 felt nausea, vomiting, and the increase of sweat secretion while being on a merry-go-round. The activation of what receptors stipulated reflex development of these symptoms?

- A. Corti's organ.
- B. Proprioceptors of skeletal muscles.
- C. Vestibular receptors of semicircular ducts.
- D. Visual.
- E. Otoconia vestibular.

43. Pushing a barbell a sportsman pulls the head back for the maximal increase of the tone of the upper extremities extensor muscles. Where are the local centers of the reflexes arising here situated?

- A. In the spinal cord.
- B. In the motor cortex.
- C. In basal nuclei.
- D. In red nuclei.
- E. In Deiters' nuclei.

44. In an experiment on a cat one irritates a cerebrum motor structure, as a result there is an increase of the tone of extensor muscles on the side of stimulation. What structures of cerebrum are irritated?
- A. Nucleus reticularis medialis.
 - B. Nucleus caudatus.
 - C. Nucleus ruber.
 - D. Nucleus vestibularis lateralis.
 - E. Nucleus intermedius lateralis.
45. A person who was rolling on a merry-go-round got an increase of heart beats, perspiration, nausea. With the irritation of what receptors is it connected first of all?
- A. Visual.
 - B. Proprioceptors.
 - C. Tactile.
 - D. Auditory.
 - E. Vestibular.
46. After the introduction of microelectrodes into the structures of diencephalon the animal's eyesight failed completely. What subcortex structure was possibly damaged?
- A. Suprachiasmatic nucleus of hypothalamus.
 - B. Medial geniculate body.
 - C. Associative nuclei of thalamus.
 - D. Supraoptical nuclei of hypothalamus.
 - E. Lateral geniculate body.
47. As a result of the destruction of certain brainstem structures an animal lost orientative reflexes in response to strong photic stimuli. What structures were ruined?
- A. Substantia nigra.
 - B. Posterior tubercles of quadrigeminal plate.
 - C. Red nuclei.
 - D. Vestibular nuclei.
 - E. Anterior tubercles of quadrigeminal plate.
48. As result of the destruction of certain brainstem structures an animal lost orientative reflexes in response to strong sound stimuli. What structures were ruined?
- A. Red nuclei.
 - B. Anterior tubercles of quadrigeminal plate.
 - C. Posterior tubercles of quadrigeminal plate.
 - D. Vestibular nuclei.
 - E. Substantia nigra.
49. After destruction of CNS structures an animal lost orientative reflexes. What structure was destroyed?

- A. Quadrigeminal plate
- B. Red nucleus
- C. Lateral vestibular nuclei
- D. Black substance
- E. Medial reticular nuclei

50. As a result of damage to certain structures of brainstem an animal lost orientation reflexes. What structures were damaged?

- A. Quadritubercular bodies
- B. Medial nuclei of reticular formation
- C. Red nuclei
- D. Vestibular nuclei
- E. Black substance

51. After a domestic trauma a patient of 18 began to complain of permanent giddiness, nystagmus of eyes, scanning speech, uncertain gait. Dysfunction of what structures of cerebrum does it testify to?

- A. Vestibular nuclei.
- B. Motor cortex.
- C. Basal nuclei.
- D. Substantia nigra.
- E. Cerebellum.

52. A man with one CNS part affected has asthenia, muscular dystonia, imbalance. What CNS part is affected?

- A. Red nuclei.
- B. Substantia nigra.
- C. Reticular formation.
- D. Cerebellum.
- E. Vestibular nuclei.

53. In vertical position a patient loses balance when closing eyes. What structures of brain are probably damaged?

- A. Basal ganglia.
- B. Cerebellum.
- C. Limbic system.
- D. Thalamus.
- E. Precentral gyrus of the cortex of cerebral hemispheres.

54. A patient underwent an extraction of a part of a CNS structures by medical indications. As a result of the extraction the patient developed atony, astasia, intention tremor, ataxy and adiadochokinesis. Which part of CNS structure had been extracted?

- A. Cerebellum
- B. Amygdaloid corpus

- C. Hippocamp
- D. Basal ganglions
- E. Limbic system

55. A patient presents with the following motor activity disturbances: tremor, ataxia and asynergia movements, dysarthria. The disturbances are most likely to be localized in:

- A. Cerebellum
- B. Basal ganglions
- C. Limbic system
- D. Brainstem
- E. Medulla oblongata

56. A patient with injury sustained to a part of the central nervous system demonstrates disrupted coordination and movement amplitude, muscle tremor during volitional movements, poor muscle tone. What part of the central nervous system was injured?

- A. Cerebellum
- B. Medulla oblongata
- C. Diencephalon
- D. Mesencephalon
- E. Prosencephalon

57. A patient staggers and walks astraddle. He has hypomyotonia of arm and leg muscles, staccato speech. In what brain section is this affection localized?

- A. Cerebellum
- B. Putamen
- C. Caudate nucleus
- D. Motor cortex
- E. Red nucleus

58. As a result of craniocerebral trauma a patient reveals the following symptoms: intention tremor, dysmetria, adiadochokinesis, and dysarthria. What structure of the brain is injured?

- A. Cerebellum
- B. Striatum
- C. Motor cortex
- D. Pale sphere
- E. Black substance

59. A patient gets tired quickly. While standing with closed eyes he is reeling, losing balance. Skeletal muscle tone is reduced. Which of the following structures of the person's brain is probably affected?

- A. Hypothalamus.
- B. Thalamus.
- C. Cerebellum.

- D. Precentral gyrus of cerebral hemispheres cortex.
- E. Basal ganglia.

60. A 50-year-old patient was injured on the occipital region of the head. The closed skull trauma was diagnosed. She was taken to the hospital. The medical examination: deregulation of walking and balance, trembling of arms. What part of brain was injured?

- A. The cerebellum
- B. The medulla oblongata
- C. The hindbrain
- D. The interbrain
- E. The spinal cord

61. A woman of 64 has disorders of fine movements of fingers, evident muscular rigidity, and tremor. A neurologist diagnosed Parkinson's disease. The defect of what structure of cerebrum resulted in this disease?

- A. Reticular formation.
- B. Thalamus.
- C. Red nuclei.
- D. Cerebellum.
- E. Substantia nigra.

62. A patient was diagnosed with Parkinson's syndrome. It is connected with the disorder of some transmitter systems of cerebrum. What transmitter systems are these?

- A. Histaminergic.
- B. Dopaminergic.
- C. Serotonergic.
- D. Cholinergic.
- E. Opioid.

63. Parkinson's disease is caused by disruption of dopamine synthesis. What brain structure synthesizes this neurotransmitter?

- A. Substantia nigra
- B. Globus pallidus
- C. Corpora quadrigemina
- D. Red nucleus
- E. Hypothalamus

64. After a craniocerebral trauma a patient lost the ability to execute learned purposeful movements (apraxia). The injury is most likely localized in the following region of the cerebral cortex:

- A. Gyrus supramarginalis
- B. Gyrus angularis
- C. Gyrus paracentralis

- D. Gyrus lingualis
- E. Gyrus parahippocampalis

65. A patient got a trauma that caused dysfunction of motor centers regulating activity of head muscles. In what parts of cerebral cortex is the respective center normally localized?

- A. Inferior part of precentral gyrus
- B. Superior part of precentral gyrus
- C. Supramarginal gyrus
- D. Superior parietal lobule
- E. Angular gyrus

66. A 68-year-old woman cannot move her upper and lower right extremities after stroke. Muscle tone of these extremities and reflexes are increased. There are pathological reflexes. What form of the paralysis is it?

- A. Hemiplegia
- B. Paraplegia
- C. Tetraplegia
- D. Monoplegia
- E. Dissociation

67. For better examination of the fundus of eye a doctor began to drip the solution of atropine on the conjunctiva of the patient's eye. It resulted in pupil expansion. The blockade of what membranous cytoceptors stipulated such effect?

- A. H₂-receptors.
- B. N-Cholinoreceptors.
- C. α -adrenoreceptors.
- D. β -adrenoreceptors.
- E. M-Cholinoreceptors.

68. Introduction of a pharmaceutical substance to an experimental animal resulted in reduction of salivation, pupil mydriasis. Next intravenous introduction of acetylcholine didn't lead to any significant changes of heart rate. Name this substance:

- A. Atropine
- B. Adrenaline
- C. Propranolol
- D. Proserin
- E. Salbutamol

69. The consequence of what process is the persistent dilation of pupil under the conditions of intense illumination?

- A. Paralysis of ciliary muscle.
- B. Normal state of regulatory mechanisms.
- C. Overactivity of the parasympathetic part of the nervous system.

- D. Paralysis of the muscle that expands the pupil.
 - E. Overactivity of the sympathetic part of the nervous system.
70. A peripheral segment of vagus nerve on a dog's neck was being stimulated in course of an experiment. The following changes of cardiac activity could be meanwhile observed:
- A. Heart rate fall
 - B. Heart hurry
 - C. Enhancement of atrioventricular conduction
 - D. Heart rate and heart force amplification
 - E. Increased excitability of myocardium
71. A man was intoxicated with mushrooms. They contain muscarine that stimulates muscarinic cholinoreceptors. What symptoms signalize intoxication with inedible mushrooms?
- A. Myotic pupils
 - B. Mydriatic pupils
 - C. Bronchodilation
 - D. Increased heart rate
 - E. Rise of arterial pressure
72. During fighting a man had a cardiac arrest as a result of a hard blow to the upper region of anterior abdominal wall. Which of the described mechanisms might have provoked the cardiac arrest?
- A. Parasympathetic unconditioned reflexes
 - B. Sympathetic unconditioned reflexes
 - C. Parasympathetic conditioned reflexes
 - D. Sympathetic conditioned reflexes
 - E. Peripheric reflexes
73. If a man has an attack of bronchospasm it is necessary to reduce the effect of vagus on smooth muscles of bronchi. What membrane cytoceptors should be blocked for this purpose?
- A. M-cholinoreceptors
 - B. N-cholinoreceptors
 - C. α -adrenoreceptors
 - D. β -adrenoreceptors
 - E. α - and β -adrenoreceptors
74. A 60-year-old patient was diagnosed with hypothalamic lateral nuclei stroke. What changes in patient's behavior may be expected?
- A. The rejection of food
 - B. Aggressive behavior
 - C. Depression

- D. Thirst
- E. Unsatisfied hunger

75. Upper neck node of sympathetic trunk was removed from the rabbit on experiment. Reddening and increased temperature of the skin of head is observed. What disorder of peripheral circulation of the blood has developed?

- A. Neuroparalytic arterial hyperemia
- B. Neurotonic arterial hyperemia
- C. Metabolic arterial hyperemia
- D. Venous hyperemia
- E. Stasis

76. Arterial pressure of a surgeon, who performed a long operation, rised up to 140/110 mm Hg. What changes of humoral regulation could have caused the rise of arterial pressure in this case?

- A. Activation of sympathoadrenal system
- B. Activation of formation and excretion of aldosterone
- C. Activation of renin-angiotensine system
- D. Activation of kallikrein-kinin system
- E. Inhibition of sympathoadrenal system

77. An aged man had raise of arterial pressure under a stress. It was caused by activation of:

- A. Sympathoadrenal system
- B. Parasympathetic nucleus of vagus
- C. Functions of thyroid gland
- D. Functions of adrenal cortex
- E. Hypophysis function

78. Students who are taking examinations often have dry mouth. The mechanism that causes this state is the realization of the following reflexes:

- A. Conditioned sympathetic
- B. Unconditioned parasympathetic
- C. Conditioned parasympathetic
- D. Unconditioned sympathetic
- E. Unconditioned peripheral

79. A man got poisoned with mushrooms. They contain muscarine that stimulates muscarinic cholinoreceptors. What symptom is typical for poisoning with inedible mushrooms?

- A. Miosis
- B. Mydriasis
- C. Bronchodilation
- D. Heart rate rise

E. Arterial pressure rise

80. The minute blood volume in a patient with transplanted heart has increased as a result of physical activity. What regulative mechanism is responsible for these changes?

- A. Catecholamines
- B. Sympathetic unconditioned reflexes
- C. Parasympathetic unconditioned reflexes
- D. Sympathetic conditioned reflexes
- E. Parasympathetic conditioned reflexes

81. Experimental stimulation of the sympathetic nerve branches that innervate the heart caused an increase in the force of heart contractions because the membrane of typical cardiomyocytes permitted an increase in:

- A. Calcium ion entry
- B. Calcium ion exit
- C. Potassium ion exit
- D. Potassium ion entry
- E. Calcium and potassium ion exit

Content Sections #6. Humoral regulation and the endocrine gland role in the visceral function regulation.

PRACTICAL LESSON 10.

Theme: Introduction to Endocrinology. Pituitary Hormones and their control by the Hypothalamus. The Thyroid Gland and Thyroid metabolic hormones.

THE GOALS:

To study the mechanisms of hormonal regulation of physiological functions. To study the laws of functioning of Endocrinologic system.

