

MINISTRY OF HEALTH OF UKRAINE
ZAPORIZHZHIA STATE MEDICAL UNIVERSITY

Normal Physiology Department

NORMAL PHYSIOLOGY
Methodical manual for
students

for students of International Faculty
(the second year of study)

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(protocol N ___ from _____)
and it is recommended for the use in educational process for foreign students.*

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Practical Tasks

Lecture topic

Module 1. General physiology. Higher integration functions. Physiology of human's ontogenesis

#	Topic names
1.	General physiology of the excitable tissues.
2.	The conduction of a nerve impulse. The structure of nerve fibres.
3.	Neuromuscular synapses. The mechanism of impulse transfer from nerve to skeletal muscle. Physiology of the muscles.
4.	Nerve centers. Synaptic and Junctional transmission. Central inhibition.
5.	Motor function of the central nerve system.
6.	Motor function of the central nerve system.
7.	Nervous regulation of vegetative function.
8.	Internal secretion. Basic concepts. Pituitary hormones and their control by the hypothalamus.

9.	Internal secretion. The thyroid gland. Parathyroid glands. Pancreatic hormones. The adrenal cortex and medulla. Pineal gland. Thymus.
10.	General physiology of receptors system. Somatic sensations: the Tactile and Position Senses, Pain, Headache and Thermal sensation.
11.	Physiology of the Pain.
12.	Physiology of the Vision.
13.	Physiology of Hearing.
14.	Physiology of Equilibrium.
15.	Higher intellectual functions. Physiology of Learning, memory phenomena, Language and speech
16.	Higher intellectual functions. Neural basis of instinctual behavior and emotions.
17.	Physiology of Blood system. The physical-chemical qualities of the blood, erythrocytes and hemoglobin of the blood
18.	Physiology of Protection functions of the blood. The white blood cells. Immunity.
19.	Homeostasis and blood coagulation.
20.	Final module control 2.

Module 2. Physiology of visceral systems

#	Topic names
1.	The cardiac cycle. Cardiac output and stroke volume.
2.	Control of cardiac activity.
3.	Hemodynamics. Regulation of the Vessels system.
4.	Physiology of the respiration. Transport of respiratory gases.
5.	Regulation of the Respiratory system's functions.
6.	Metabolism and thermoregulation.
7.	Digestion system. Digestion in the oral cavity and in the stomach.
8.	Digestion in the Stomach and Pancreas. Physiology regulatory of Digestion system.
9.	Excretory system. Urine formation mechanisms. Regulation of urine formation and egestion. Kidneys role in the homeostasis providing.
10.	Final module control 2.
	TOTAL

Theme actuality. Students' independent practical work is an important part of the syllabus in the course of Normal Physiology. It helps students to study this fundamental subject.

Systematic independent work enables to reach the final goal in the students' education. It is also important while preparing the students for their future clinical work with patients.

These theoretic materials, questions and tests will help students to get ready for the examination. This manual is compiled according to the work program.

CREDIT-MODULE #1: *General physiology. The higher integration functions.*

Thematic module #1. Introduction in 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. What do you know about the Organization of the Cell?
2. What functions does Cell Membrane have?
3. Explain what functions Lipid Barrier performs?
4. What functions do Cell Membrane Proteins and Carbohydrates have?
5. Explain the mechanisms of active and passive transport substances across Cell Membranes.
6. What are some of the substances that are transported through the Cell Membrane by active and passive transports? Name them, please.
7. What is the role of the ATP in the Cell?
8. Describe the Cell amoeboid and ciliary motions and their mechanisms.
9. Explain what is meant by the "internal environment."
10. Explain the differences between the extra cellular and intracellular fluids.
11. Homeostatic Mechanism of the Major Functional systems.
12. Control system of the Body.
13. Describe the methods of the Physiology experiments.

INDEPENDENT PRACTICAL WORK

TASK 1.a.). Draw the scheme of the Cell membrane structure.

c). 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 transport of through the cellular membrane in the table.

Table1.

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 4. 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.

Thematic module #2. Introduction in physiology. Physiology of the excitable tissues.

PRACTICAL LESSON 2

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. Explain the Basic Physics of Membrane Potentials.
2. Measuring the Membrane Potential.
3. Origin of the normal Resting Membrane Potential.
4. Describe and explain the ionic basis of Local response.
5. Explain the biphasic of the Action Potential
6. Explain the ionic fluxes during the Action Potential.
7. What do you know about the distribution of ions during after potential depolarization and hyper polarization?
8. Describe the propagation of the Action Potential.
9. What is this "refractory period"?
10. Describe the role of Sodium-Potassium pump for origin of Resting Membrane Potential and Action Potential.

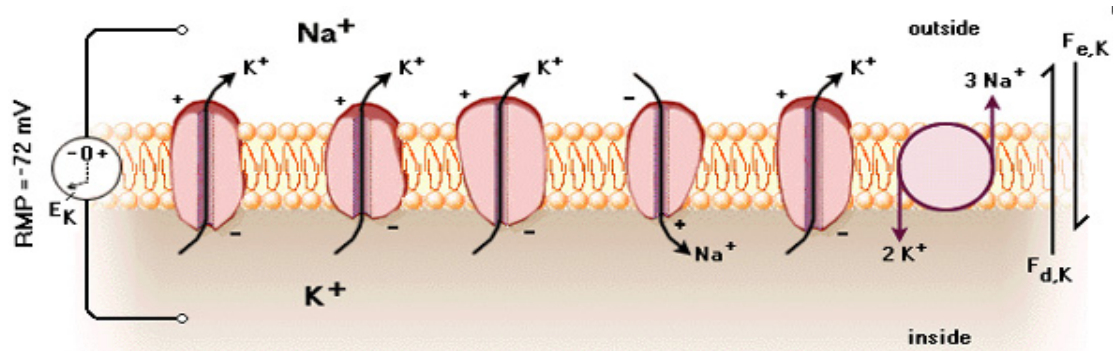
INDEPENDENT PRACTICAL WORK

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

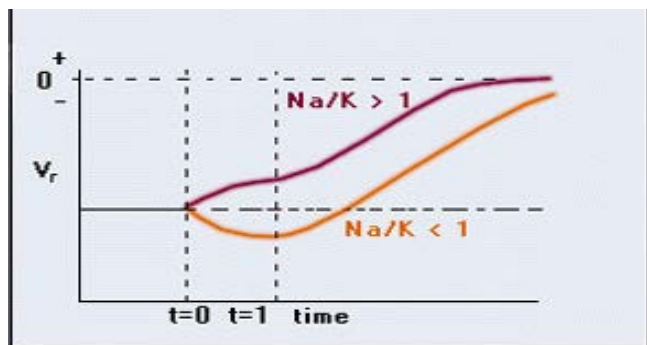
#	factors	factors' action
1.	The transmembrane ion distribution	
2.	The selective conductance of the membrane	

3.	The transmembrane ion diffusion	
4.	Na/K pump	

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



TASK 2. Look at this figure. How can you explain effects of Inhibition of an Electrogenic Na/K Pump: total inhibition (you can see the red or green curve) and a depolarizing pump (you can see the orange or yellow curve). Write an explanation.



TASK 3. Solving the clinical task. Write an explanation.

1. The ions from the intracellular fluid plus an 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 #2. Introduction in physiology. Physiology of the excitable tissues.

PRACTICAL LESSON 3

Theme: Excitable tissue: Nerve

THE GOALS:

Study the nature of the biocurrents 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

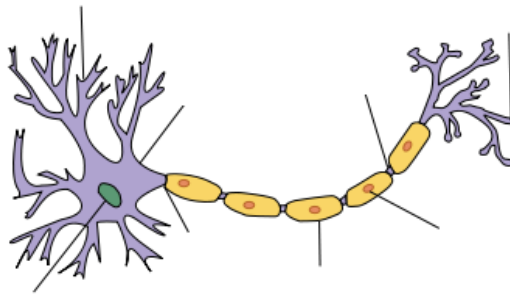
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Explain what the morphology parts does neuron has?
2. Explain the structure of Myelinated Nerve Fibers. What functions do they have?
3. Describe the structure of Unmyelinated Nerve Fibers. What functions do they have?
4. Describe the mechanism of excitation and conduction in the Nerve Fibers.
5. Explain the origin of Resting Membrane Potential of the Nerve Fibers.
6. What do you know about ionic basis of Action Potential of the Nerve Fibers?
7. Explain the ionic basis of «All -or- None» Law.
8. Describe the Local response and firing level origin of the Nerve Fibers.
9. What do you know about the mechanism of Action Potential conduction along the Myelinated and Unmyelinated Nerve Fibers?
9. What do you know about the orthodromic and antidromic of Action Potential conduction?
10. Describe the types of nerve fibers. What functions do they have?

INDEPENDENT PRACTICAL WORK

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



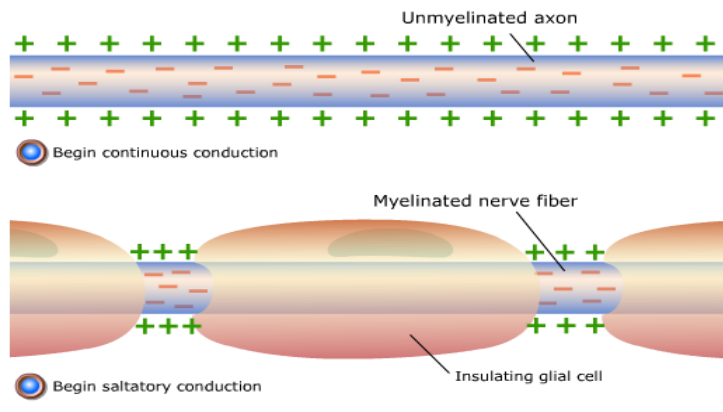
□

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

TASK 2. Complete the table about the nerve fiber.

nerve fiber	the regions of innervations
Unmyelinated Nerve	
Myelinated Nerve	

TASK 3. Look at this figure. How can you explain the mechanism of Action Potential conduction along the Myelinated and Unmyelinated Nerve Fibers? Write an explanation.



nerve fiber	ionic mechanism of AP conduction
Unmyelinated Nerve	
Myelinated Nerve	

TASK 4. 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 #2. Introduction in 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. Describe the anatomy and physiology of a neuromuscular junction
2. Describe the mechanism transmission of active potential through neuromuscular junction
3. Explain the physiological mechanism of End Plate potential.
4. What types of muscle do you know?
5. Describe the organization of the muscle. Why does the skeletal muscle have the striations?
6. What do you know about the Sarcotubular System of muscle?
7. Explain the molecular basis of muscle contraction.
8. What do you know about types of muscle contraction?
9. Explain the energy sources and metabolism during of muscle contraction.
10. What do you know about the heat production in muscle?
11. What function does Motor Unit have?
12. What do you know about the dynamometry and electromyography?
13. Explain the Mechanical activity and Molecular basis of smooth muscle contraction.
14. Explain the term « plasticity of smooth muscle».

INDEPENDENT PRACTICAL WORK

TASK1. 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									

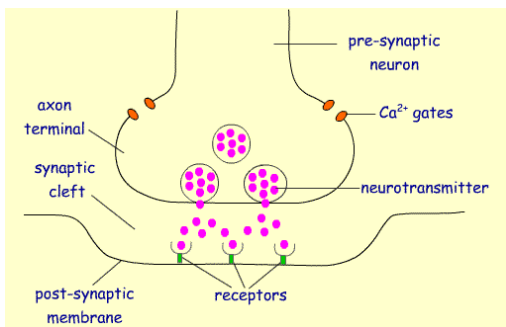
TASK2. Registration of electromyography of a person.

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).

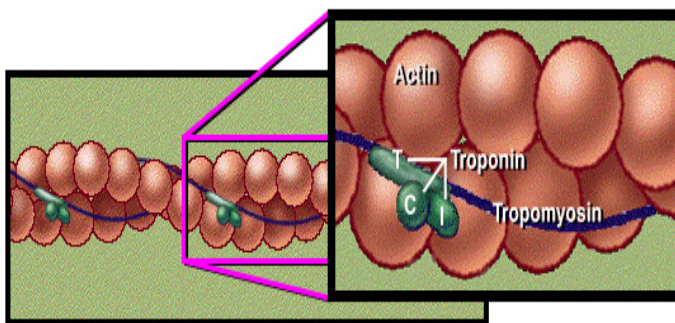
b). draw the biopotentials and compare the results before the physical loading and after it

c). make conclusions.

TASK3. Look at this figure and explain how does neuromuscular junction work? Write an explanation.



TASK4. Look at this figure and explain the Sliding mechanism of muscle contraction. Write an explanation.



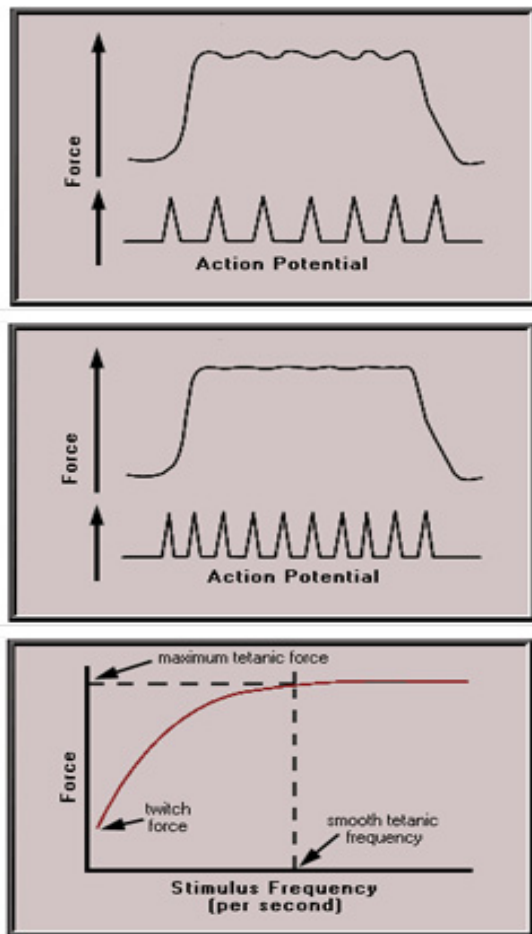
TASK5. Solving the clinical tasks.

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

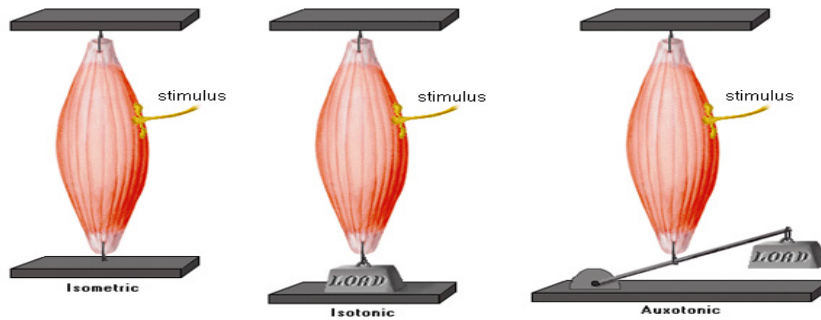
a). What should be an interval between the first and the second irritation for developing an incomplete tetanus ?

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.



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



THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #3. Nervous regulation of the organism functions. Synaptic transmission

PRACTICAL LESSON 5

Theme: Synaptic and Junctional Transmission.

THE GOALS:

Study the mechanism of Synaptic and Junctional Transmission; study the properties of the nervous centers

Initial level of knowledge

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

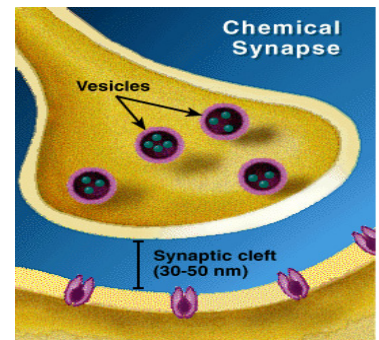
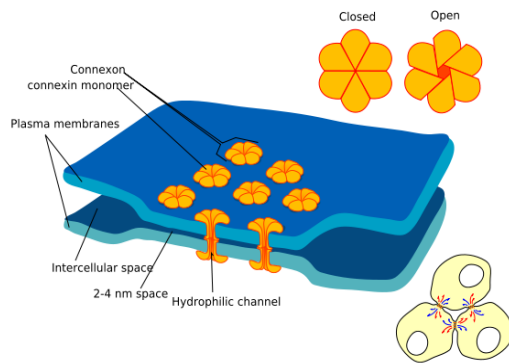
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

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. Explain the mechanism of generation of the Action Potential in the Postsynaptic neuron
6. Explain the mechanism of Excitatory Postsynaptic Potentials and Synaptic Delay
7. What do you know about the mechanism of Inhibitory Postsynaptic Potentials?
8. Describe the mechanism of Postsynaptic Inhibition in the CNS.
9. Describe the mechanism of Presynaptic Inhibition in the CNS.
10. The Summation; convergence; divergence and occlusion in the CNS
11. What do you know about the Chemistry of neurotransmitters and Receptors?

INDEPENDENT PRACTICAL WORK

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



TASK 2. What is the difference between electrical and chemical Synapses?

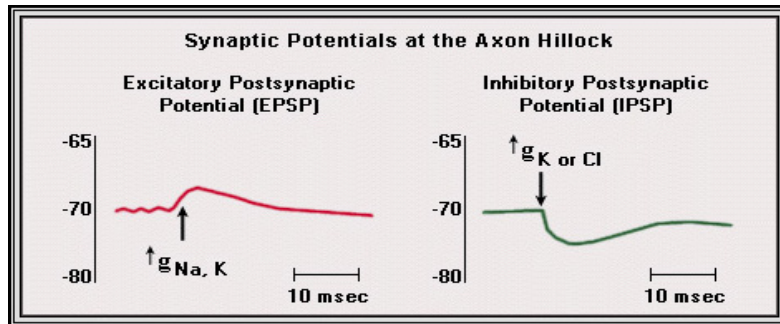
	<i>The description</i>	<i>an Electrical synapse</i>	<i>a Chemical synapse</i>
	<i>Location</i>		
	<i>Synaptic Delay.</i>		
	<i>Unilateral transmission</i>		
	<i>Transfer of Excitation.</i>		
	<i>Transfer of Inhibition.</i>		
	<i>Neurotransmitters</i>		

Put the information about difference in the table.

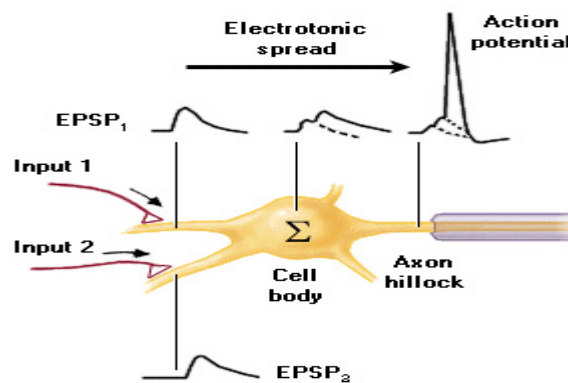
TASK 3. Put the information about Neurotransmitters in the table

<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.



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



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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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.