The Initial level of the knowledge

1. Anatomy and histology the Pituitary gland, the Hypothalamus, the Thyroid gland.

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Properties of Endocrine and Nervous Systems.
2. Role of Endocrine Systems system in homeostasis.
3. Coordination of body functions by chemical messengers.
4. Chemical structure and synthesis of hormones.
5. Hormone secretion, transport, and clearance from the blood.
Hormone Secretion After a Stimulus and Duration of Action of Different Hormones.
6. Feedback control of hormone secretion.
7. Hormone transport and Clearance from the Blood.
8. Describe the structure of Hormones and the mechanism of their action (Steroid hormones, Peptide and Protein Hormones).
 - a. Hormone receptors and their activation

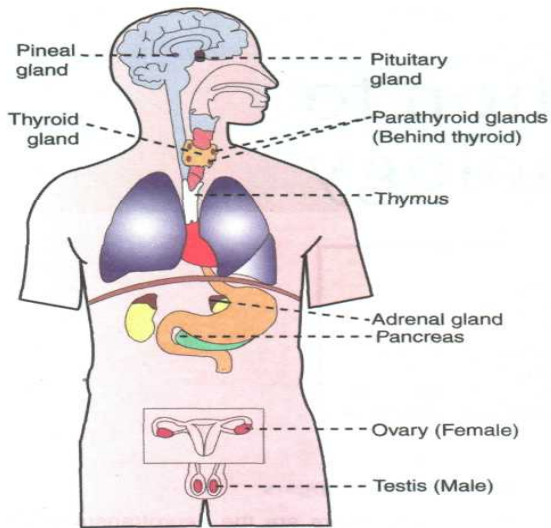
- b. Mechanism of hormonal action
- 9. Hypothalamo-hypophyseal Relationship.
 - a. Regulation of anterior pituitary secretion
- 10. Hormones secreted by anterior pituitary
 - a. Growth hormone
 - b. Other hormones of anterior pituitary
- 11. Hormones of Posterior pituitary or neurohypophysis
 - a. Antidiuretic hormone
 - b. Oxytocin
- 12. Applied physiology – disorders of pituitary gland

INDEPENDENT PRACTICAL WORK

TASK 1. Put the information about chemical messengers in this table.

substances	major functions
<i>Endocrine messenger</i>	
<i>Neurocrine messenger</i>	
<i>Paracrine messenger</i>	
<i>Autocrine messenger</i>	

TASK 2. Look at this figure and write an explanation about function of endocrine system.



Source: <https://www.quora.com/What-are-the-different-hormones-secreted-by-the-different-parts-of-the-endocrine-system>

TASK 3. What is different between Steroid and Peptide Hormones action? Write an explanation.

TASK 4. Put the information about the Mechanisms of Hormone synthesis Regulation in this table.

	mechanisms	an example
<i>Positive/Negative Feedback Mechanisms</i>		
<i>feed-forward loop Mechanisms</i>		
<i>Push/Pull systems</i>		

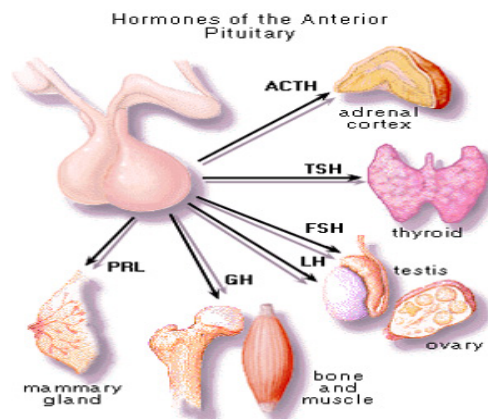
TASK 5. Put the information about the effect o Hormones which produce by Hypothalamus in this table.

Hormone	Chemical structure	action	Target organ

<i>Growth hormone releasing hormone</i>			
<i>Growth hormone releasing polypeptide</i>			
<i>Growth hormone inhibitory hormone</i>			
<i>Thyrotropic releasing hormone</i>			
<i>Corticotropin releasing hormone</i>			
<i>Gonadotropin releasing hormone</i>			

<i>Prolactin inhibitory hormone</i>			
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TASK 6. Look at this figure and write an explanation about function of anterior Pituitary hormones.

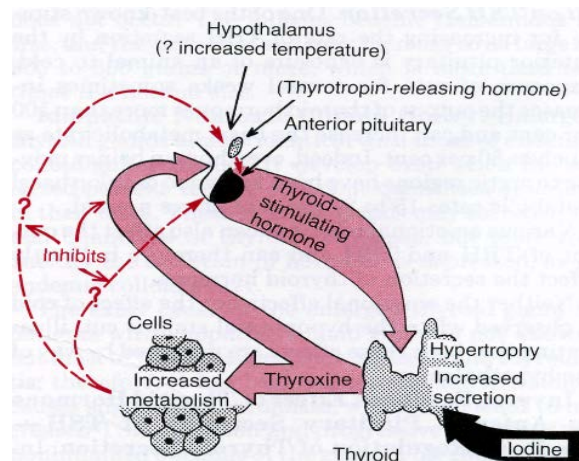


Source: <https://www.ottawahospital.on.ca/en/documents/2017/03/pituitary-disease-handbook-eng.pdf/>

TASK 7. Put the information about the intermedium and posterior Pituitary hormones in this table.

hormone	chemical structure	action
Melanocyte-stimulating hormone		
Vasopressin		
Oxytocin		

TASK 8. Draw the scheme of Regulation of the Thyroid secretion and write an explanation.



Source: <https://qsstudy.com/regulation-thyroid-hormone-secretion-ths/>

THE CONTROL OF THE LEVEL OF KNOWLEDGE

The signature of the report by teacher

Content Sections #6. Humoral regulation and the endocrine gland role in the visceral function regulation.

PRACTICAL LESSON 11

Theme: The endocrine functions of the Parathyroid gland, the Pancreas, the Adrenal Medulla and Adrenal Cortex. The hormonal control of Calcium metabolism. The endocrine function of the reproductive system. The endocrine functions of the Kidneys, the Heart, and the Pineal gland.

THE GOALS:

To study mechanisms of hormonal regulation of physiological functions.

Initial level of knowledge

1. Anatomy and histology the Thyroid gland, the Pancreas, the Adrenal Medulla, the Adrenal Cortex, Parathyroid gland, the Pineal gland , the Reproductive system.

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Describe the physiologic functions of the Thyroid hormones.

2. Describe the physiologic functions of the Parathyroid hormones.
3. Explain the effects of Insulin and Glucagon and the mechanism of their action. What do you know about the Endocrinologic pathologies of Pancreas?
4. The Adrenal Medulla, its structure and the function of medullary hormones. Describe the regulation of Adrenal Medullary secretion
5. The Adrenal Cortex, its structure and the Cortex hormones (Glucocorticoids and Mineralocorticoids) function. Describe the regulation of Adrenal Cortex secretion
6. What do you know about the Endocrinologic pathologies of Adrenal gland?
7. Describe the effects of Androgens and Estrogens.
8. Describe the endocrine functions of Kidneys, Heart and Pineal gland.

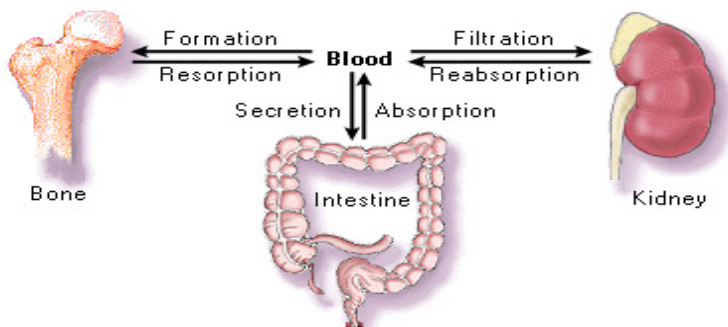
PRACTICAL WORK

TASK 1. Put the information about the Physiologic effects of Thyroid hormones in the table

target tissue	effect	mechanism
<i>Heart</i>		
<i>Adipose tissue</i>		
<i>Muscle</i>		
<i>Bone</i>		
<i>Nervous system</i>		
<i>Gut</i>		
<i>Lipoprotein</i>		

--	--	--

TASK 2. Look at this figure and write an explanation about Parathormone functions.



Source: <https://www.hormones-australia.org.au/the-endocrine-system/parathyroid/>

TASK 3. Put the information about the effects of Insulin on various tissues in this table

Adipose tissue	Muscle	Liver	General

TASK 4. Put the information about the effects of Insulin deficiency

Glucose uptake	Protein catabolism	Lipolysis

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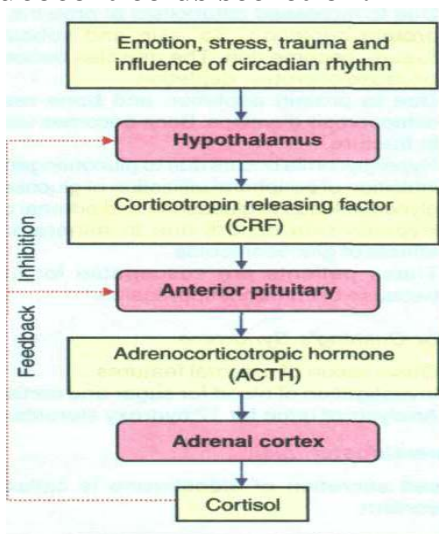
TASK 5. Put the information about the factors affecting Glucagon secretion

Stimulators	Inhibitors

TASK 6. Put the information about the effects of Glucocorticoids on various tissues in this table

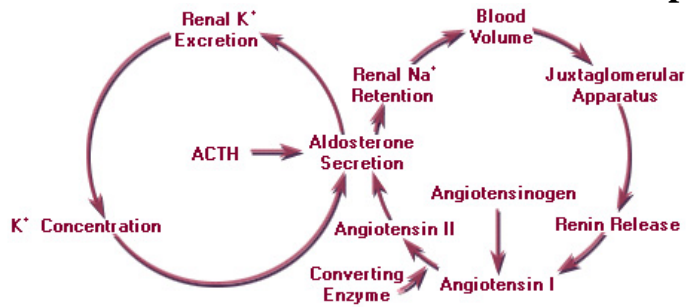
Hormones	Effects

TASK 7. Look at this scheme and write an explanation about regulations of Glucocorticoids secretion.



Source: <https://www.jaypeedigital.com/book/9789385999468/chapter/ch54>

TASK 8. Look at this scheme and write an explanation about Aldosterone effects.



Source: https://www.researchgate.net/figure/Feedback-loops-regulating-aldosterone-secretion-Reproduced-with-permission-from-G_fig3_10723296

TASK 9. Put the information about the Adrenaline effects in this table

Organs	Effects

THE CONTROL OF THE LEVEL OF KNOWLEDGE

The signature of the report by teacher

Content Sections #7. Physiology of the sensory systems.

PRACTICAL LESSON 12

Theme: Sense organs. Physiology of receptors system. Initiation of impulses in Sense organs. Somatic sensations: General organization, the Tactile and Position Senses. Pain, Headache and Thermal sensation.

THE GOALS:

To study the physiology of receptors' system

Initial level of the knowledge

1. Anatomy of Sense organs

THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. What's meaning of the Sensory organs and receptors system?
2. What do you know about classifications of Sensory organs?
3. Describe the characteristics of Sensory receptors: mechanoreceptors, thermoreceptors, nociceptors, electromagnetic receptors, chemoreceptors.
4. Mechanism of Receptor potentials.
5. Adaptation of receptors.
6. Nerve fibers that transmit different types of signals, and their physiologic classification.
7. Transmission of signals of different intensity in Nerve tracts – spatial and temporal summation.
8. Classification of Somatic Senses. Tactile sensations, Vibration; tickle and itch. Vibratory sensation
9. The types of Pain and their qualities – fast Pain and slow Pain.
10. Pain receptors and their stimulation.
11. Pain suppression (“Analgesia”) System in the Brain and Spinal cord.
12. Referred Pain and Visceral Pain.
13. Thermal receptors and their excitation.

INDEPENDENT PRACTICAL WORK

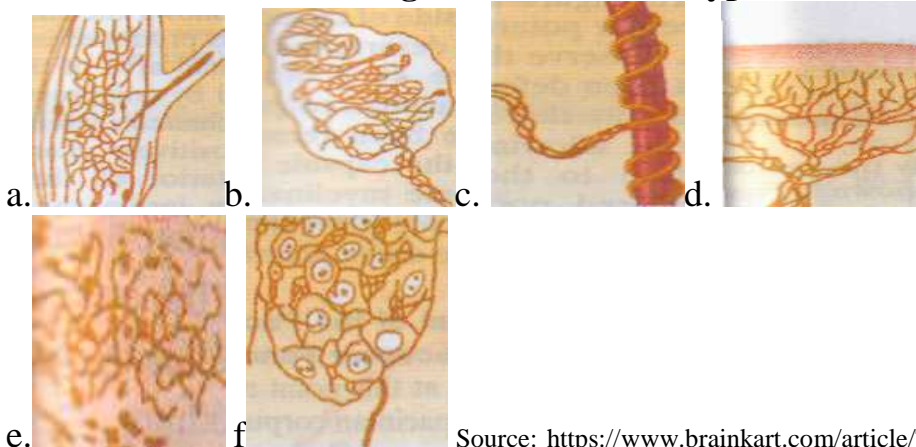
TASK 1. Write the information about “Classifications of Sensory receptors” in the table.

Table 1. Classifications of Sensory receptors

Organs	Sensory receptors	Types of sensory receptors
for example: taste	Receptors of taste buds	chemoreceptors
	Merkel's discs	
	Vestibular receptors	
	Meissner's corpuscles	

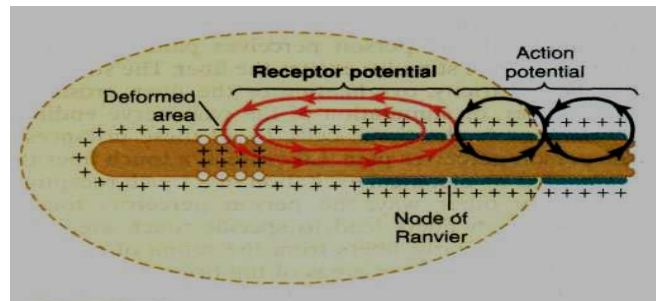
	Cool receptors	
	Free nerve endings	
	Muscle spindles	
	Golgi tendon receptors	
	Pacinian corpuscles	
	Sound receptors of cochlea Equilibrium	
	Warm receptors	
	Baroreceptors	
	Krause's corpuscles	
	Ruffini's endings	
	Nociceptors	
	Receptors of olfactory epithelium	
	Rods, Cones	

TASK 2. Look at these figures. Write their types name and describe all functions



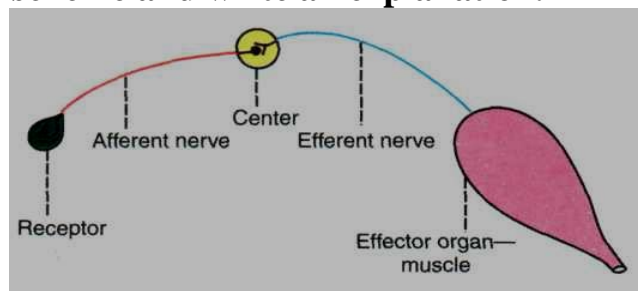
e. Source: https://www.brainkart.com/article/Types-of-Sensory-Receptors-and-the-Sensory-Stimuli-They-Detect_19632/

TASK 3. Look at this figure. Write an explanation about excitation of a sensory nerve fiber by a receptor potential produced in a Pacinian corpuscle



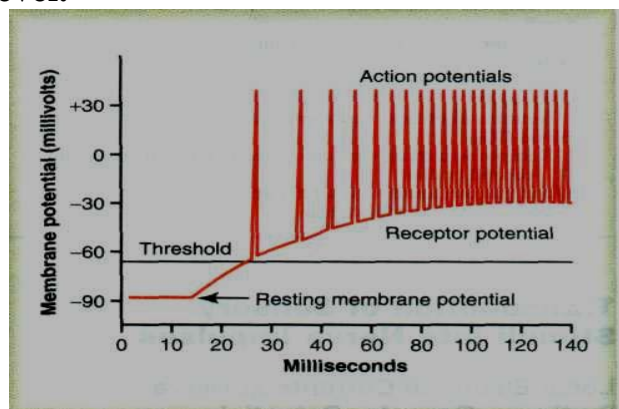
Source: https://www.brainkart.com/article/Transduction-of-Sensory-Stimuli-into-Nerve-Impulses_19633/

TASK 4. Look at this scheme and write an explanation.