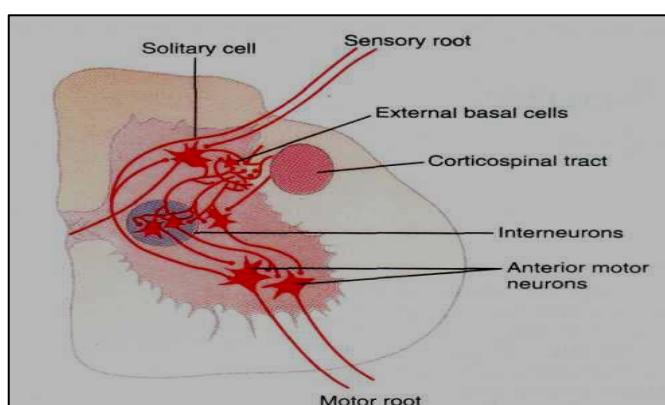
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

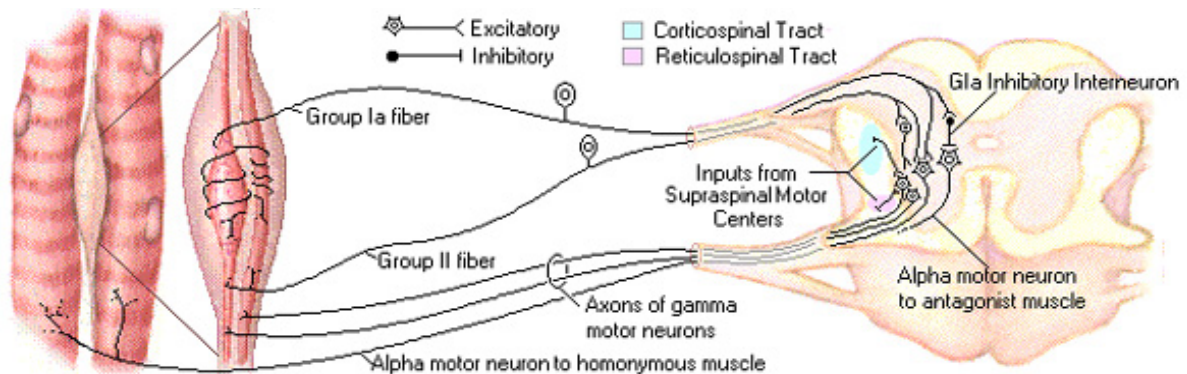
1. Describe the Organization of General Principles controlling of Posture and Movement.
2. Organization of the Spinal Cord for Motor Functions: muscle sensory receptors (Muscle Spindles and Golgi Tendon organs); Spinal cord's neurons (the alpha motor neurons, the gamma motor neurons and interneurons).
3. The Spinal stretch reflexes (or Deep Tendon Reflex, or Myotatic reflex): the adequate stimulus for the stretch reflex; the sensory ending and afferent fibers; Reflex action.
4. What do you know about the control of sensitivity of the Spinal reflex?
5. Describe the Clinical applications of the Stretch reflex (Biceps tendon reflex, Triceps tendon reflex, Knee Jerk Reflex, and Achilles tendon reflex).
6. Explain the Clasp Knife Phenomenon; the Flexion (Withdrawal) Reflex; the Crossed Extensor reflex.
7. The Spinal Shock and it origin. What Complications can be after the Cord Transection?
10. What kind of Responses can be in Chronic Spinal Animals and Humans?

INDEPENDENT PRACTICAL WORK

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



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



TASK3. Test the state of nutrition in the upper and lower limbs of the subject provided. Put the information about your results in the table.

This can be easily estimated by inspection, palpation, and by measuring the circumference of the limbs with a tape measure at certain points, and comparing them on the two sides.

In *upper limbs*, the circumference is measured 5 inches above the elbow and 4 inches below it.

In *lower limbs*, the circumference is measured 9 inches above the knee and 6 inches below it.

The *muscle mass decreases* in muscular atrophy (the muscles are smaller and softer), which may be generalized or localized. It may result from cachexia, disuse (prolonged confinement to bed, or when a limb is kept in a plaster cast), or as a consequence of lower motor neuron disease.

The *muscle mass increases* (hypertrophy) with physical exercise, and in certain occupations requiring excessive work load. In certain diseases of muscles—dystrophy and pseudohypertrophy, though the muscle bulk is increased, they are weak.

TASK4. 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.

TASK5. 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.

TASK6. 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.

TASK7.Elicit the triceps reflex. Draw the reflex arc. 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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Thematic Module #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.

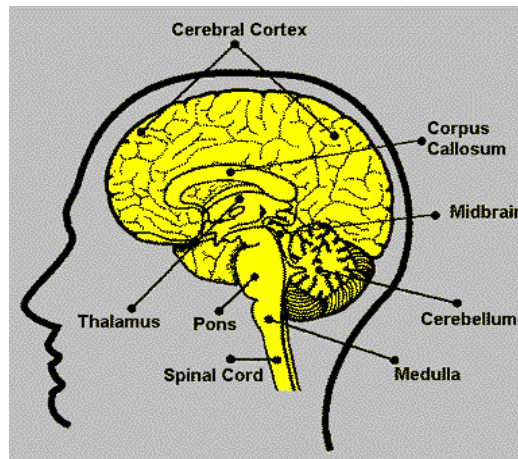
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Explain the role of the Medullary Components in movement and origin of Tonic Labyrinthine Reflexes and the Tonic Neck Reflexes.
2. Explain the role of the Midbrain Components in movement and origin of Righting Reflexes, the Grasp Reflex and other Midbrain Responses
3. Explain the role of the Thalamus and the Hypothalamus in movement.
4. Describe the role of the Basal Ganglia in movement.
5. Explain the role of the Cerebellum in movement
6. What do you know about the Corticospinal and the Corticobulbar Tracts?
7. Explain the Anatomy and Function of the Cortical Motor Areas, their plasticity.
8. The Supplementary Motor Area, the Premotor Cortex, the Posterior Parietal Cortex and its Role in Movement and influence on Stretch reflexes.

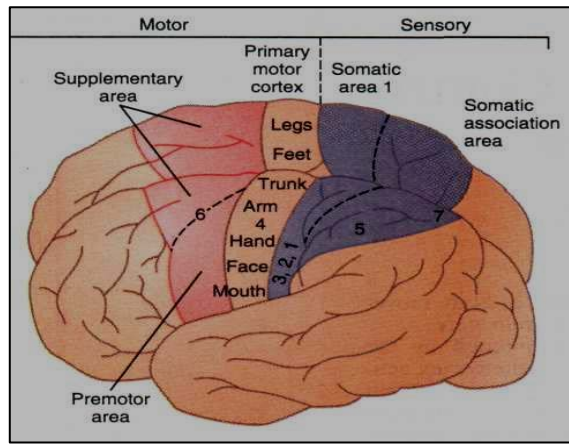
INDEPENDENT PRACTICAL WORK

TASK1. Look at this figure and put the explanations about motor functions of Cerebrum in this table.



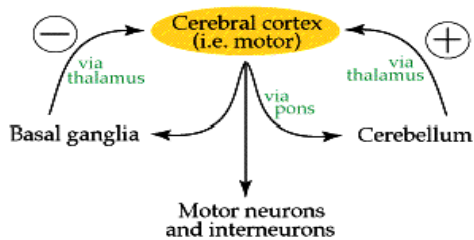
#	Part of cerebrum	Motor functions
1.	Medulla	
2.	Pons	
3.	Midbrain	
4.	Reticular formation	
5.	Thalamus :	
5.1	relay nuclei	
5.2	association nuclei	
6.	Hypothalamus	
7.	Cerebellum	

TASK2 .Look at this figure and write the explanations about motor functions of Cortex in this table.



#	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



TASK4. 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.

TASK5. 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.

TASK6. 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 9. 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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Thematic Module #5. The autonomic nervous system

PRACTICAL LESSON 8

Theme: The functions of Autonomic nervous system. Sympathetic division

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

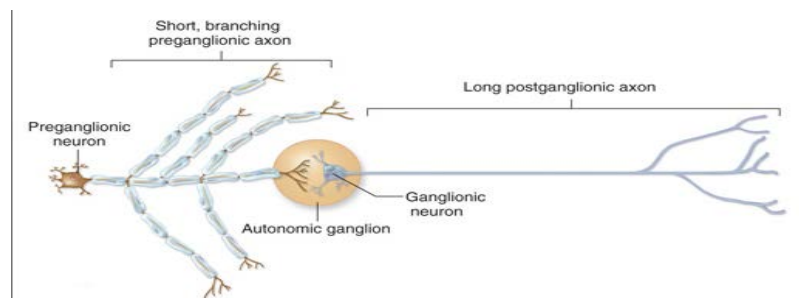
CONTROL QUESTIONS:

1. What do you know about Structure of peripheral nervous system?
2. What is the role of Somatic and Autonomic nervous system?
3. Describe the anatomic organization of Sympathetic Autonomic out flow.
4. Explain the Physiologic structure and functions of Preganglionic and Postganglionic Sympathetic Neurons.
5. What can you tell about Preganglionic and Postganglionic pathways of Sympathetic nerve system?
6. What do you know about the Chemical transmission at Autonomic junctions?

7. Explain the Chemical Divisions of the Autonomic nervous system. The transmission in Sympathetic Ganglia. Describe the Preganglionic and Postganglionic transmitter substances of Sympathetic division.
8. The responses of effector organs to Autonomic nerve impulses. What you know about their General Principles? Describe the Receptors System on the Effector organs of Sympathetic division.
9. Explain the excitatory and inhibitory Actions of Sympathetic stimulation and effects of it stimulation on Specific Organs: the eyes; the glands of the body; the gastrointestinal system; the heart; the systemic Blood Vessels and other functions of the Body.

INDEPENDENT PRACTICAL WORK

TASK1. Look at this figure and write the explanations about the bineuronal structure of Sympathetic division.



TASK 2. Put the information about the response of effectors organs to Sympathetic nerve impulses in this table.