Source: <https://www.jaypeedigital.com/book/9789350259368/chapter/ch142>

TASK 5. Look at this scheme and write an explanation of the typical relationship between receptor potential and action potential when the receptor potential rises above the threshold level.



Source: <https://doctorlib.info/physiology/textbook-medical-physiology/46.html>

TASK 6. Draw the scheme:

A). “Divergence” in neuronal pathways (in same tract and in multiple tracts);

B). “Convergence” in neuronal pathways (from single source and from multiple sources).

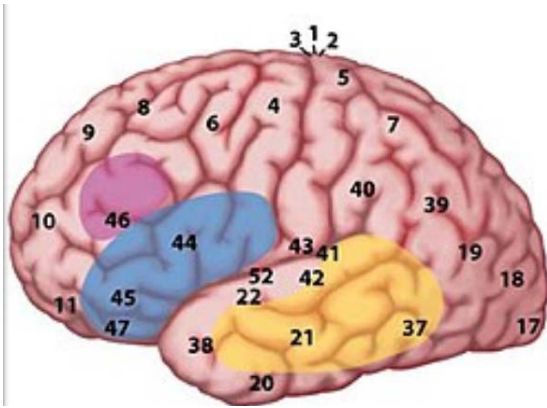
Write the explanations about differences between “Divergence” and “Convergence”.

TASK 7. Write the explanation of clinical tasks.

1. Why don't we usually feel clothes we are having on? Why do we sometimes feel them?

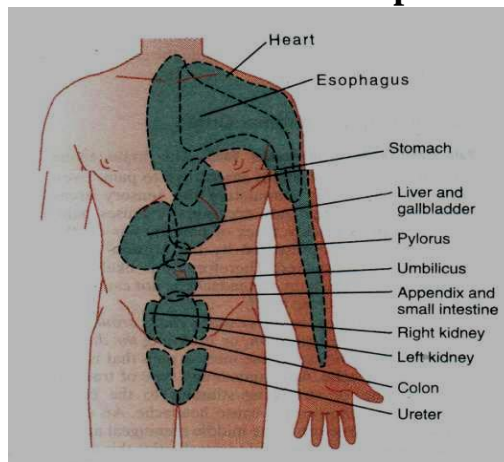
2. What's the difference between the notion “receptors” and “organs of sense”?

TASK 8. Look at this figure. What kind of functions can specifically areas (1, 2, 3, 5, 7) of the brain have? Describe an explanation.



Source: <https://medical-enc.com.ua/arhitektonika-kory-bolshogo-mozga.htm>

TASK 9. Look at these figures. Write the explanations about the reasons for referred pain. Put information about the sites of referred pain in this table.



Source: <https://doctorlib.info/physiology/textbook-medical-physiology/48.html>

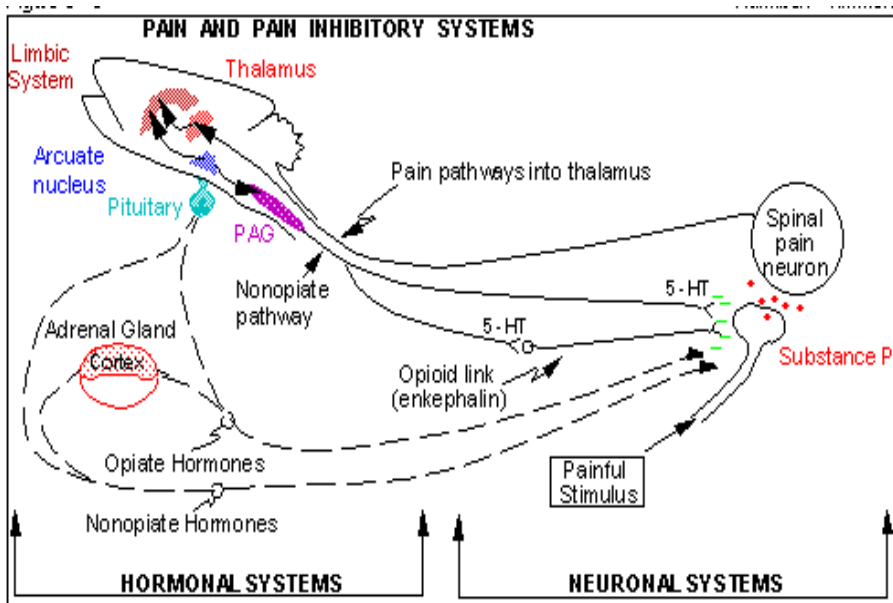
#	organ	region of referred pain
	Heart	
	Esophagus	
	Stomach	
	liver and gallbladder	
	appendix and small intestine	

right kidney	
left kidney	
colon	
Ureter	

TASK 10. Look at these figures. Write the explanations about the pain inhibitory system. Put information in this table.

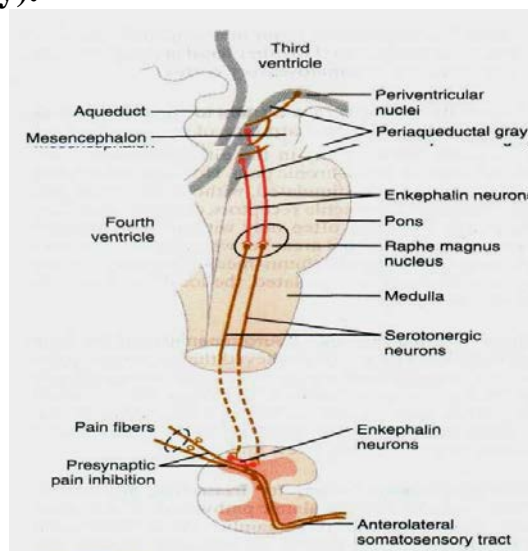
#	Hormonal pain inhibitory system		Neuronal pain inhibitory system	
	Substance	action	substance	action

--	--	--	--



Source: <https://www.sciencedirect.com/topics/medicine-and-dentistry/pain-modulation>

TASK 12. Look at this figure, note morphologic components for this Pain pathway. Write an explanation of the transmission of pain signals into the thalamus and cortex via (the fast “pricking pain» pathway and the slow “burring pain» pathway).



TASK 13. Look at the general sensory scheme for tactile, pain and thermal sensations. You can use a table 144-1.

TABLE 144-1: Sensory pathways

Sensation	Receptor	First order neuron in	Second order neuron in	Third order neuron in	Center
Fine touch, Tactile localization, Tactile discrimination, Vibratory sensation, Stereognosis	Meissner's corpuscles and Merkel's disc	Posterior nerve root ganglion— Fibers form Fasciculus gracilis and Fasciculus cuneatus	Nucleus gracilis and Nucleus cuneatus— Internal arcuate fibers	Ventral posterolateral nucleus of thalamus	Sensory cortex
Pressure, Crude touch	Pacinian corpuscle	Posterior nerve root ganglion	Chief sensory cells— Fibers form anterior spinothalamic tract	Ventral posterolateral nucleus of thalamus	Sensory cortex
Temperature	Warmth— Raffini's end bulb Cold—Krause's end bulb	Posterior nerve root ganglion	Substantia gelatinosa— Fibers form lateral spinothalamic tract	Ventral posterolateral nucleus of thalamus	Sensory cortex
Conscious kinesthetic sensation	Proprioceptors— Muscle spindle, Golgi tendon apparatus, etc.	Posterior nerve root ganglion—Fibers form Fasciculus gracilis and Fasciculus cuneatus	Nucleus gracilis and nucleus cuneatus— Internal arcuate Fibers	Ventral posterolateral nucleus of thalamus	Sensory cortex
Subconscious kinesthetic sensation	Proprioceptors— Muscle spindle, Golgi tendon apparatus, etc.	Posterior nerve root ganglion	Clarke's column of cells and marginal cells— Fibers form dorsal and ventral spinocerebellar tracts	—	Cerebellum
Pain	Free nerve endings	Posterior nerve root Ganglion Fast pain – A δ fibers Slow pain – C fibers	Fast pain—marginal cells in spinal cord Slow pain—substantia gelatinosa	Ventral posterolateral nucleus of thalamus reticular formation and midbrain	Sensory cortex

TASK 14. The examination of touch.

Two-point discrimination (tactile discrimination)

The ability to distinguish two simultaneously applied touch stimuli as separate can be tested with a Weber's compass (it has two blunt and two sharp points, and a scale to read the distance between the two points), or an ordinary pair of dividers, or the heads of two pins.

Ask the subject to close his eyes. Test areas on the fingers, back of hands, forearms, legs and back of the subject for the minimum distance between two points which arouse two distinct touch sensations. Start with a separation of 1 millimeter between the two points, and varying this distance irregularly, find out the minimum distance, until a very slight reduction in the separation of the two points results in the sensation of being touched at only one site. The subject should report "one", "two", or "don't know". Record the minimum separation discriminated with certainty for each site in your workbook. Discrimination varies greatly in different regions of the body— 2 mm at the fingertips, a few cm on the forearms and legs, and many cm on the back. It is related to the density of the touch spots.

Results:

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Content Sections #7. Physiology of the sensory systems.

PRACTICAL LESSON 13.

Theme: The Vision system. The physiology and functions

THE GOALS:

To study the physiology of the Vision

Initial level of the knowledge

1. Anatomy of the eye

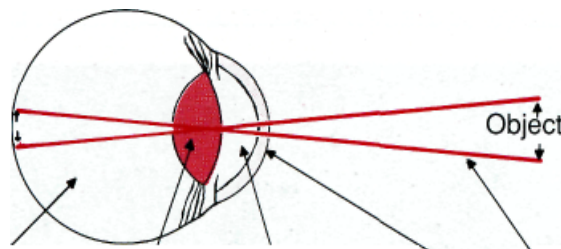
THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. The structure of the eye:
 - a) general description of the eyeball;
 - b) wall of the eyeball;
 - c) fundus oculi; intraocular fluid and pressure; lens;
 - d) ocular muscles and movements.
2. Pupillary reflexes
3. Mechanism of accommodation
4. The visual process:
 - a) image forming mechanism;
 - b) neural basis of visual process (structure and functions of rods and cones);
 - c) chemical basis of visual process (phototransduction, dark and light adaptation, night blindness);
 - d) electrical basis of visual process;
5. The Visual pathway
6. Acuity of vision.
7. The field of vision:
 6. Color vision.
8. Errors of refraction.

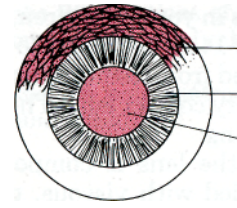
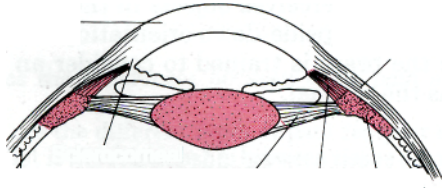
PRACTICAL WORK

TASK 1. Look at this figure and indicate the morphological components of the eye. Write an explanation about the structure of the eyeball.



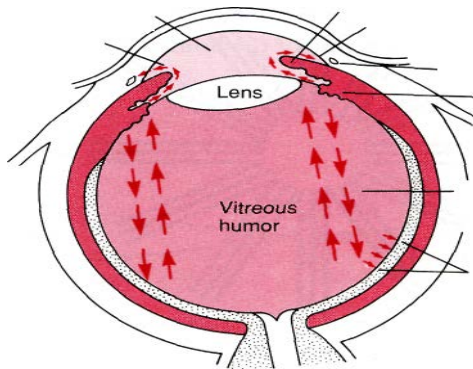
Source: <https://www.aao.org/education/image/angle-kappa-2>

TASK 2. Look at these figures and indicate their morphological components. Write an explanation about the mechanism of accommodation.



Source: https://www.brainkart.com/article/Mechanism-of---Accommodation-----Optics-of-the-Eye_19668/

TASK 3. Look at this figure and indicate their morphological components. Write an explanation about the formation and flow of fluid of an eye.



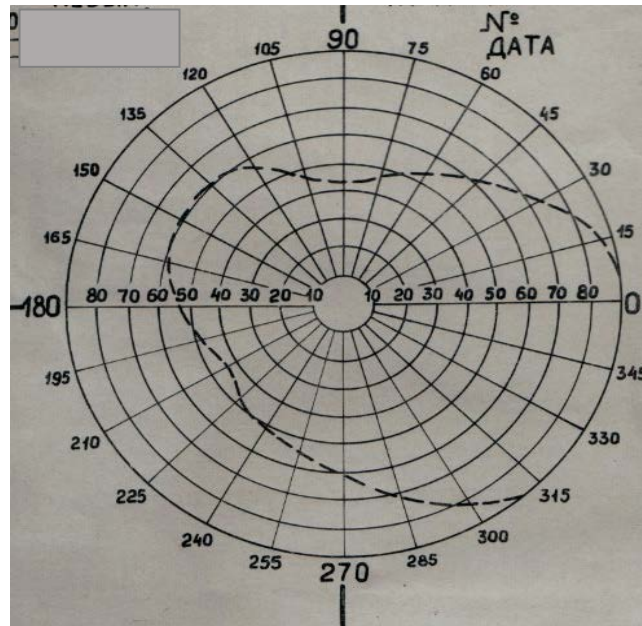
Source: <https://overallscience.com/intraocular-fluid/>

TASK 4. Test the visual acuity of the subject provided.

Visual acuity, i.e. the ability to see subjects clearly, is tested for distant as well as for near vision.

Testing for distant vision. For testing distant vision, special types of print varying in size are used. Each eye is tested separately. The subject is seated at a distance of 5 - 6 m from a well-lighted chart and the central visual acuity is recorded as a fraction as that of a person with normal vision. A person with normal vision can read the smallest test type (**the visual acuity is about 1.0**).

TASK 5. Perimetry.



Student Perimeter

In this model the inclination of the arc is read from a plastic dial fitted behind the mirror. When an object, which is moved along the inside of the arc, becomes visible, the angle it subtends at the fixation point (the mirror, for example) in a given meridian can be read from the scale engraved on the outside of the arc. The readings—the meridian and the angle-area then transferred to the corresponding points on the chart.

1). Place the perimeter on a table of suitable height and seat the subject in front of it. Fix a chart in the frame. Ask him to place his chin on the chin rest and adjust its height so that his eye (right eye, for example) is at the level of the mirror. Instruct the subject not to move his eye but to keep looking at the mirror. Tell him to cover his left eye with a cupped hand.

2). Position the arc on a zero meridian on the temporal side. Fix a 5 mm white object in the carrier and take it to the end of the arc, switch on the light. Ask the subject to say “yes” as soon as the object comes into view. Slowly move the object towards the mirror and as soon as the subject says “yes”, strike the chart holder against the pin so that it punches a hole in the chart.

The object will be visible beyond 90° on this side

3). Rotate the arc down wards (or upwards) by 30° and then take the object to the end of the arc, and move it towards the mirror. When it becomes visible you can mark the angle on the chart paper as before. Repeat the procedure after moving the arc by 30° each time until the arc returns back to the starting position (through 360 degrees).

4). To mark the blind spot, position the arc at 100° meridian (10° below the horizontal) on the temporal side. Move the object from the periphery towards the center. The subject will continue to see the object up to about 20°, and then it will disappear, but reappear once again after about 5°. Mark both the points on the chart; a small circle around these points will mark the blind spot which is 5-6° in

diameter and situated about 15 ° laterals to the fixation point. Plot the field of vision for the other eye in similar manner.

- 5). Record the peripheral field of vision of one eye for green, blue, and red objects.
- 6). Remove the chart from its holder and join all the pinholes with a pen to obtain the peripheral fields of visions for both the eyes. Note the area that is common to both eyes.
- 7). Examine the entire field of vision, in addition to mapping only the peripheral field of vision, by bringing the test object right up to the fixation point at the mirror, in all meridians, and noting if the object disappears after appearing at the periphery of the field. This will reveal if there is any scotoma in any part of the field.
- 8). **Examine the color fields. Put information about your results in table 2.**

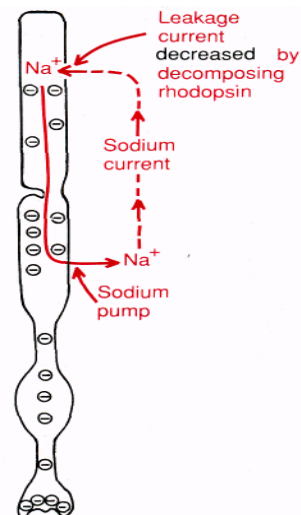
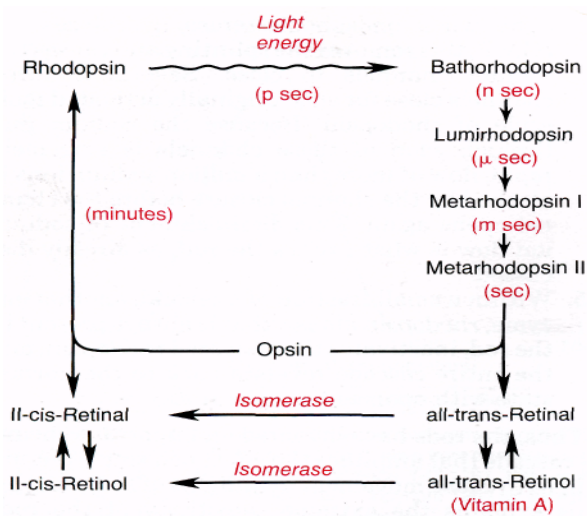
Table1. The average person's results

The color	External	Side lower	Interior	The upper
white	90	60	50	55
Green	30	25	20	20

Table2.

The color	External	Side lower	Interior	The upper
white				
Green				

TASK 6. Look at these figures. Write the explanations.



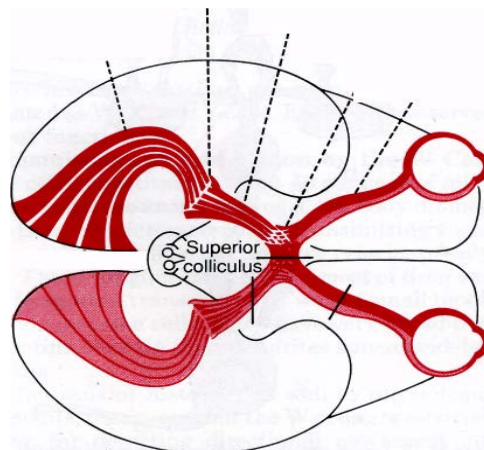
A.

Source: <https://doctorlib.info/physiology/textbook-medical-physiology/46.html>

B.

TASK 7. Draw the scheme of different variants of eye's accommodations. Explain the approach to its correction.

TASK 8. Draw this figure. Note morphological components. Write an explanation Visual pathway.



Source: <https://www.doctorc.net/EYE/CNSPROC.HTM>

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Content Sections #7. Physiology of the sensory systems.

PRACTICAL LESSON 14.

Theme: Physiology of Hearing and Equilibrium. Sensation of Taste and Smell.

THE GOALS:

To study the physiology of the Hearing and Equilibrium

Initial level of the knowledge

1. Anatomy of the Ear

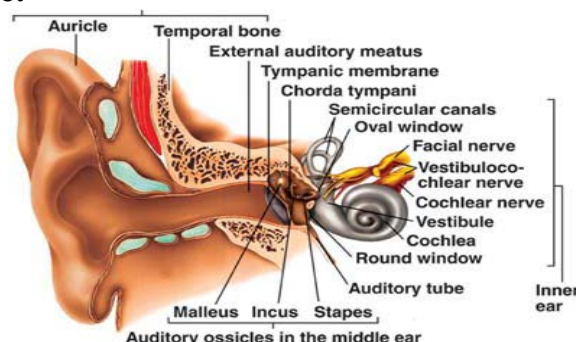
THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. The anatomic structure and physiological functions of an external Ear: auricle of pinna; external auditory meatus.
2. The middle ear and its function: tympanic cavity; tympanic membrane; auditory ossicles; auditory tube; muscles attached to auditory ossicles (m. tensor tympani and m. stapedius); tympanic reflex.
3. The internal ear and its function: a). compartments of spiral canal of cochlea (basilar membrane; vestibular membrane); b). scala vestibule; scala tympani; scala media.
4. The organ of Corti: border cells; inner and outer hair cells; inner and outer phalangeal cells; inner and outer pillar cells; cells of Hensen and cells of Claudius; tectorial membrane and reticular membrane.
5. The Auditory pathway (receptors; first, second and third order neurons; cortical auditory centers.. Mechanism of hearing: role of external ear; role of middle ear (role of tympanic membrane and auditory ossicles; types of conduction; role of Eustachian tube); role of inner ear (traveling wave; excitation of hair cells).
6. Electrical events during process of hearing (cochlear microphonic potential; endolymphatic potential; action potential in auditory nerve fiber).
7. Appreciation of loudness of sound; localization of sound.
8. Auditory defects: types and causes; tests for hearing (Whispering test; Tickling of watch test; Rinne's test; Weber's test; audiometry).
9. Structure of vestibular apparatus: labyrinth; semicircular canals; otolith organ.
10. Receptor organ of vestibular apparatus: crista ampullaris; macula. Nerve supply to vestibular apparatus.
11. Responses to rotational and linear acceleration.
12. Sensation of the Taste:
13. Sensation of Smell:

PRACTICAL WORK

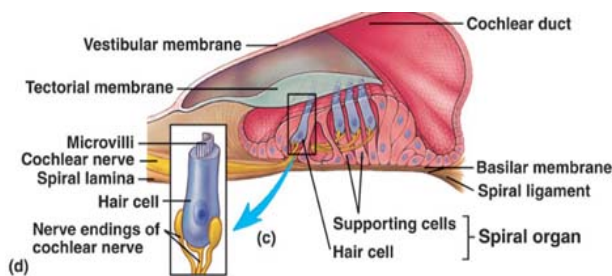
TASK 1. Draw this figure and put information about function of morphological parts of ear in this table.



Source: https://www.brainkart.com/article/Anatomy-and-function-of-the-Ear_21844/

morphological structure	function
auricle of pinna	
external auditory meatus	
tympanic membrane	
auditory ossicles	
m. tensor tympani	
m. stapedius	
Eustachian tube	

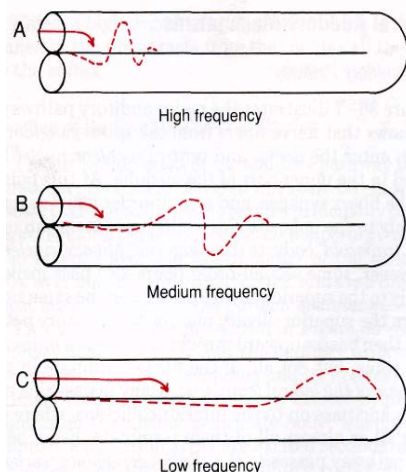
TASK 2. Look at the figure of the organ of Corti and write an explanation about the mechanism of receptor potential in one.



Source: https://www.brainkart.com/article/Anatomy-and-function-of-the-Ear_21844/

TASK 3. Look at this figure. Write an explanation about the "Traveling waves" along the basilar membrane for high, medium, and low frequency sounds.

Source: https://www.brainkart.com/article/Transmission-of-Sound-Waves-in-the-Cochlea---Traveling-Wave---_19695/



TASK 4. The Tuning-Fork Tests

Principles of Tuning-Fork Tests .Tuning forks, which emit pure tones, allow comparison of AC (air-conducted) hearing and BC (bone-conducted) hearing in an individual. In *AC hearing*, sound from a vibrating tuning fork held in front of the external ear passes via the external auditory meatus, tympanic membrane, and middle ear ossicles to the organ of Corti. In *BC hearing*, vibrations from a tuning fork, directly placed on the skull are conducted to the organ of Corti and perceived as sound. *Normally, AC hearing is better than BC hearing (written as AC > BC, or Rinne positive).*

Pathology in the outer ear (e.g., wax), or damage to the tympanic membrane (e.g., perforation), or pathology in the middle ear (e.g., loss of mobility or destruction of ossicles), reduces AC hearing without affecting bone conduction (BC hearing), a condition called *conductive deafness*. On the other hand, damage to the hair cells in the organ of Corti, or auditory pathways, will reduce both AC and BC hearing, a condition called *nerve deafness* or *perceptive deafness*. In other words, if BC is normal, the inner ear (cochlea) and auditory pathways must be normal, but if BC is reduced the cochlea or the pathways are; t fault.

The student should perform the following tests on himself and on his work partner/subject.

I. Rinne's Test : This test compares the subject's AC hearing with his BC hearing.

1. Set a tuning fork (256 Hz) into vibration by striking one of its prongs on the heel of your hand and, holding it from its stem; place its base on the subject's mastoid process (the bony prominence behind the ear). The subject will hear a sound; ask him to raise his hand when the sound disappears. Note the time for which the sound is heard.

2. When the sound stops, bring the prongs of the fork in front of his ear—the sound will become audible once again. Note the time for which it lasts. This means that air conduction is better than bone conduction if the hearing on that side is normal. For example, sound heard on mastoid process = 35 seconds; and in front of the ear for another 10 sec (i.e., total 45 sec)

In *conduction deafness*, BC remains normal at 35 sec, but AC will be reduced, say, to 25 sec, i.e., $AC < BC = \text{Rinne negative}$. (In such a case the fork will be heard near the ear till inaudible and then placed on the mastoid when the sound will be heard once again).

In *nerve deafness*, the hearing will be impaired by both routes. AC becomes 20 sec, BC becomes 15 sec, i.e., $AC > BC = \text{Rinne positive}$ (Compare normal ear).

3. Test the other ear and record the timings for AC and BC.

TASK 5. Localization of sound: Seat the subject in a quiet room, and ask him to close his eyes. Use a forceps to produce clicking noises behind, in front, and to each side of his head, one after the other, and ask him to locate the direction of sound in each case. Enter the results in your workbook, indicating the ability to localize the sound as excellent, good, fair and poor.