An effector organ	Noradrenergic impulse response	Type of receptor
<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 3. 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

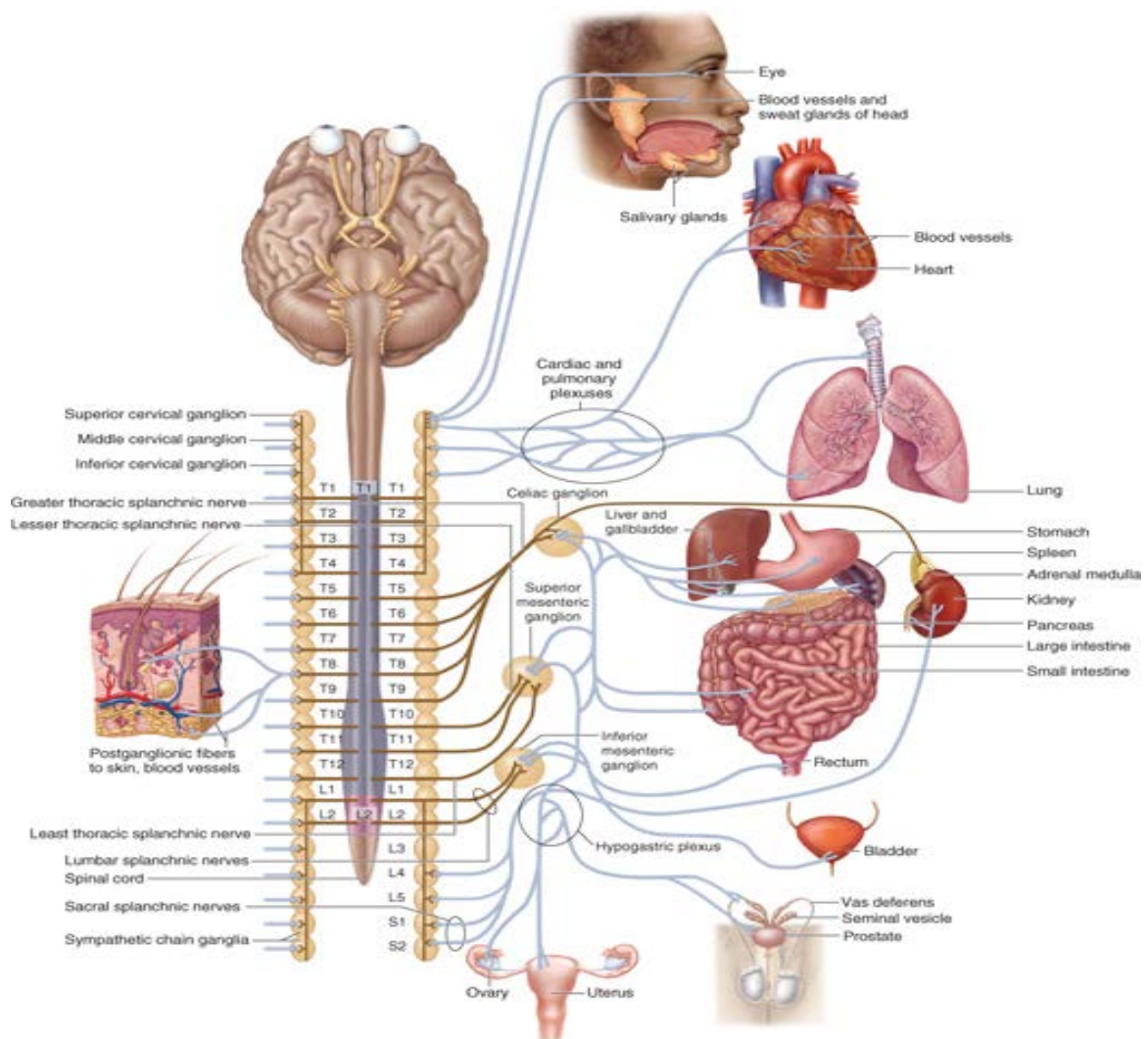
After the white line disappears in about a minute, use a stronger stimulus with the forceps. The response will vary from person to person. A full-fledged triple response, especially in sensitive skins, consists of the following 3 stages:

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. Look at this figure and write the explanations about the postganglionic pathways of Sympathetic nerve system.



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Thematic Module #5. The autonomic nervous system

PRACTICAL LESSON 9

Theme: The functions of Autonomic nervous system. Parasympathetic division

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

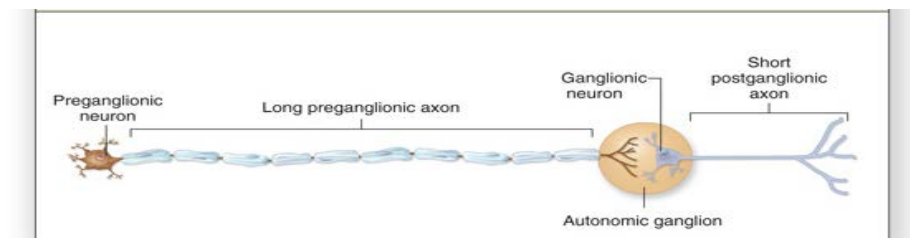
CONTROL QUESTIONS:

1. Describe the anatomic organization of Parasympathetic Autonomic out flow.
4. Explain the Physiologic structure and functions of Preganglionic and Postganglionic Parasympathetic Neurons.

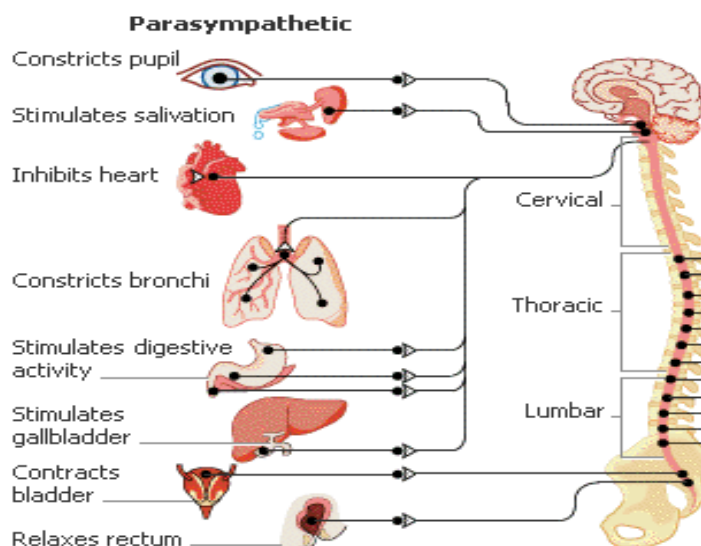
5. What can you tell about Preganglionic and Postganglionic pathways of Parasympathetic nerve system?
6. What do you know about the Chemical transmission at Parasympathetic Autonomic junctions? Describe the Preganglionic and Postganglionic transmitter substances of Parasympathetic division.
7. The responses of effector organs to Parasympathetic Autonomic nerve impulses. What you know about their General Principles? Describe the Receptors System on the Effector organs of Parasympathetic division.
8. Explain the excitatory and inhibitory Actions of Parasympathetic stimulation and effects of it stimulation on Specific Organs: the eyes; the glands of the body; the gastrointestinal system; the heart; the systemic Blood Vessels and other functions of the Body.
9. What do you know about the Autonomic Reflexes?

INDEPENDENT PRACTICAL WORK

TASK1. Look at this figure and write the explanations about the bineuronal structure of Parasympathetic division.



TASK 2. Look at this figure and write the explanations about the organization of Parasympathetic nerve system.



TASK3. Put the information about the response of effector organs to Parasympathetic nerve impulses in this table.

An effector organ	Cholinergic impulse response	Cholinergic Reflex arc
<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>kidney</i>		
<i>urinebladder</i>		
<i>ovary</i>		
<i>uterus</i>		
<i>penis</i>		
<i>scrotum</i>		

TASK 4. The Oculocardiac reflex. Explain results after person's examination; draw the reflex ark 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		

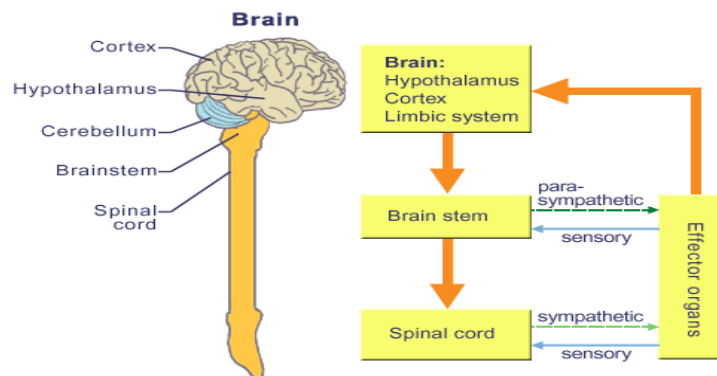
TASK 5. The Carotid sinus reflex. Explain results after person's examination; draw the reflex ark and write an explanation.

Pressure with the thumb on the carotid sinus in the neck (on one side only, never on both sides) causes slowing of the heart. **Put your results in this table.**

	Before test (beats per minute)	After test (beats per minute)
Person's heart beats		

This reflex is hyperactive in some persons with marked vasomotor instability; slight stimulation of this type may cause fainting (carotid sinus syncope).

TASK 6. Look at this figure and write the explanations for Gastrointestinal autonomic reflex.



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Thematic Module #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. Describe the Common Features of Endocrine and Nervous Systems
2. What do you know about distinctive Properties of Endocrine and Nervous Systems?
3. Explain the mechanism of coordination of Body Functions by Chemical Messengers.
Describe the chemical structure, synthesis of Hormones and types of ones.
4. What do you know about the Hormone transport and Clearance from the Blood?
5. Describe the structure of Hormones and the mechanism of ones action (Steroid hormones, Peptide and Protein Hormones).
5. What do you know about the Positive/Negative Feedback Mechanisms of Hormone synthesis Regulation; the feed-forward loop Mechanisms of Hormone synthesis Regulation and Push/Pull systems of Hormone synthesis Regulation?
6. The endocrine role of Hypothalamus.
7. The endocrine role of s Pituitary gland:
 - a). Explain the Physiological function of Growth Hormone; Adrenocorticotropin hormones; Thyroid Stimulating Hormone; Prolactin; Follicle-stimulating hormone and Luteinizing hormone (which produce by anterior lobe of Pituitary gland);
 - b). Explain the physiological functions of melanocyte-stimulating hormone (which produce by pars intermedium of Pituitary gland);
 - c). Explain the physiological functions of Vasopressin and Oxytocin (which produce by pars posterior of Pituitary gland).
8. Describe the physiologic functions of the Thyroid hormones:
 - a) increase the transcription of large numbers of genes;
 - b) increase cellular metabolic activity;

- c) effects of Thyroid hormone on specific Body mechanisms;
 9. The mechanism of regulation of Thyroid hormone secretion
 10. What do you know about the symptoms of hyperfunction and hypofunction of Hypothalamus, Pituitary and Thyroid gland?