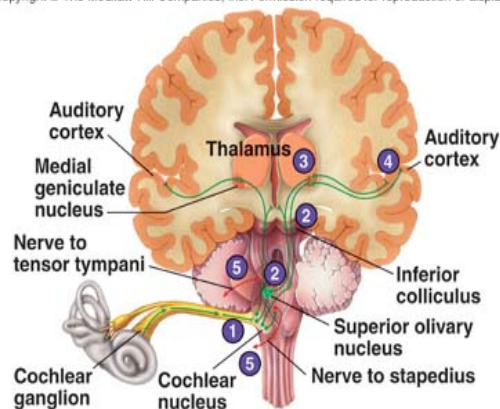
Comments. The ability to judge the position of the source of sound with both ears is called the *binaural effect*. Two factors are involved in this process: the difference in the loudness of the sounds at the two ears, and the difference in the interval of sound at the two ears, i.e., the phase difference or the interval between equal phases of sound waves entering the two ears.

The human ear can gauge the direction of a sound's origin on a 0.00003-sec difference in its interval at the two ears. When we want to localize a sound coming from a distance, we turn our head until the sound is equally loud in the two ears. The direction in which we are facing is the direction of the sound's origin.

TASK 6. Look at this figure and write explanation about the auditory pathway.

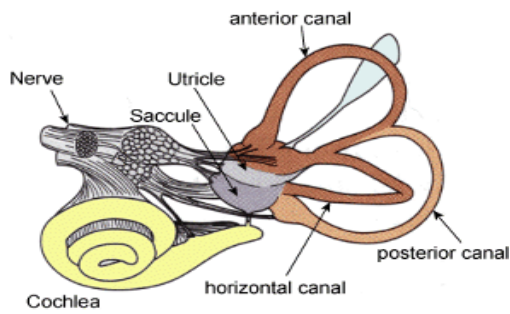
Source:

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TASK 7. Look at this figure and write an explanation about the functions of an each

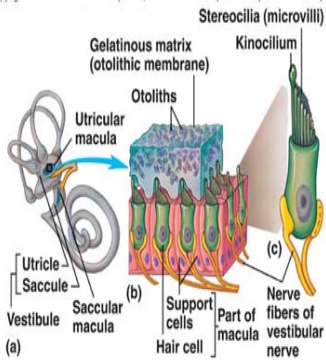
morphological part of Labyrinth. Put information in this table.



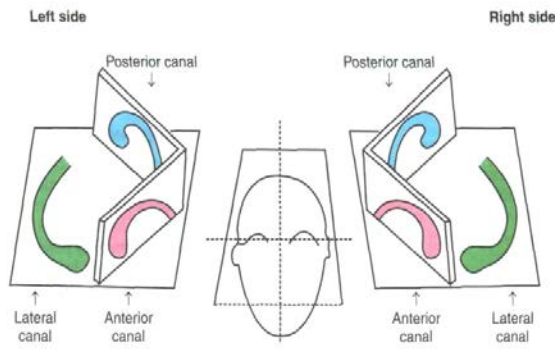
Source: https://www.researchgate.net/figure/Illustration-of-the-human-vestibular-system-and-its-components-10_fig1_264163470

Morphological components	function	Morphological components	function	Morphological components	function
<i>Anterior semicircular canal</i>		<i>Posterior semicircular canal</i>		<i>sacculus</i>	
<i>Lateral semicircular canal</i>		<i>ampulla</i>		<i>Vestibular nerve</i>	

TASK 8. Look at these figures and write the explanations about the mechanism of receptor potential (figure A) and change of position of semicircular canal (figure B).



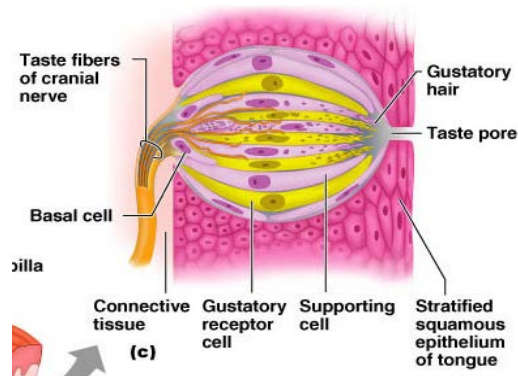
figureA.



figureB.

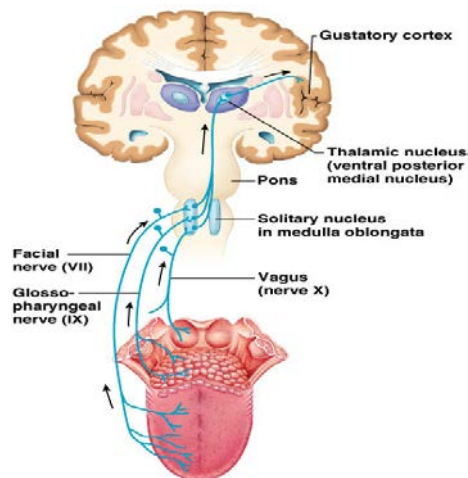
Source: <https://anul2semestru2.files.wordpress.com/2018/05/cerebel-tr-cerebral.pdf>

TASK 9. Look at this figure. Write the morphological components and functions of a Taste bud.



Source: <https://quizlet.com/122374298/chapter-24-special-senses-taste-gustation-flash-cards/>

TASK 10. Look at this figure and note the morphological components of taste pathway



Source: https://www.researchgate.net/figure/Graphic-showing-the-taste-pathways-from-tongue-to-the-central-brain-areas_fig3_328769525

THE CONTROL OF THE LEVEL OF KNOWLEDGE

The signature of the report by teacher

**Content Sections #9. Higher nervous activity of the human.
PRACTICAL LESSON 15.**

Theme: Higher intellectual functions. Conditioned reflexes. Learning, memory phenomena, speech.

THE GOALS OF OCCUPATION:

To study the physiology of Conditioned reflexes, learning, memory phenomena, speech.

Initial level of the knowledge

1. Anatomy of CNS

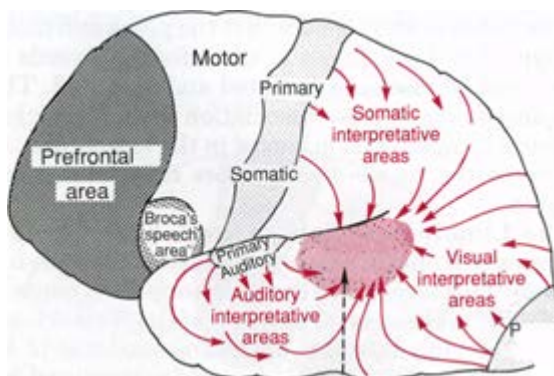
THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Lower nervous activity: Unconditioned reflexes, motivations, instincts (definition; types).
2. Neural basis of instinctual behavior (anatomic consideration and histology; afferent and efferent connections; correlation between structure and function)
3. Conditioned reflexes (definition; types and properties of conditioned reflexes; instrumental or operant conditioned reflexes).
4. Physiological basis of conditioned reflexes.
5. Inhibition of conditioned reflexes (internal and external inhibition: definition; types and mechanism)
6. Learning (definition and types of learning).
7. Memory (definition; process, types).
8. Classifications of memory.
9. Physiological, anatomical and chemical basis of memory.
10. Physiology of Language and speech (definition; mechanism of speech).
11. Development and nervous control of speech.
12. Brain areas concerned with language
13. Disorders of speech

PRACTICAL WORK

TASK 1. Look at this figure. Note all morphological components, write an explanation of the physiological different between the Broca's and Wernicke's areas.



Source: <https://www.euroformhealthcare.biz/medical-physiology/association-areas.html>

TASK 2. Examination of Visual short term memory of a person.

Part 1. Words are written on a card. During 1 minute look and remember these words. Put a card and write down words which you has remembered. Write result of the test in the table

Part 2 Repeat the test at sound handicaps .Write result of the test in the table

RESEARCH PROBLEMS

Compare results and write an explanation to them

TASK 3. The research of hearing and long term memory's volume.

The work's order. Use the table with consistent signal complexes of figures in work.

The component's number	The signal's complex
3	9,2,7
4	1,4,5,6
5	8,5,9,4,3
6	4,6,7,8,2,5
7	3,5,1,6,2,9,7
8	3,8,3,9,1,2,7,4
9	7,6,4,5,8,3,1,2,9
10	2,1,6,4,3,8,9,5,7,3

Read the person who takes in experiment the figures of first row at a speed of 3 signs in 2sec. After that this person writes the figures on by his memory Than make a break in 10 sec. and read second row of figures. Do it to the end of the table.

After that check up the mistakes. For example, if mistakes appear in 7th row, that memory's volume is 6 bit of information.

Average a grown man correct learn 3 - 7 bit of information concern to this method.

The research's tasks

1. Value the received results.

words	Result before a sound handicapes		Result after a sound handicapes	
	truly	mistake	truly	mistake

TASK 4. Examination of Auditory and Visual long term memory of a person.

Listen and remember to 18 concepts. Do any sketches or marks (but not words) about these concepts during time of its reading . In 30 minutes write concepts under each mark Write result of the test in the table and do an explanation to them.

Name of concepts	Results	
	truly	mistake

THE CONTROL OF THE LEVEL OF KNOWLEDGE

The signature of the report by teacher

Content Sections #9. Higher nervous activity of the human.

PRACTICAL LESSON 16.

Theme: Type of higher nervous activity. Neural basis of instinctual behavior and emotions. Physiology of sleep. Electroencephalogram.

GOALS OF OCCUPATION:

To study the physiology of instinctual behavior and emotions.

Initial level of the knowledge

1. Anatomy of CNS

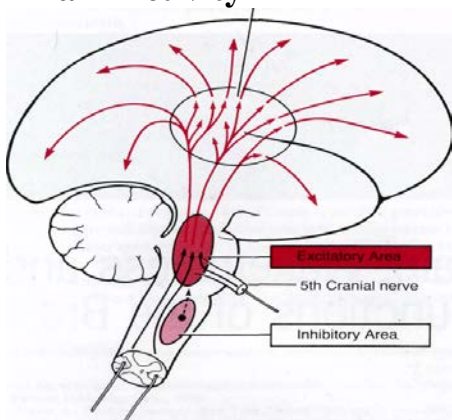
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Types of the “Higher nervous activity” according to I.P. Pavlov (Temperaments by Hippocrates).
2. Emotions (Notion and Classification)
3. Neural basis of behavior and emotions (anatomic consideration and histology; afferent and efferent connections; correlation between structure and function).
4. Limbic functions (structure and functions).
5. Behavioral Functions of the Hypothalamus
6. Nerve substrate of emotions.
7. Brain chemistry and behavior. Aminergic systems in the brain (serotonin; norepinephrine; epinephrine; dopamine; histamine; acetylcholine; opioid peptides).
8. The highest center of emotions (frontal lobes. temporal lobe and prefrontal cortex).
9. Emotional intelligence (definition and components).
10. Structure of behavioural act by Anokhin.
11. Sleep and awake. Physiology of the sleep.
12. Brain Waves. EEG Patterns During Sleep
13. Stages of Sleep.
14. Basic theories of sleep.

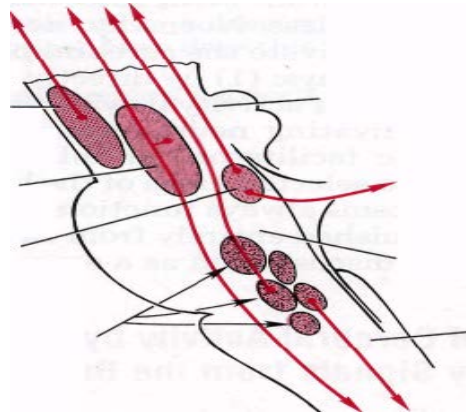
PRACTICAL WORK

TASK 1. Look at this figure. Write an explanation of the Neurohormonal Control of Brain Activity



Source: <https://www.benbest.com/science/anatmind/anatmd7.html>

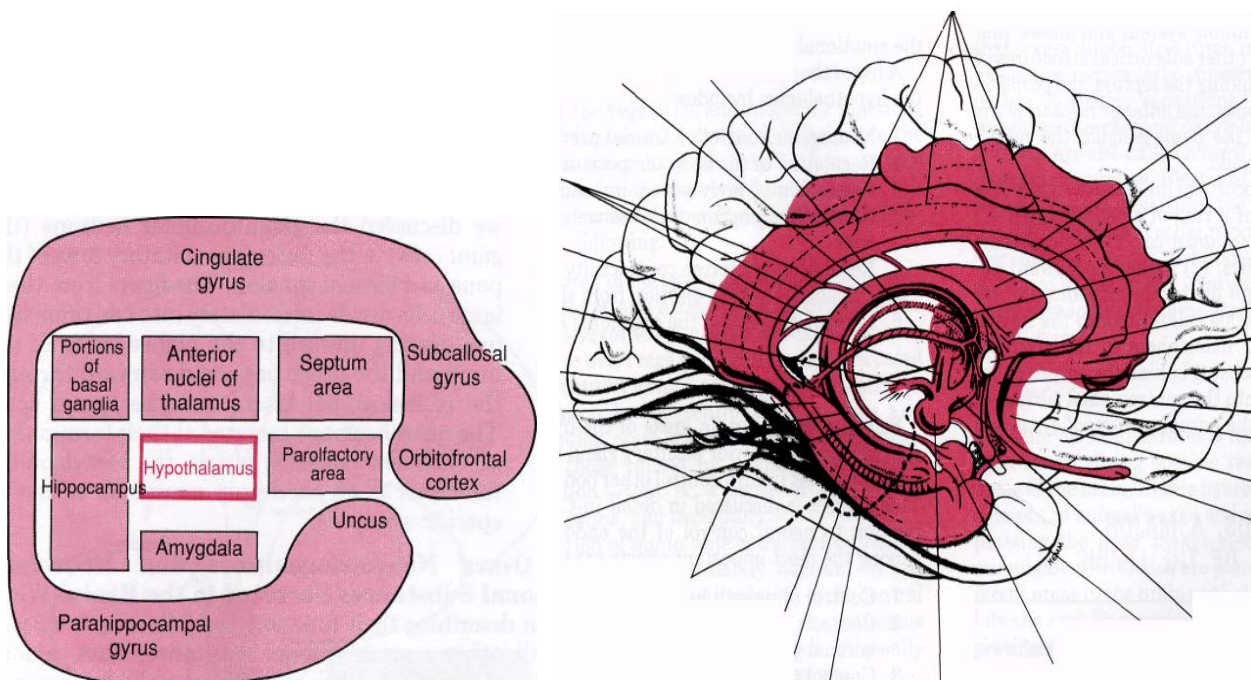
TASK 2. Look at this figure. Note all morphological components, write an explanation of the Neurohormonal Control of Brain activity.