INDEPENDENT PRACTICAL WORK

TASK1. 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. 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>		

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

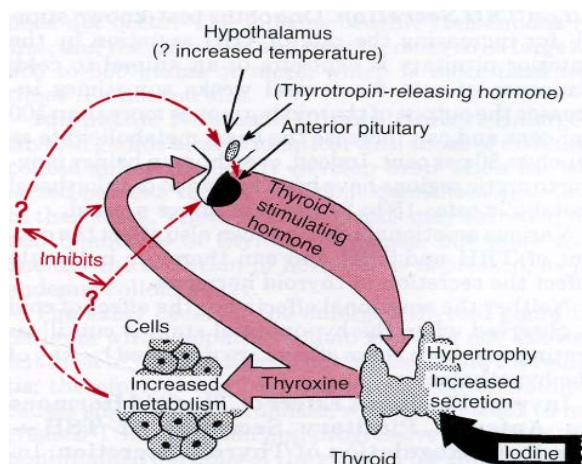
Hormone	Chemical structure	action	Target organ
<i>Growth hormone</i>			

<i>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>			

TASK6. Put the information about the intermedium and posterior Pituitary hormones in this table.

hormone	chemical structure	action
Melanocyte-stimulating hormone		
Vasopressin		
Oxytocin		

TASK 7. Draw the scheme of Regulation of the Thyroid secretion and write an explanation.



TASK 8. 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>		

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Thematic Module #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.

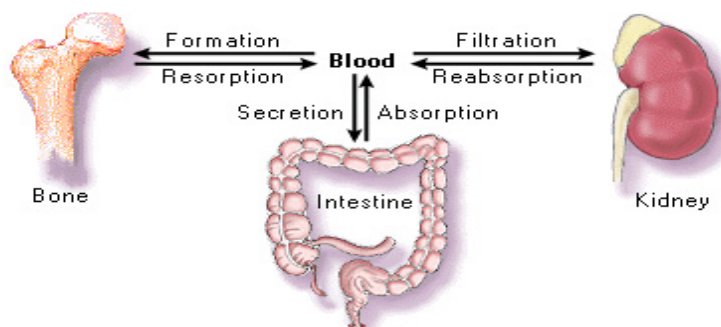
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

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

PRACTICAL WORK

TASK 1. Look at this figure and write an explanation about Parathormone functions.



TASK 2. Put the information about the effects of Insulin on various tissues in this table

Adipose tissue	Muscle	Liver	General

TASK 3. Put the information about the effects of Insulin deficiency

Glucose uptake	Protein catabolism	Lipolysis

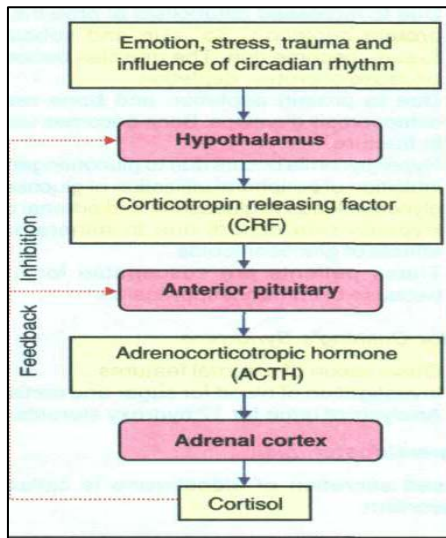
TASK 4. Put the information about the factors affecting Glucagon secretion

Stimulators	Inhibitors

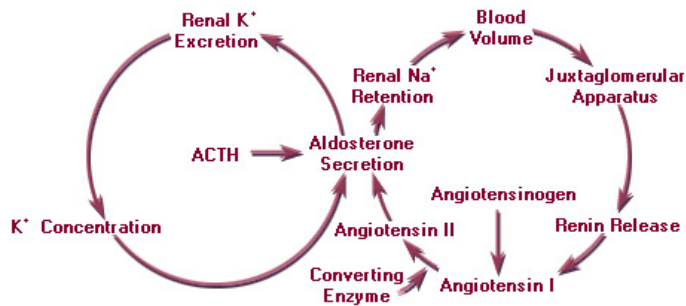
TASK 5. Put the information about the effects of Glucocorticoids on various tissues in this table

Hormones	Effects

TASK6. Look at this scheme and write an explanation about regulations of Glucocorticoids secretion.



TASK 7. Look at this scheme and write an explanation about Aldosterone effects.



TASK8. Put the information about the Adrenaline effects in this table

Organs	Effects

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #7. Physiology of the sensory systems

PRACTICAL LESSON 12

Theme: Physiology of receptors' system. Initiation of impulses in Sense organs

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?
- 4. Describe the characteristics of Sensory receptors: mechanoreceptors, thermoreceptors, nociceptors, electromagnetic receptors, chemoreceptors.
- 5. What do you know about Receptor potentials:
 - a). mechanisms of Receptor potentials;
 - b). maximal Receptor potential amplitude;
 - c). relation of the Receptor potentials to Action Potential;
 - d). receptor potential of the Pacinian corpuscle – en example of Receptor function;
 - e). relation between stimulus intensity and the Receptor potential.
- 6). Adaptation of receptors:
 - a). mechanisms by which Receptors adapt;
 - b). slowly adapting receptors defect continuous stimulus strength – the “tonic receptors”;
 - c). rapidly adapting receptors defect change in stimulus strength – the “rate receptors» or “movement receptors”.
- 7. Nerve fibers that transmit different types of signals, and their physiologic classification.
- 8. Transmission of signals of different intensity in Nerve tracts – spatial and temporal summation.

INDEPENDENT PRACTICAL WORK

TASK1 Write the information about “Classifications of Sensory receptors” in the table.

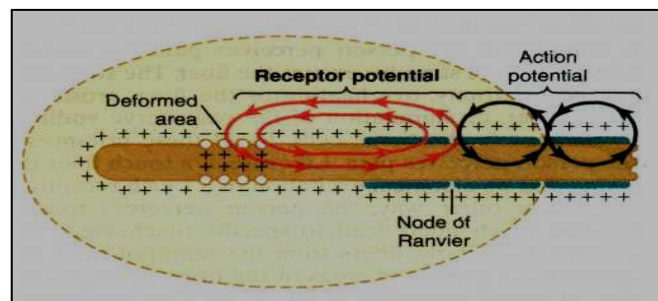
Table1. Classifications of Sensory receptors

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	

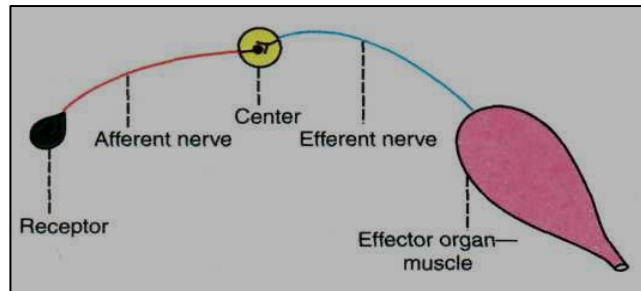
	Free nerve endings	
	Muscle spindles	
	Golgi tendon receptors	
	Pacinian corpuscles	
	Sound receptors of cochlea Equilibrium	
	Warm receptors	
	Baroreceptors	
	Krause's corpuscles	
	Ruffini's endings	
	Nociceptors	
	Receptors of olfactory epithelium	
	Rods, Cones	

TASK2.

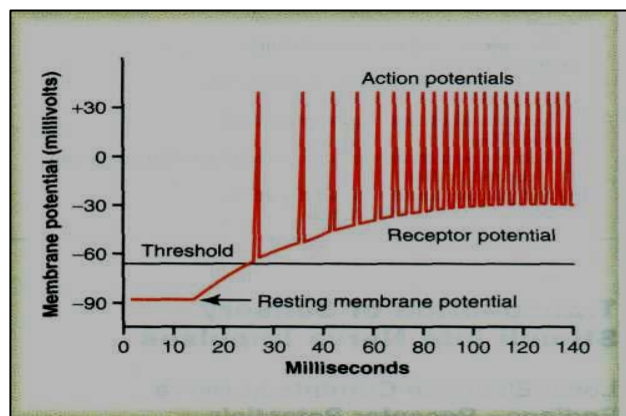
Look at this figure. Write an explanation about excitation of a sensory nerve fiber by a receptor potential produced in a Pacinian corpuscle



TASK3. Look at this scheme and write an explanation.



TASK4. 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.



TASK5. 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”.

TASK9. Write the explanation of clinical tasks.

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

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

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #7. Physiology of the sensory systems

PRACTICAL LESSON 13

Theme: Somatic sensations: the Tactile and Position senses; Pain; Headache and Thermal sensation.

THE GOALS:

To study the physiology of the Tactile and thermal sensation

Initial level of the knowledge

1. Anatomy of the Spinal cord

THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

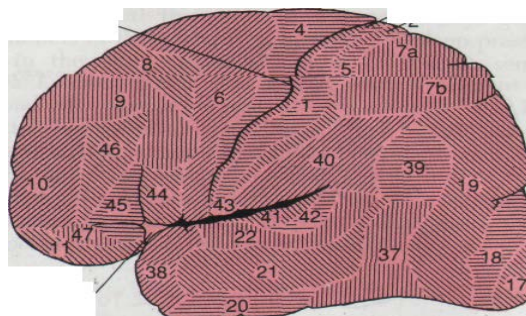
1. What do you know about classification of Somatic Senses?