Source:

https://fmos.usttb.edu.ml/cours/pluginfile.php/19070/mod_resource/content/0/CHAPITRE%20I%20ORGANISATION%20ANATOMOFONCTIONNELLE%20DU%20SYSTEME%20NERVEUX.pdf

TASK 3. Look at this figure. Note all morphological components of Limbic system, write an explanation of its functions in development of emotion.



Source: https://www.brainkart.com/article/Functional-Anatomy-of-the-Limbic-System--Key-Position-of-the-Hypothalamus_19770/

TASK 4. Determination of HNA's type.

The work's order. The teacher offers students questions with typical manifestations of different HNA's sires. Don't use your time and don't consider. Students should answer «+» or «-».

The answers (positives and negatives) write in four rows.

Do you think, that you:

1. Restless, fussy.
2. Lacking self-control, hot-tempered.
3. Impatient.

4. Resolute, initiative.
5. Short - temper and rectilinear in relations to peoples.
6. Obstinate.
7. Resourceful in argument.
8. Work by jerks.
9. Not rancorous and not touchy.
10. Disposed to risk.
11. Possess the passionate, rapid with confused speech's intonation.
12. Unbalanced, disposition to warmth.
13. Aggressive squabbler.
14. Intolerant to someone's defects.
15. Possess the expressive mimicry.
16. Capable of quick acting and decide.
17. Tirelessly strive for something new.
18. Possess the sharp, jerky movements.
19. Persistent in aim's achievement.
20. Disposed to sharp mood's changes.
21. Funny and joy with his eyes.
22. Energetic and efficient.
23. Often do you job partially.
24. Disposed to overestimate your strength.
25. Capable of catching new information quickly.
26. Unstable in your interests and inclinations.
27. Misfortunes and troubles come through easy for you.
28. Easy adopted to new conditions.
29. Take for each business with enthusiasm.
30. Quick cool, if the business don't interesting you.
31. Quick take part in a new job.
32. Burden on monotony of everyday life.
33. Sociable and responsive.
34. Of great endurance and able - bodied.
35. Possess the loud and quick speech.
36. Safe the self – control in difficult situations.
37. Always in good spirits.
38. Quick fell asleep and get up.
39. A fussy person, show hurriedness in business.
40. Sometimes slide on a surface.
41. Quiet and cold-blooded.
42. Successive and thorough in business.
43. Careful and reasonable.
44. Can wait.
45. Taciturn and don't like to talk without sense.
46. Possess the quiet and even speech.
47. Restrained and patient.

48. Carry something (business) through.
49. Strictly follow the elaborated day's order or work's.
50. Easy control your passion.
51. Not susceptible to approval and blame.
52. Not wicked.
53. Constant in your interests.
54. Don't waste your time.
55. Immediately join in conversation.
56. Equally in interrelation.
57. Disposed to unsociability.
58. Like accuracy and put in order.
59. Difficult adapt to new conditions.
60. Not mobile and languid.
61. Possess to self-control.
62. Diffident, shy.
63. Lose your presence of mind in new conditions.
64. Find it difficult to associate with unknown people.
65. Don't believe in your inner power.
66. Easy transfer the solitude.
67. Feel the depression and confusion under failures.
68. Disposed to shrink into yourself.
69. Quickly feel tired.
70. Quickly adjust to interlocutor's character.
71. Possess the weak and quiet speech.
72. Impressionable to crying.
73. Extraordinarily susceptible to approval and blame.
74. Make high demands to surrounding.
75. Disposed to suspiciousness, nervous.
76. Painfully sensible and easy receptive.
77. Excessively touchy.
78. Not active and shy.
79. Without any word.
80. Strive for the giving rise to the sympathy and help with surrounding.

$$AT = Ch(a_1 / A * 100) + S(a_2 / A * 100) + Ph(a_3 / A * 100) + M(a_4 / A * 100) = 100 \%$$

C – choleric person, S – sanguinic person, P - phlegmatic person,
M - melancholic person.

A – quantity of positive answers

If Ch = 40 % - dominated type

30-29 % - evidently expressed

20-29 % - middling is expressed

10-19% - little expressed.

The tasks research

1. Determine your own type of HNA

TASK 5. The determination of the force and the mobility of the nervous processes with the help of correctory method.

The order's work. It's necessary to have Anphimov's table, the stop-watch. Anphymov's table is 8 letters which are printed on the standard piece of paper in free turn – all 1600. The person under the test has to write out the definite (the conditionally moving reactich) letter (the conditional irritant). The work lasts not more than 5 minutes, it should be done at maximum rate. The indicator of the mobility of nervous processes will be the quantity of symbols the person under the test looked through, but the force of nervous processes – the change of work's productivity (the quantity of symbols, looked through per 30 s. and mistakes).

The work are done simultaneously by all students of the group. Every student is given the table, then fills in the form. Then the instructing is given: “Now you are given the task and simultaneously due to the command you should start doing it maximum quickly as you can and exactly. It's necessary to look through the letters in sequence in every line in direction from the left to the right. Every 30 sec. due to the signal mark by the vertical line the place's table you have looked through already”.

For example, it's necessary to wright off the letter «S». After the work the students should change the forms and checked the quality of the work due to the instruction.

The research's tasks

1. In the protocol you should put the quantity of the symbols you have looked through, also you should fix maximum and the minimum quantity of the symbols. The dynamic productivity of the work you should draw graphically. Make up the conclusions.

The text control of the last knowledge's level

The defense of self-made work.

THE CONTROL OF THE LEVEL OF KNOWLEDGE

The signature of the report by teacher

Thematic Section #10. Physiology of human's ontogenesis. Physiology of the main periods of human evolution.

PRACTICAL LESSON 17.

Credit lesson: Humoral regulation of physiological function. Higher integration functions. Physiology of human's ontogenesis.

GOALS OF OCCUPATION:

To study the physiology of Reproductive Development & Function of the Female Reproductive System.

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Hypothalamo-hypophyseal relationship.
2. Hormones secreted by anterior pituitary
3. Hormones of Posterior pituitary or neurohypophysis
4. Physiological functions of the Thyroid hormones.
5. Physiological functions of the Parathyroid hormones.
6. Physiological functions of the Pancreas hormones.
7. Physiological functions of the Adrenal Medullar hormones.
8. Physiological functions of the Suprarenal gland hormones.
9. Physiological functions of Androgens and Estrogens.
10. Physiological functions of the of Kidneys, Heart and Pineal gland hormones.
11. Physiology of receptors system. Somatic sensations.
12. Vision system. The physiology and functions.
13. Hearing and Equilibrium Sensation of Taste and Smell.
14. Neural basis of instinctual behavior and emotions.
15. Higher intellectual functions. Speech. Nervous control of speech. Physiology of sleep.
16. The male reproductive system.
17. Endocrine function of the testes.
18. Control of testicular function.
19. Female Reproductive System
20. Embryology of the human reproductive system.

Test tasks to control the source level of knowledge

1. A boy of 12 is 180 cm tall. The reason for it is the disorder of hormone secretion. What kind of hormone is it?
 - A. Somatotropin.
 - B. Thyroxin.
 - C. Thyreotropin.
 - D. Gonadotropin.
 - E. Insulin.

2. The height of a grown-up person is 120 cm. Proportions of the body-build and mental capacity are normal. These characteristics are the result of a lack of some hormone secretion in childhood. What kind of hormone is it?
- A. Thyroxin.
 - B. Gonadotropin.
 - C. Corticotropin.
 - D. Thyreotropin.
 - E. Somatotropin.
3. Height of a grown-up person is 100 cm. Proportions of the body-build and mental capacity are normal. These characteristics are the result of a lack of some hormone secretion in childhood. What kind of hormone is it?
- A. Thyreotropin.
 - B. Gonadotropin.
 - C. Corticotropine.
 - D. Somatotropin.
 - E. Prolactin.
4. The height of a 10-year-old child is 80 cm, he has right proportions of body, normal mental development. What hormone deficit in the organism can cause such changes?
- A. Thyroxin.
 - B. Somatostatin.
 - C. Somatotropin.
 - D. Triiodothyronine.
 - E. Cortisol.
5. Examination of patient revealed overgrowth of facial bones and soft tissues, tongue enlargement, wide interdental spaces in the enlarged dental arch. What changes of the hormonal secretion are the most likely?
- A. Hyposecretion of insulin
 - B. Hyposecretion of thyroxin
 - C. Hyposecretion of the somatotropic hormone
 - D. Hypersecretion of insulin
 - E. Hypersecretion of the somatotropic hormone
6. A 46 year-old patient has complained of headache, fatigue, thirst, pains in the spine and joints for the last 2 years. Clinically observed disproportional enlargement of hands, feet, nose, and superciliary arches. He notes that he needed to buy bigger shoes three times. What is the main reason of such disproportional enlargement of different parts of the body?
- A. Cartilaginous tissue proliferation under growth hormone influence
 - B. Increased sensitivity of the tissues to growth hormone
 - C. Joints dystrophy development
 - D. Increased sensitivity of the tissues to insulin

- E. Joints chronic inflammation development
7. The height of a 10-year-old child is 178 cm, the weight is 64 kg. It is connected with function disorders of some gland. What gland is it?
- A. Gonads.
 - B. Thyroid gland.
 - C. Pituitary gland.
 - D. Adrenal glands.
 - E. Parathyroid glands.
8. Roentgenological examination of skull base bones revealed enlargement of sellar cavity, thinning of anterior clinoid processes, destruction of different parts, destruction of different parts of sella turcica. Such bone destruction might be caused by a tumor of the following endocrine gland:
- A. Hypophysis
 - B. Epiphysis
 - C. Thymus gland
 - D. Adrenal glands
 - E. Thyroid gland
9. A woman of 25 came to a doctor a month after childbirth with a complaint about the decrease of galactopoiesis. What hormone deficit resulted in such state?
- A. Prolactin.
 - B. Somatostatin.
 - C. Corticotropin.
 - D. Insulin.
 - E. Glucagon.
10. A 26-year-old woman at 40 weeks pregnant has been delivered to the maternity ward. Objectively: the uterine cervix is opened, but the contractions are absent. The doctor has administered her a hormonal drug to stimulate the labor. Name this drug:
- A. Oxytocin
 - B. Hydrocortisone
 - C. Estrone
 - D. Testosterone
 - E. ACTH
11. A 32-year-old patient consulted a doctor about the absence of lactation after parturition. Such disorder might be explained by the deficit of the following hormone:
- A. Vasopressin
 - B. Glucagon
 - C. Thyrocalcitonin
 - D. Prolactin
 - E. Somatotropin

12. Person felt thirsty after staying in heat for a long time. Signals of what receptors caused it first of all?
- A. Osmoreceptors of hypothalamus
 - B. Sodium receptors of hypothalamus
 - C. Osmoreceptors of the liver
 - D. Glucoreceptors of hypothalamus
 - E. Baroreceptors of aortic arch
13. A patient has osmotic pressure of blood plasma at the rate of 350 mOsmol/l (norm is 300 mOsmol/l). This will cause hypersecretion of the following hormone:
- A. Cortisol
 - B. Adrenocorticotropin
 - C. Vasopressin
 - D. Natriuretic
 - E. Aldosterone
14. A man after 1.5 liter blood loss has suddenly reduced diuresis. The increased secretion of what hormone caused such diuresis alteration?
- A. Vasopressin
 - B. Corticotropin
 - C. Natriuretic
 - D. Cortisol
 - E. Parathormone
15. A man has a considerable decrease in diuresis as a result of 1.5 L blood loss. The primary cause of such diuresis disorder is the hypersecretion of the following hormone:
- A. Vasopressin
 - B. Corticotropin
 - C. Natriuretic
 - D. Cortisol
 - E. Parathormone
16. A 20 year old patient complains of morbid thirst and hyperdiuresis (up to 10 L daily). Glucose concentration in blood is normal but it is absent in urine. The patient has been diagnosed with diabetes insipidus. What hormonal drug is the most appropriate for management of this disorder?
- A. Vasopressin
 - B. Cortisol
 - C. Thyroxin
 - D. Oxytocin
 - E. Insulin

17. A patient complains of hydruria (7 liters per day) and polydipsia. Examination reveals no disorders of carbohydrate metabolism. These abnormalities might be caused by the dysfunction of the following endocrine gland:
- A. Neurohypophysis
 - B. Adenohypophysis
 - C. Islets of Langerhans (pancreatic islets)
 - D. Adrenal cortex
 - E. Adrenal medulla
18. A patient has an increased basal metabolism, high body temperature, tachycardia in the state of rest. What gland's hyperfunctioning can be the reason for this state?
- A. Pancreas.
 - B. Thyroid.
 - C. Neurohypophysis.
 - D. Adrenal cortex.
 - E. Gonads.
19. A 19-year-old female suffers from tachycardia in rest condition, weight loss, excessive sweating, exophthalmos and irritability. What hormone would you expect to find elevated in her serum?
- A. Thyroxine
 - B. Cortisol
 - C. Mineralocorticoids
 - D. ACTH
 - E. Insulin
20. Inhabitants of territories with cold climate have high content of an adaptive thermoregulatory hormone. What hormone is meant?
- A. Thyroxin
 - B. Insulin
 - C. Glucagon
 - D. Somatotropin
 - E. Cortisol
21. While examining a patient, attention was paid to cervical intumescence, exophthalmos, high body temperature, pulse 110 per min. The content of what hormone in blood is it necessary to examine?
- A. Insulin.
 - B. Sex hormones.
 - C. Catecholamines.
 - D. Thyroxin.
 - E. Cortisol.