2. Detection and transmission of tactile sensations:

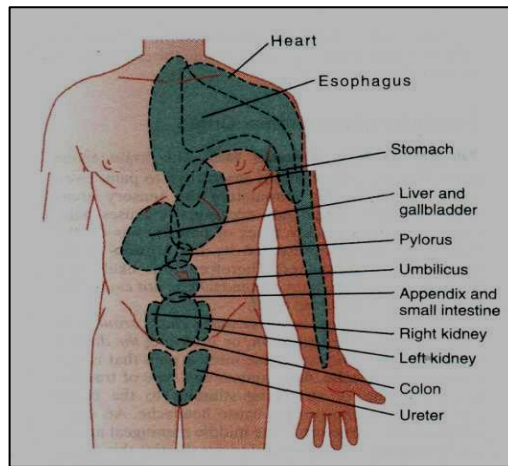
a). tactile receptors;

- b). transmissions of the tactile signals in peripheral nerve fibers.
3. Detection of Vibration; tickle and itch. Vibratory sensation
 4. Sensory pathways for transmitting Somatic signals into the central nerve system.
 5. The types of Pain and their qualities – fast Pain and slow Pain.
 6. Pain receptors and their stimulation: a). pain receptors are free nerve endings; b). three types of stimuli excite Pain receptors – mechanical, thermal and chemical; c). nonadapting nature of Pain receptors.
 7. Rate of tissue damage as a stimulus for Pain: a). special importance of chemical Pain stimuli during tissue damage; b). tissue ischemia as cause of Pain; c). muscle spasm as cause of Pain.
 8. Pain suppression (“Analgesia”) System in the Brain and Spinal cord: a).Brain’s Opiate system – Endorphins and Enkephalins; b). Inhibition of Pain transmission by simultaneous active sensory signals;
 9. Referred Pain and Visceral Pain: a). causes of true visceral Pain (ischemia; chemical stimuli; spasm of Hollow viscus; over distention of a Visceral Pain; intensive viscera) b).”Parietal Pain” caused by visceral Disease;
 11. Headache: a). ... of intracranial origin; b). extracranial types of Headache.
 12. Thermal receptors and their excitation.
 13. Stimulation of Thermal receptors- sensations of cold, cool, indifferent, warm and hot.
 14. Stimulatory effects of rising and falling Temperature – adaptation of Thermal receptors.
 15. Mechanism of stimulation of Thermal receptors.

TASK1. Look at this figure. What kind of functions can specifically areas (1, 2, 3 ,5, 7) of the brain have? Describe an explanation.



TASK2. Look at these figures. Write the explanations about the reasons for referred pain. Put information about the sites of referred pain in this table.

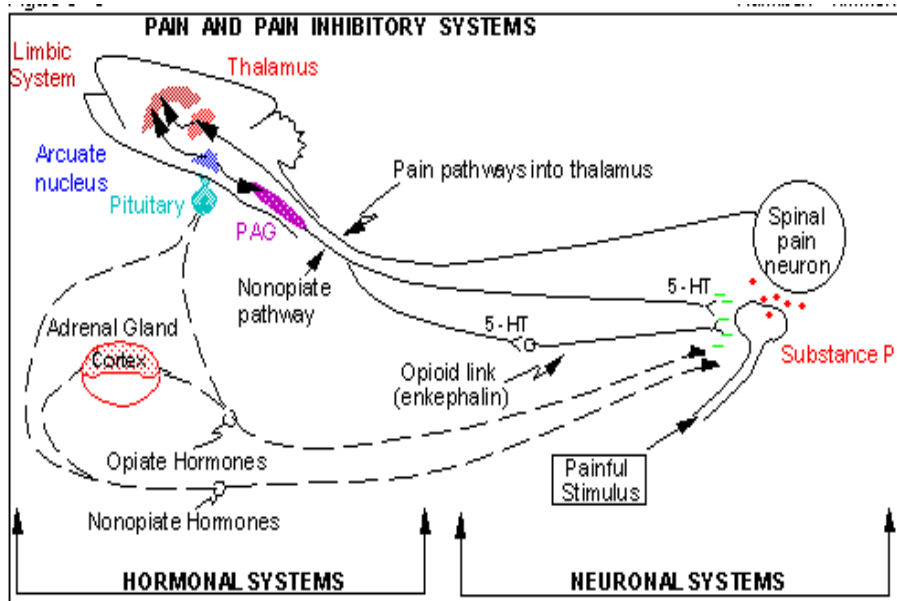


TASK 3.

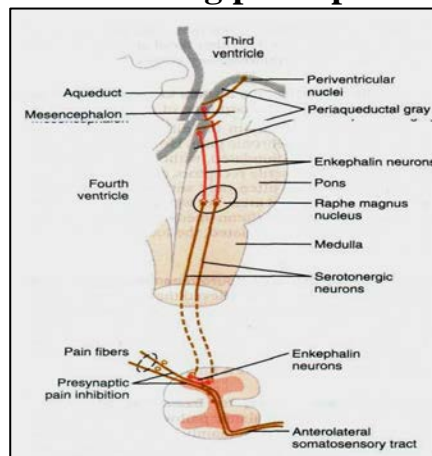
#	organ	region of referred pain
	Heart	
	Esophagus	
	Stomach	
	liver and goldbladder	
	appendix and small intenzyme	
	right kidney	
	left kidney	
	colon	
	Ureter	

TASK4. 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



TASK5. Look at this figure, note morphologic components for this Pain pathway. Write an explanation of the transmission of pain signals into the hindbrain, thalamus and cortex via (the fast “pricking pain» pathway and the slow “burring pain» pathway).



TASK10. Write the explanations for clinical tasks

1. What is the hyperesthesia, analgesia, parestesia?

2. What kind of visceroreceptive reflexes do you know?

TASK6. 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

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #7. Physiology of the sensory systems

PRACTICAL LESSON 14.

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:

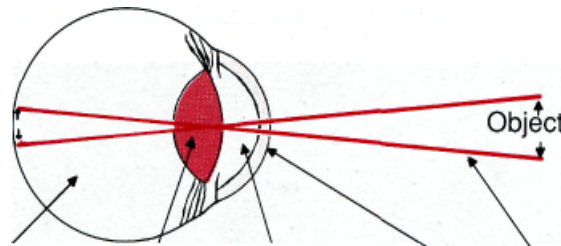
1. The structure of the eye:

- 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. 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;
 - e). acuity of vision.
 3. The field of vision:
 4. The Visual pathway.
 5. Pupillary reflexes.
 6. Color vision.
 7. Errors of refraction.

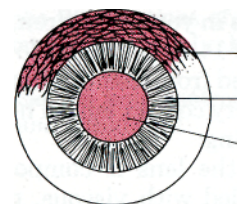
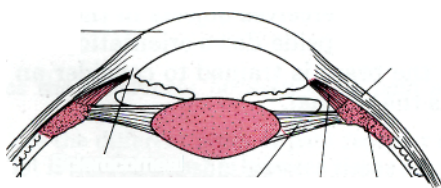
PRACTICAL WORK

TASK1. Look at this figure and indicate the morphological components of the eye.

Write an explanation about the structure of the eyeball.



TASK2. Look at these figures and indicate their morphological components. Write an explanation about the mechanism of accommodation.



TASK3. Test the visual acuity of the subject provided.

Visual acuity, ie. 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**) .

TASK4. Demonstrate the light reflex in the subject provided. What is the pathway of this reflex?

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.

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.

TASK5. Perimetry.

The part of the external world visible to one eye when a person fixes his gaze on one point is called *the field of vision* for that eye. The process of charting the monocular field of vision is called perimetry. It is employed for the diagnosis of various lesions of the visual pathways.

Perimeter

Priestley-Smith and Lister perimeters are self-recording. A simple "hand" perimeter is also available. The former consists of the following parts:

1. *Stand* A heavy stand, on which a metal arc is fitted on a pivot, provides stability to the apparatus. A large black disc with a frame for holding the perimeter chart is provided on the back.
2. *Metal arc* A broad metal arc shaped like a half circle is mounted on the stand and can be rotated in any meridian around its central pivot. One half of the arc, the concavity of which is directed toward the subject, has a scale of 0 to 90 degrees marked on its convex surface, while a source of light is fitted at the end of the other limb of the arc. A small plane mirror is fixed in the center of the arc. Test objects of various sizes and colors can be fitted in a carrier which moves in a groove in the graduated limb of the arc. When the test object is moved with a knob, a pin on the back of the apparatus moves correspondingly.
3. *Chin rest* An adjustable chin rest is provided to keep the head steady. The chin of the subject rests on the right cup when the left eye is to be tested and the left cup is used when the right eye is tested.
4. *Chart* The perimeter chart on which the field of vision is to be plotted is divided by circles from 0 to 90°, and by meridians at 15° intervals (**Figure A.**) Both the angles and the meridians are printed on the chart. The limits for the *normal peripheral fields of vision* for the two eyes, and the blind spots, are printed on the chart for comparison with the plotted fields of vision. The term "peripheral field" refers to the peripheral or outer limits of the field.

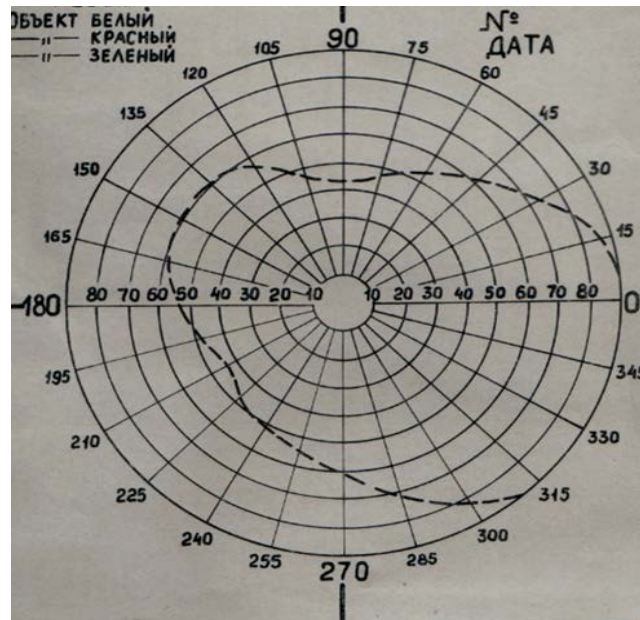


Figure A.