22. Tachycardia, increase of basal metabolism and body temperature, weight loss, increase of excitability of a patient are diagnosed. The reason for it is the increase of the hormone secretion of some gland. What gland is it?
- A. Neurohypophysis.
 - B. Adrenal glands.
 - C. Parathyroid glands.
 - D. Gonads.
 - E. Thyroid gland.
23. The function of the thyroid gland of a child has been reduced since birth. What is the main consequence of this state?
- A. Gigantism.
 - B. Nanism.
 - C. Cretinism.
 - D. Hypopituitarism.
 - E. Hyperpigmentation of skin.
24. A child has signs of physical development delay and mental retardation (cretinism). With the deficit of what hormone is it connected?
- A. Thyroxin.
 - B. Somatotropin.
 - C. Calcitonin.
 - D. Insulin.
 - E. Testosterone.
25. Demineralization of bones (decreasing of calcium ions content) is often a problem of elderly people. The reason for this is the decreasing of some hormone. What hormone is it?
- A. Thyrocalcitonin.
 - B. Thyroxin.
 - C. Insulin.
 - D. Aldosterone.
 - E. Parathormone.
26. Parodontitis is treated with calcium preparations and a hormone that stimulates tooth mineralization and inhibits tissue resorption. What hormone is it?
- A. Calcitonin
 - B. Parathormone
 - C. Adrenalin
 - D. Aldosterone
 - E. Thyroxine
27. A patient has got a sharp lowering of calcium level in blood. It will cause the increasing secretion of some hormone. What hormone is this?

- A. Parathormone.
 - B. Thyrocalcitonin.
 - C. Aldosterone.
 - D. Vasopressin.
 - E. Somatotropin.
28. A 35 year old man consulted a dentist about reduced density of dental tissue, high fragility of teeth during eating solid food. This patient suffers the most probably from the deficiency of the following mineral element:
- A. Calcium
 - B. Potassium
 - C. Sodium
 - D. Magnesium
 - E. Iron
29. A patient with signs of osteoporosis and urolithiasis has been admitted to the endocrinology department. Blood test revealed hypercalcemia and hypophosphatemia. These changes are associated with abnormal synthesis of the following hormone:
- A. Parathyroid hormone
 - B. Calcitonin
 - C. Cortisol
 - D. Aldosterone
 - E. Calcitriol
30. A 46-yr-old patient suffering from the diffuse toxic goiter underwent resection of the thyroid gland. After surgery the patient presents with appetite loss, dyspepsia, increased neuromuscular excitement. The body weight remained unchanged. Body temperature is normal. Which of the following has caused such a condition in this patient?
- A. Reduced production of parathormone
 - B. Increased production of thyroliberin
 - C. Reduced production of thyroxin
 - D. Increased production of calcitonin
 - E. Increased production of thyroxin
31. Kidneys of a man under examination show increased resorption of calcium ions and decreased resorption of phosphate ions. What hormone causes this phenomenon?
- A. Parathormone
 - B. Thyrocalcitonin
 - C. Hormonal form D3
 - D. Aldosterone
 - E. Vasopressin
32. A 2 y.o. child has convulsions as a result of lowered concentration of calcium ions in blood plasma. It is caused by reduced function of:

- A. Parathyroid glands
- B. Hypophysis
- C. Adrenal cortex
- D. Pineal gland
- E. Thymus

33. An infant has got a laryngospasm. In anamnesis there is a susceptibility to cramps development. One must think about the dysfunction of some endocrine glands. What are these?

- A. Parathyroid glands.
- B. Pancreas.
- C. Thymus.
- D. Thyroid gland.
- E. Adrenal glands.

34. A child has abnormal formation of tooth enamel and dentin as a result of low concentration of calcium ions in blood. Such abnormalities might be caused by deficiency of the following hormone:

- A. Parathormone
- B. Thyrocalcitonin
- C. Thyroxin
- D. Somatotropic hormone
- E. Triiodothyronine

35. A doctor examined a child and revealed symptoms of rachitis. Development of this disease was caused by deficiency of the following compound:

- A. 1,25 [OH]-dihydroxycholecalciferol
- B. Biotin
- C. Tocopherol
- D. Naphtaquinone
- E. Retinol

36. A 4 year old child with hereditary renal lesion has signs of rickets, vitamin D concentration in blood is normal. What is the most probable cause of rickets development?

- A. Impaired synthesis of calcitriol
- B. Increased excretion of calcium
- C. Hyperfunction of parathyroid glands
- D. Hypofunction of parathyroid glands
- E. Lack of calcium in food

37. During regular check-up a child is detected with interrupted mineralization of the bones. What vitamin deficiency can be the cause?

- A. Calciferol

- B. Riboflavin
- C. Tocopherol
- D. Folic acid

38. A 6-year-old child suffers from delayed growth, disrupted ossification processes, decalcification of the teeth. What can be the cause?

- A. Vitamin D deficiency
- B. Decreased glucagon production
- C. Insulin deficiency
- D. Hyperthyroidism
- E. Vitamin C deficiency

39. Some diseases reveal symptoms of aldosteronism with hypertension and edema due to sodium retention in the organism. What organ of the internal secretion is affected on aldosteronism?

- A. Adrenal glands
- B. Testicles
- C. Ovaries
- D. Pancreas
- E. Hypophysis

40. Under some diseases it is observed aldosteronism accompanied by hypertension and edema due to sodium retention in the organism. What organ of the internal secretion is affected under aldosteronism?

- A. Adrenal glands
- B. Testicle
- C. Ovaries
- D. Pancreas
- E. Hypophysis

41. A person has reduced diuresis, hypernatremia, hypokalemia. Hypersecretion of what hormone can cause such changes?

- A. Aldosterone
- B. Vasopressin
- C. Atrial natriuretic peptide
- D. Adrenalin
- E. Parathormone

42. Hyponatremia and hyperkalemia of a patient were diagnosed. The reduced secretion of what hormone can cause such changes?

- A. Cortisol.
- B. Vasopressin.
- C. Aldosterone.
- D. Parathormone.

- E. Atrial natriuretic factor.
43. A long abuse of potassium preparations by a person resulted in the increase of potassium content in blood plasma. The change of secretion of what hormone will it cause?
- A. Increase of aldosterone secretion.
 - B. Decrease of aldosterone secretion.
 - C. Increase of vasopressin secretion.
 - D. Decrease of vasopressin secretion.
 - E. Decrease of rennin secretion.
44. Examination of a patient revealed hyperkalemia and hyponatremia. Low secretion of which hormone may cause such changes?
- A. Aldosteron
 - B. Vasopressin
 - C. Cortisol
 - D. Parathormone
 - E. Natriuretic
45. A concentrated solution of sodium chloride was intravenously injected to an animal. This caused decreased reabsorption of sodium ions in the renal tubules. It is the result of the following changes of hormonal secretion:
- A. Aldosterone reduction
 - B. Aldosterone increase
 - C. Vasopressin reduction
 - D. Vasopressin increase
 - E. Reduction of atrial natriuretic factor
46. People adapted to high external temperatures have such peculiarity: profuse sweating isn't accompanied by loss of large volumes of sodium chloride. This is caused by the effect of the following hormone upon the perspiratory glands:
- A. Aldosterone
 - B. Vasopressin
 - C. Cortisol
 - D. Thyroxin
 - E. Natriuretic
47. A 50-yr-old patient complains about general weakness, appetite loss and cardiac arrhythmia. The patient presents with muscle hypotonia, flaccid paralyzes, weakened peristaltic activity of the bowels. Such condition might be caused by:
- A. Hyperkalemia
 - B. Hypophosphatemia
 - C. Hypokalemia
 - D. Hyponatremia

E. Hypoproteinemia

48. A woman has a limited blood flow in kidneys, high arterial pressure. What hormone's hypersecretion was the reason for high arterial pressure?

- A. Vasopressin.
- B. Adrenaline.
- C. Noradrenaline.
- D. Erythropoietin.
- E. Renin.

49. A month after surgical constriction of rabbit's renal artery the considerable increase of systematic arterial pressure was observed. What of the following regulation mechanisms caused the animal's pressure change?

- A. Angiotensin-II
- B. Vasopressin
- C. Adrenaline
- D. Noradrenaline
- E. Serotonin

50. A patient has insufficient blood supply to the kidneys, which has caused the development of pressor effect due to constriction of arterial resistance vessels. This condition results from the vessels being strongly affected by the following substance:

- A. Angiotensin II
- B. Angiotensinogen
- C. Renin
- D. Catecholamines
- E. Norepinephrine

51. A patient with hypertensive crisis has increased content of angiotensin II in blood. Angiotensin pressor effect is based on:

- A. Contraction of arteriole muscles
- B. Activation of biogenic amine synthesis
- C. Prostaglandin hyperproduction
- D. Vasopressin production stimulation
- E. Activation of kinin-kallikrein system

52. A careless student met the dean by chance. The concentration of what hormone will increase in the student's blood first of all?

- A. Cortisol.
- B. Thyroliberin.
- C. Corticotropin.
- D. Adrenaline.
- E. Somatotropin.

53. A 40-year-old patient complains of intensive heartbeats, sweating, nausea, visual impairment, arm tremor, hypertension. From his anamnesis: 2 years ago he was diagnosed with pheochromocytoma. Hyperproduction of what hormones causes the given pathology?
- A. Catecholamines
 - B. Aldosterone
 - C. Glucocorticoids
 - D. ACTH
 - E. Thyroidal hormones
54. A 41-year-old man has a history of recurrent attacks of heartbeats (paroxysms), profuse sweating, headaches. Examination revealed hypertension, hyperglycemia, increased basal metabolic rate, and tachycardia. These clinical presentations are typical for the following adrenal pathology:
- A. Hyperfunction of the medulla
 - B. Hypofunction of the medulla
 - C. Hyperfunction of the adrenal cortex
 - D. Hypofunction of the adrenal cortex
 - E. Primary aldosteronism
55. During the last 6 months a woman has signs of masculinization: increased hair growth on the face, white line of stomach, legs. She complains of irregular menstrual cycle. The reason for such state can be the increased secretion of some hormone. What hormone is it?
- A. Mineralocorticoids.
 - B. Estrogens.
 - C. Somatotropin.
 - D. Thyroxin.
 - E. Androgens.
56. Testosterone and its analogs increase the mass of skeletal muscles that allows using them for treatment of dystrophy. Due to interaction of the hormone with what cell substrate is this action caused?
- A. Nuclear receptors
 - B. Membrane receptors
 - C. Ribosomes
 - D. Chromatin
 - E. Proteins-activators of transcription
57. Parents of a 10 y.o. boy consulted a doctor about extension of hair-covering, growth of beard and moustache, low voice. Intensified secretion of which hormone must be assumed?
- A. Of testosterone
 - B. Of somatotropin

- C. Of estrogen
- D. Of progesterone
- E. Of cortisol

58. A girl is diagnosed with adrenogenital syndrome (pseudohermaphroditism). This pathology was caused by hypersecretion of the following adrenal hormone:

- A. Androgen
- B. Estrogen
- C. Aldosterone
- D. Cortisol
- E. Adrenalin

59. In the pubertal period cells of the male sexual glands start producing the male sexual hormone testosterone that is responsible for formation of the secondary sexual characters. What cells of the male sexual glands produce this hormone?

- A. Leydig cells
- B. Sertoli cells
- C. Sertoli's cells
- D. Sustentacular cells
- E. Spermatozoa

60.#

61. The secretion of which hypophysial hormones will be inhibited after taking the oral contraceptives containing sex hormones?

- A. Gonadotropic hormone
- B. Vasopressin
- C. Thyrotrophic hormone
- D. Somatotrophic hormone
- E. Oxytocin

62. A female patient presents with endocrine dysfunction of follicular cells of the ovarian follicles resulting from an inflammation. The synthesis of the following hormone will be inhibited:

- A. Estrogen
- B. Progesterone
- C. Lutropin
- D. Follicle stimulating hormone
- E. Follistatine

63. A 30-year-old female exhibits signs of virilism (growth of body hair, balding temples, menstrual disorders). This condition can be caused by the overproduction of the following hormone:

- A. Testosterone
- B. Estrinol

- C. Relaxin
- D. Oxytocin
- E. Prolactin

64. A girl has been diagnosed with adrenogenital syndrome (pseudohermaphroditism). This pathology is caused by hypersecretion of the following adrenal hormone:

- A. Androgens
- B. Glucocorticoids
- C. Catecholamines
- D. Estrogens
- E. Mineralocorticoids

65. Atria of an experimental animal were superdistended by blood that resulted in decreased reabsorption of Na^+ and water in renal tubules. This can be explained by the influence of the following factor upon kidneys:

- A. Natriuretic hormone
- B. Aldosterone
- C. Renin
- D. Angiotensin
- E. Vasopressin

66. Before the cells can utilize the glucose, it is first transported from the extracellular space through the plasmatic membrane inside them. This process is stimulated by the following hormone:

- A. Insulin
- B. Glucagon
- C. Thyroxin
- D. Aldosterone
- E. Adrenalin

67. Prior to glucose utilization in cells it is transported inside cells from extracellular space through plasmatic membrane. This process is stimulated by the following hormone:

- A. Insulin
- B. Glucagon
- C. Thyroxin
- D. Aldosterone

68. A middle-aged man went to a foreign country because he had been offered a job there. However he had been unemployed for quite a long time. What endocrine glands were exhausted most of all in this man?

- A. Substernal gland
- B. Thyroid gland
- C. Seminal glands
- D. Parathyroid glands

E. Adrenal glands

69. To prevent the transplant rejection after organ transplantation it is required to administer immunotherapy for the purpose of immunosuppression. What hormones are used for this purpose?

- A. Glucocorticoids
- B. Mineralocorticoids
- C. Sex hormones
- D. Catecholamines
- E. Thyroid

70. A patient has been given high doses of hydrocortisone for a long time. This caused atrophy of one of the adrenal cortex zones. Which zone is it?