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

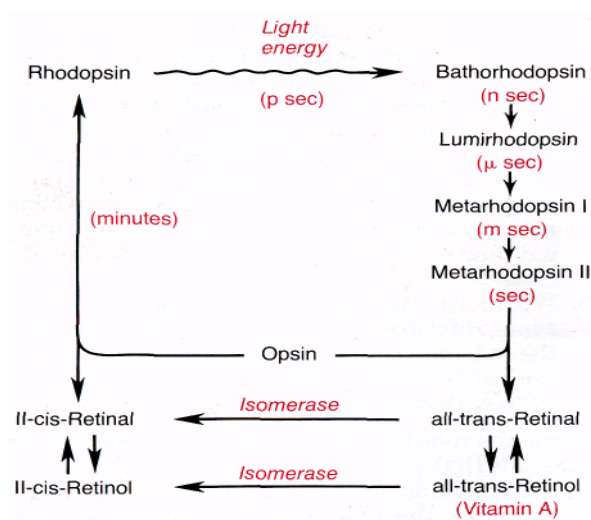
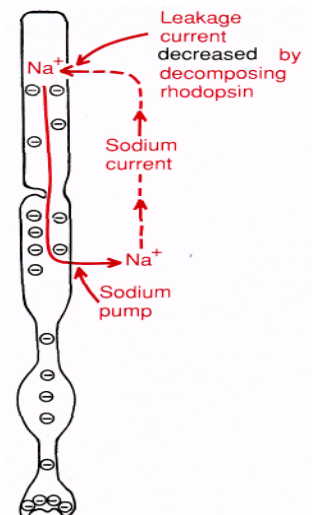
The color	External	Side lower	Interior	The upper
white	90	60	50	55
Blue	70	50	40	40
Red	50	30	25	25

Green	30	25	20	20
-------	----	----	----	----

Table 2.

The color	External	Side lower	Interior	The upper
white				
Blue				
Red				
Green				

TASK6. Look at these figures. Write the explanations.



A.

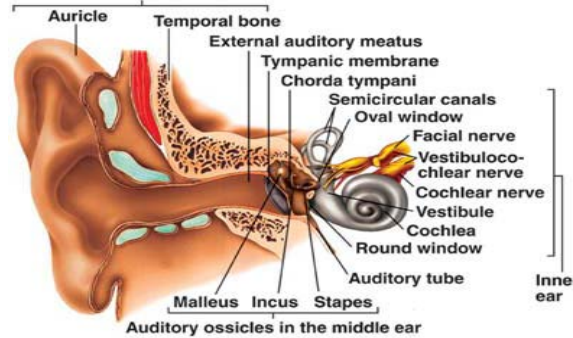
B.

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.

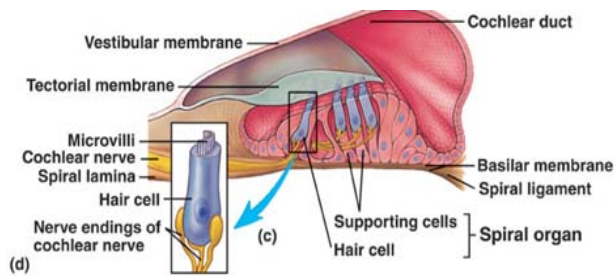
PRACTICAL WORK

TASK1. Draw this figure and put information about function of morphological parts of ear in this table.

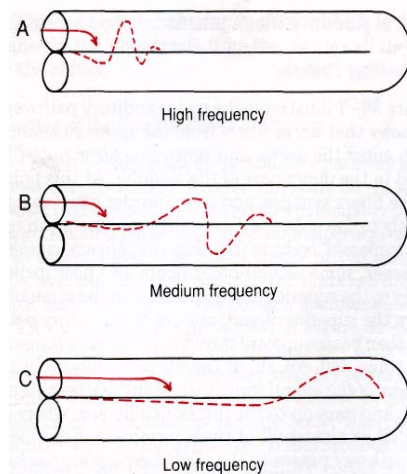


	morphological structure	function
	auricle of pinna	
	external auditory meatus	
	tympanic membrane	
	auditory ossicles	
	m. tensor tympani	
	m.stapedius	
	Eustachian tube	

TASK2. Look at the figure of the organ of Corti and write an explanation about the mechanism of receptor potential in one.



TASK3. Look at this figure. Write an explanation about the "Traveling waves" along the basilar membrane for high, medium, and low frequency sounds.



TASK4. 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.

TASK5. 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 work book, 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

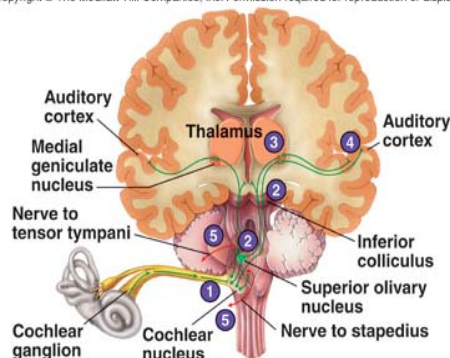
difference in its interval at the two ears. When we want to localize a sound coming from a distance, we turn our head until the sound is equally loud in the two ears. The direction in which we are facing is the direction of the sound's origin.

TASK6. Perform the whisper test in the subject provided.:The simplest way of testing for hearing loss is the use of human voice. A conversational voice is generally heard at a distance of 10-12 feet in each ear, separately. The whisper test is the simplest test for assessing gross defects in hearing.

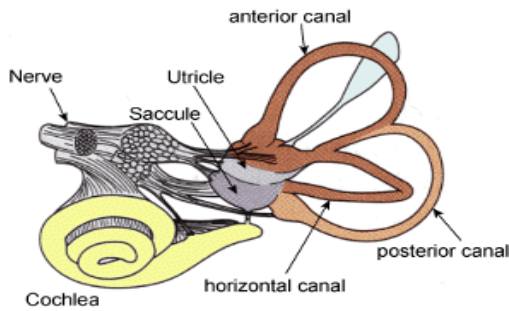
The examiner stands on one side of the subject and closes the subject's opposite ear with his own finger. He then asks the subject's name, nature of his work, etc by gently whispering into his ear from a distance of 12-14 inches. The procedure is repeated on the other side. A ticking watch may be gradually brought towards each ear of the subject, separately. The examiner can then compare the subject's hearing with his own.

TASK7. Look at this figure and write explanation about the auditory pathway.

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7. Look at this figure and write an explanation about the functions of an each morphological part of Labyrinth. Put information in this table.



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>	

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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PRACTICAL LESSON 16.

Theme: The chemical Senses: Taste and Smell

THE GOALS:

Study the physiology of the Taste and Smell

Initial level of knowledge

1. Anatomy of the tongue and smell organ

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Sensation of the Taste:

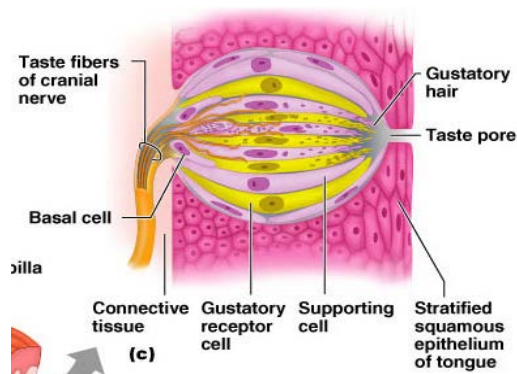
- a). taste buds (situation of taste buds; structure of taste bud);
- b). taste pathway (receptors; the first, second and third order neurones; taste center);
- c). primary taste sensations;
- d). discrimination of different taste sensations;
- e). taste sensations and chemical constitution (sweet taste; salt taste; sour taste; bitter taste; umami taste);
- f). mechanism of stimulation of taste receptors – generator potential in taste receptor cells;
- g). abnormalities of taste sensation.

2. Sensation of Smell:

- a). olfactory receptors;
- b). olfactory pathway;
- c). generator potential in olfactory receptor;
- d). classification of odor;
- e). threshold for olfactory sensation;
- f). abnormalities of olfactory sensation.

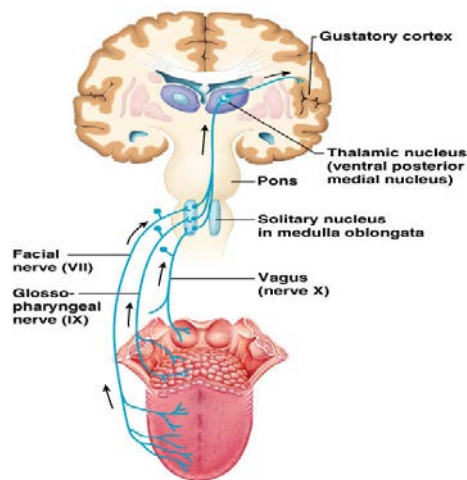
PRACTICAL WORK

TASK1. Look at this figure. Write the morphological components and functions of a Taste bud.



TASK2. Look at this figure and note the morphological components of taste

pathway



TASK3 . Sensation of the taste.

The following material will be required: Strong solutions of sucrose (10%) and sodium chloride (15%), and weak solutions of acetic acid (1%), and quinine sulfate (0.1%) kept in dropper bottles. A hand lens, small cotton swabs, toothpicks or pipette, four cards with sweet, salt, sour and bitter printed on them

Procedures

Instruct the subject that he is to point to a card to indicate the taste felt by him.