- A. Fasciculata
- B. Glomerular
- C. Reticular
- D. Glomerular and reticular

71. There is only one hormone among the neurohormones which refers to the derivatives of amino acids according to classification. Point it out:

- A. Melatonin
- B. Thyrotropin
- C. Vasopressin
- D. Oxytocin
- E. Somatotropin

72. During an experiment the dorsal roots of the spinal cord of an animal have been cut. What changes will be observed in the innervation zone?

- A. Decrease in muscle tone
- B. Sensitivity loss and loss of motor functions
- C. Increase in muscle tone
- D. Sensitivity loss
- E. Loss of motor functions

73. When a patient with traumatic impairment of the brain was examined, it was discovered that he had stopped to distinguish displacement of an object on the skin. What part of the brain was damaged?

- A. Posterior central gyrus
- B. Occipital zone of the cortex
- C. Parietal zone of the cortex
- D. Frontal central gyrus
- E. Frontal zone

74. A patient has a hemorrhage into the posterior central gyrus. What type of sensitivity on the opposite side will be disturbed?
- A. Skin and proprioceptive
 - B. Visual
 - C. Auditory
 - D. Olfactory
75. As a result of a craniocerebral injury a patient has decreased skin sensitivity. What area of the cerebral cortex may be damaged?
- A. Posterior central gyrus
 - B. Occipital region
 - C. Cingulate gyrus
 - D. Frontal cortex
 - E. Anterior central gyrus
76. A man has normal sensitivity of his finger skin, however he doesn't sense his wedding ring around the finger. What process induced by wearing of the ring has caused this phenomenon?
- A. Receptor adaptation
 - B. Development of the fibrous tissue
 - C. Abnormality of the epidermis structure
 - D. Impaired circulation
 - E. Abnormality of the receptor structure
77. As a result of spinal-cord trauma a 33 y.o. man has a disturbed pain and temperature sensitivity that is caused by damage of the following tract:
- A. Spinothalamic
 - B. Medial spinocortical
 - C. Posterior spinocerebellar
 - D. Lateral spinocortical
78. After a craniocerebral injury a patient has lost the ability to recognize shapes of objects by touch (stereognosis). What area of cerebral cortex normally contains the relevant center?
- A. Superior parietal lobule
 - B. Inferior parietal lobule
 - C. Supramarginal gyrus
 - D. Postcentral gyrus
 - E. Angular gyrus
79. A patient presents with twilight vision impairment. Which of the following vitamins should be administered?
- A. Retinol acetate
 - B. Cyanocobalamin

- C. Pyridoxine hydrochloride
- D. Ascorbic acid
- E. Nicotinic acid

80. While shifting the gaze to the closely situated object the refracting power of eye's optical mediums will increase by 10 diopters. It results from changing of such eye structure:

- A. Lens
- B. Cornea
- C. Vitreous body
- D. Liquid of the anterior chamber of eye
- E. Muscle that dilatates pupil

81. A 25-year-old patient complained of the decreased vision. Accommodation disorders, dilated pupil, lack of reaction for the light were revealed on examination. What muscles function is disturbed?

- A. Pupil narrowing muscle, ciliary
- B. Pupil dilating muscle, ciliary
- C. Inferior oblique muscle, ciliary
- D. Lateral rectus muscle, pupil narrowing
- E. Pupil narrowing and dilating muscles

82. A patient suffers from vision impairment hemeralopy (night blindness). What vitamin preparation should be administered the patient in order to restore his vision?

- A. Retinol acetate
- B. Vicasol
- C. Pyridoxine
- D. Thiamine chloride
- E. Tocopherol acetate

83. Vitamin A deficit results in the impairment of twilight vision. Name the cells that have the above-mentioned photoreceptor function:

- A. Rod receptor cell
- B. Horizontal neurocytes
- C. Cone receptor cells
- D. Bipolar neurons
- E. Ganglion neurocytes

84. As a result of destruction of certain brainstem structures an animal has lost its orientative reflexes in response to strong photic stimuli. What structures were destroyed?

- A. Anterior tubercles of quadrigeminal plate
- B. Posterior tubercles of quadrigeminal plate
- C. Red nuclei

- D. Vestibular nuclei
- E. Black substance

85. A 64 year old woman has impairment of twilight vision (hemeralopia). What vitamin should be recommended in the first place?

- A. Vitamin A
- B. Vitamin B2
- C. Vitamin E
- D. Vitamin C
- E. Vitamin B6

86. A man was intoxicated with mushrooms. They contain muscarine that stimulates muscarinic cholinergic receptors. What symptoms signalize intoxication with inedible mushrooms?

- A. Myotic pupils
- B. Mydriatic pupils
- C. Bronchi dilatation
- D. Increased heart rate
- E. Rise of arterial pressure

87. A 75-year-old-female patient with complaints of visual impairment has been delivered to the ophthalmologic department. Objective examination revealed a brain tumor in area of the left optic tract. The patient has a visual field defect in the following area:

- A. Left half of both eyes retina
- B. Right half of both eyes retina
- C. Left and right halves of the left eye retina
- D. Left and right halves of the right eye retina
- E. Left and right halves of both eyes retina

88. In the experiment on the animal the part of the cerebral cortex hemispheres was removed. It caused elimination of previously formed conditioned reflex to the light irritation. What part of the cortex was removed?

- A. Occipital cortex
- B. Precentral convolution
- C. Postcentral convolution
- D. Limbic cortex
- E. Temporal lobe

89. A patient demonstrates functional loss of nasal halves of the retinas. What area of visual pathways is affected?

- A. Optic chiasm
- B. Left optic tract
- C. Right optic tract
- D. Left optic nerve

E. Right optic nerve

90. A 75-year-old female patient with complaints of visual impairment has been delivered to the ophthalmologic department. Objective examination revealed a brain tumor in area of the left optic tract. The patient has a visual field defect in the following area:

- A. Left and right halves of both eyes retina
- B. Left and right halves of the left eye retina
- C. Left and right halves of the right eye retina
- D. Left half of both eyes retina
- E. Right half of both eyes retina

91. A 20-year-old female comes to the clinic after missing her last 2 periods. Her cycles are usually regular, occurring at 28-30 day interval with moderate bleeding and some abdominal discomfort. She also complains of progressively diminishing peripheral vision. Her doctor reveals loss of vision in the lateral halves of both eyes. Involvement of which of the following structures would you most likely expect to be the reason of bitemporal hemianopsia?

- A. Right optic tract
- B. Left optic nerve
- C. Right optic nerve
- D. Optic chiasm
- E. Left optic tract

92. Pupil dilation occurs when a person steps from a light room into a dark one. What reflex causes such a reaction?

- A. Sympathetic unconditioned reflex
- B. Sympathetic conditioned reflex
- C. Metasympathetic reflex
- D. Parasympathetic unconditioned reflex
- E. Parasympathetic conditioned reflex

93. A 60-year-old patient has reduced perception of high-frequency sounds. What structures' disorder of auditory analyzer caused these changes?

- A. Main membrane of cochlea near the oval window
- B. Main membrane of cochlea near helicotrema
- C. Eustachian tube
- D. Muscles of middle ear
- E. Tympanic membrane

94. A 60 year old patient has impaired perception of high-frequency sounds. These changes were caused by damage of the following auditory analyzer structures:

- A. Main cochlea membrane near the oval window
- B. Main cochlea membrane near the helicotrema
- C. Eustachian tube

- D. Middle ear muscles
- E. Tympanic membrane

95. According to audiometry data a patient has a disturbed perception of medium frequency sounds. It might have been caused by a damage of:

- A. Middle part of helix
- B. Cochlear nuclei
- C. Spiral ganglion
- D. Quadritubercular structure
- E. Lateral geniculate bodies

96. A male working as a blacksmith has been tested for auditory acuity. The tests revealed 50% hearing loss in the low frequency range and a near-normal auditory acuity in the high-frequency range. This condition has been caused by the damage to the following structures of the auditory system:

- A. Corti's organ - closer to helicotrema
- B. Corti's organ - closer to the oval foramen
- C. Median part of the Corti's organ
- D. Muscles of the middle ear
- E. Eardrum

97. Middle part of cochlear of internal ear was destroyed in animal while experiment. It will cause abnormalities of the sound perception of the following frequencies:

- A. Middle
- B. Low
- C. High
- D. High and low
- E. No abnormalities

98. A patient complains of dizziness and hearing loss. What nerve is damaged?

- A. Vestibulocochlear
- B. Trigemini
- C. Sublingual
- D. Vagus
- E. Trochlear

99. A histological specimen presents a receptor zone of a sensoepithelial sense organ. Cells of this zone are placed upon the basal membrane and include the following types: external and internal receptor cells, external and internal phalangeal cell, stem cells, external limiting cells and external supporting cell. The described receptor zone belongs to the following sense organ:

- A. Acoustic organ
- B. Visual organ
- C. Gustatory organ

- D. Equilibrium organ
- E. Olfactory organ

100. A man having a hearing loss after a head trauma was delivered to the neurosurgery department. The cause of the hearing loss might be the damage of the following lobe of cerebral cortex:

- A. Temporal
- B. Postcentral gyrus
- C. Parietal
- D. Occipital
- E. Frontal

101. A laboratory experiment on a dog was used to study central parts of auditory system. One of the mesencephalon structures was destroyed. The dog has lost the orienting response to auditory signals. What structure was destroyed?

- A. Inferior colliculi of corpora quadrigemina
- B. Superior colliculi of corpora quadrigemina
- C. Substantia nigra
- D. Reticular formation nuclei
- E. Red nucleus

102. A soldier with explosion-caused trauma was delivered to a hospital. Examination revealed his tympanic membrane to be intact. What defense reflex prevented the tympanic membrane from rupturing?

- A. Contraction of m. tensor tympani
- B. Relaxation of m. tensor tympani
- C. Contraction of m. auricularis anterior
- D. Relaxation of m. auricularis anterior
- E. Relaxation of m. stapedius

103. During experiment a dog has developed conditioned digestive reflex in response to a sound stimulus. This conditioned reflex will not be exhibited anymore after the extirpation of the following areas of the cerebral hemispheres:

- A. Temporal lobe on both sides
- B. Occipital lobe on one side
- C. Parietal lobe on both sides
- D. Temporal lobe on one side
- E. Occipital lobe on both sides

104. A man who went for a ride on a roundabout had amplification of heart rate, sweating and nausea. What receptors stimulation is it primarily connected with?

- A. Vestibular
- B. Proprioceptors
- C. Tactors

- D. Auditory
- E. Visual

105. A man who is riding the carousel presents with increased heart rate, sweating, nausea. This condition is caused primarily by the stimulation of the following receptors:

- A. Vestibular ampullar
- B. Proprioceptors
- C. Vestibular otolithic
- D. Auditory
- E. Visual

106. Surface with an intact toad on it was inclined to the right. Tone of extensor muscles became reflectory higher due to the activation of the following receptors:

- A. Vestibuloreceptors of utricle and saccule
- B. Vestibuloreceptors of semicircular ducts
- C. Mechanoreceptors of foot skin
- D. Photoreceptors of retina
- E. Proprioceptors

107. A man who is riding the carousel presents with increased heart rate, sweating, nausea. This condition is caused primarily by the stimulation of the following receptors:

- A. Vestibular ampullar
- B. Proprioceptors
- C. Vestibular otolithic
- D. Auditory
- E. Visual

108. While examining the oral cavity a stomatologist revealed inflammation of papillae on the border of the median and posterior third of the back of tongue. What papillae are inflamed?

- A. Papillae vallatae
- B. Papillae fungiformes
- C. Papillae foliatae
- D. Papillae filiformes
- E. Papillae conicae

109. In course of an experiment thalamocortical tracts of an animal were cut. What type of sensory perception remained intact?

- A. Olfactory
- B. Auditory
- C. Exteroreceptive
- D. Visual

- E. Nociceptive
110. The receptors under study provide transfer of information to the cortex without thalamic involvement. Specify these receptors:
- A. Olfactory
 - B. Tactile
 - C. Gustatory
 - D. Visual
 - E. Auditory
111. A patient consulted a doctor about loss of taste sensitivity on the tongue root. The doctor revealed that it is caused by nerve affection. Which nerve is it?
- A. Glossopharyngeal
 - B. Vagus nerve
 - C. Facial nerve
 - D. Superlaryngeal nerve
 - E. Trigeminal nerve
112. A patient's tip of the tongue was anointed with Novocaine. What taste sensations will disappear?
- A. Salt
 - B. Sweet
 - C. Sour
 - D. Bitter
 - E. Sour and salt
113. There is no conductivity in the glossopharyngeal nerve of a patient. What taste sensation will disappear?
- A. Sour and salt
 - B. Sour
 - C. Sweet
 - D. Salt
 - E. Bitter
114. A student is thoroughly summarizing a lecture. When his groupmates begin talking the quality of the summarizing worsens greatly. What type of inhibition in the cerebral cortex is the cause of it?
- A. External
 - B. Protective
 - C. Dying
 - D. Differential
 - E. Delayed

115. A 60-year-old man felt asleep after cerebral hemorrhage for a long time. Damage of what structure caused this state?
- A. Reticular formation
 - B. Hippocampus
 - C. Nuclei of the cerebral nerves
 - D. Cortex of the large hemispheres
 - E. Black substance
116. Examination of a patient revealed a strong, balanced, inert type of higher nervous activity according to Pavlov. What temperament type does the patient have (according to Hippocrates classification)?
- A. Phlegmatic
 - B. Sanguine
 - C. Choleric
 - D. Melancholic
117. A student takes notes of a lecture. Quality of his notes became significantly worse when his neighbours began talking. What type of conditional reflex inhibition was the cause of it?
- A. External
 - B. Protective
 - C. Extinctive
 - D. Differentiated
 - E. Delayed
118. A patient complains that at the bare mention of the tragic events that once occurred in his life he experiences tachycardia, dyspnea and an abrupt rise in blood pressure. What structures of the CNS are responsible for these cardiorespiratory reactions in this patient?
- A. Cerebral cortex
 - B. Cerebellum
 - C. Lateral hypothalamic nuclei
 - D. Specific thalamic nuclei
 - E. Quadrigemina of mesencephalon

RECOMMENDED LITERATURE

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