1. Seat the subject near your work table. Ask him to protrude his tongue. Using the hand lens, examine and identify the areas which have large concentrations of papillae and taste buds. Locate the fungiform and circumvallate papillae.

2. Ask the subject to rinse his mouth; then dry it with gauze. Moisten a swab with a few drops of sugar solution, apply it to the tip of the tongue, and ask him to indicate, without withdrawing the tongue, the taste experienced by him.

3. Have him rinse his mouth; dry the tongue with gauze, and repeat the procedure with the salt solution.

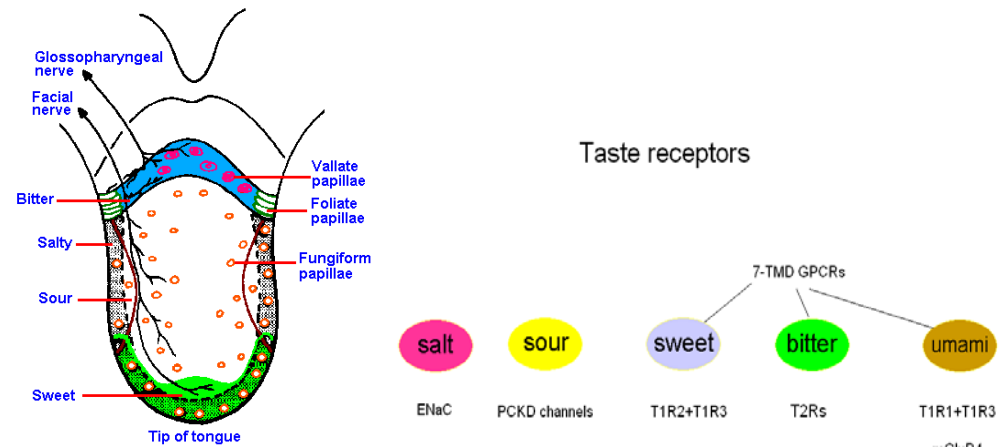
4. Repeat this procedure with all the four substances, one by one, on the sides, near the tip, the anterior 2/3, and the posterior 1/3 of the dorsum of the tongue; and taking care that the test solution does not spread across the midline. The tip of the tongue may be held with gauze while testing.

Record the results, and grade the intensity of taste sensation as: intense (+ + +), moderate (+ + +), mild (+ +), slight (+), or absent (0).

Comments Though the 7th cranial nerve is almost entirely a motor nerve, it carries taste fibers from the anterior 2/3 of the tongue. These fibers pass from the lingual nerve into the chorda tympani and then through the geniculate ganglion and the nervus intermedius of Wrisburg to enter the medulla to form the tractus solitarius. Taste fibers from the posterior 1/3 of the tongue are carried by the 9th

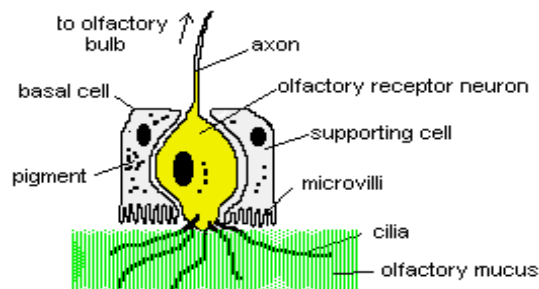
nerve. General sensations from the tongue are carried by the 5th cranial nerve.

TASK4. Look at these figures. Write an explanation about the physiological basic of a taste card. What do you know about umami sense? Write an explanation.



The sweet taste is better experienced near the tip of the tongue, salt on the sides and top, bitter in the posterior part, and sour sensation in between these areas.

TASK5. Look at this figure. Write an explanation about olfactory membrane and olfactory bulb.



TASK6. Describe the mechanism of an action potential for olfactory receptors' cells. Write an explanation

TASK7. Draw a scheme of olfactory pathway. Write an explanation.

TASK8. Sensation of smell

Vials containing oil of cloves, turpentine oil, and alcohol (or other substances) will be used for testing the sense of smell. Ammonia or acetic acid should not be used because these irritants stimulate the 5th nerve supplying the nasal mucosa. It should be confirmed that the subject's nose is not blocked by common cold.

Procedures

1. Ask the subject to close his eyes, and occlude one of his nostrils. Then have him smell and distinguish the odors of each of the test substances, one by one, in each nostril, separately.
2. Ask him to occlude one nostril, and have him smell the oil of cloves until the odor can no longer be detected. Immediately after this, ask the subject to try to distinguish, with the adapted nostril, between turpentine and alcohol. Describe the result in your practical work book.

Pathway for Smell

The pathway of smell is: Olfactory receptor cells-* Olfactory nerves-* Olfactory bulb-*Olfactory tract-* Olfactory cortex (uncus and pyriform cortex, for perception of sense of smell). Lesions in this area may be associated with perversion of smell. The olfactory cortex forms part of the limbic system which is concerned with emotions, and instinctual and social behavior.

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #7. Physiology of the sensory systems

PRACTICAL LESSON 17.

Theme: Conditioned reflexes, learning, memory

THE GOALS OF OCCUPATION:

To study the physiology of Conditioned reflexes, learning, related phenomena
Initial level of the knowledge

1. Anatomy of CNS

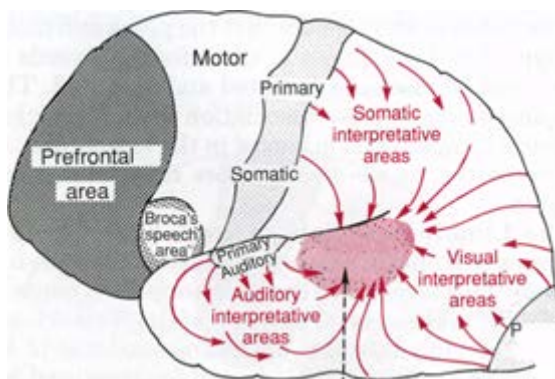
THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Learning (definition and types of learning).
2. Memory (definition; types).
3. Physiological and anatomical basis of memory.
4. Chemical basis of memory.
5. Consolidation of memory; drugs facilitating and abnormalities of memory.
6. Conditioned reflexes (definition; types; types and properties of conditioned reflexes; instrumental or operant conditioned reflexes).
7. Physiological basis of conditioned reflexes.
8. Speech (definition; mechanism of speech).
9. Development and nervous control of speech.
10. Applied physiology – disorders of speech.

PRACTICAL WORK

The TASK1 **Look at this figure. Note all morphological component, write an explanation of the physiological differences between the Broca's and Wernicke's areas.**



The TASK3. **Examination of Visual short- term memory at 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 handicapes .Write result of the test in the table

RESEARCH PROBLEMS

Compare results and write an explanation to them

The TASK3. The research of hearing and long – duration 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 write 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 7 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

The TASK5. Examenation of Auditory and Visual long- term memory at 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

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Thematic module #8. Physiological principles of behavior.

PRACTICAL LESSON 18.

Theme: Neural basis of instinctual behavior and emotions.

GOALS OF OCCUPATION:

To study the physiology of instinctual behavior and emotions.

Initial level of the knowledge

1. Anatomy of CNS

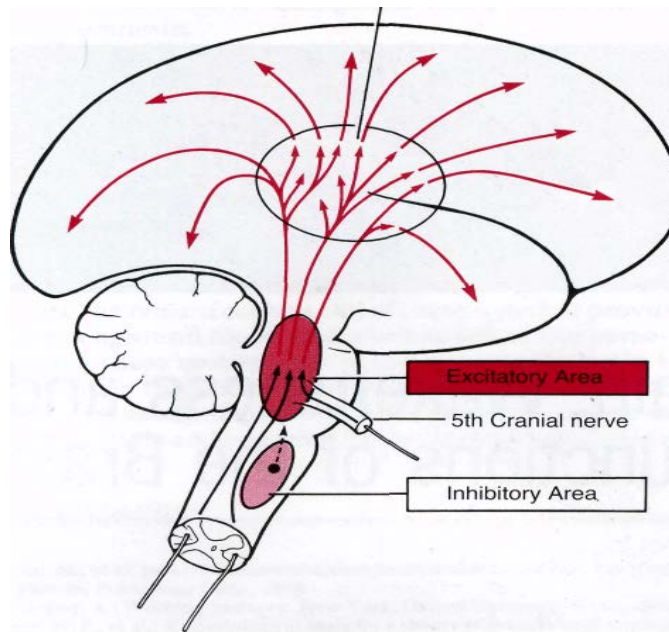
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Neural basis of instinctual behavior and emotions (anatomic consideration and histology; afferent and efferent connections; correlation between structure and function; unconditioned reflexes).
2. Limbic functions.
3. Sexual behavior (relation to endocrine function; neural control in the Male and Female; effects of Sex hormones in infancy on Adult behavior; pheromones; maternal behavior).
4. Emotions (fear; anxiety; rage and placidity; disgust).
5. Motivation and addiction (self-stimulation; addiction).
6. Brain chemistry and behavior. Aminergic systems in the brain (serotonin; norepinephrine; epinephrine; dopamine; histamine; acetylcholine; opioid peptides).
7. Types of the "Higher nervous activity".
8. Physiology of the sleep.

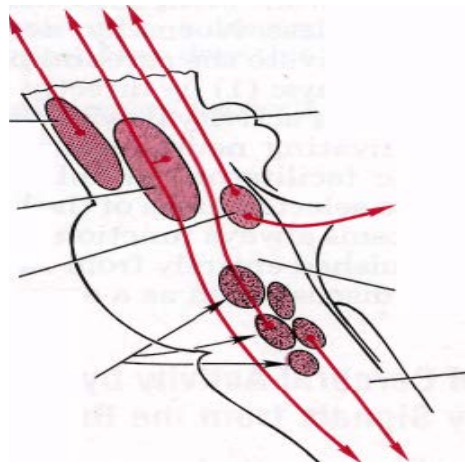
PRACTICAL WORK

TASK1 Look at this figure. Write an explanation of the Neurohormonal Control of Brain Activity

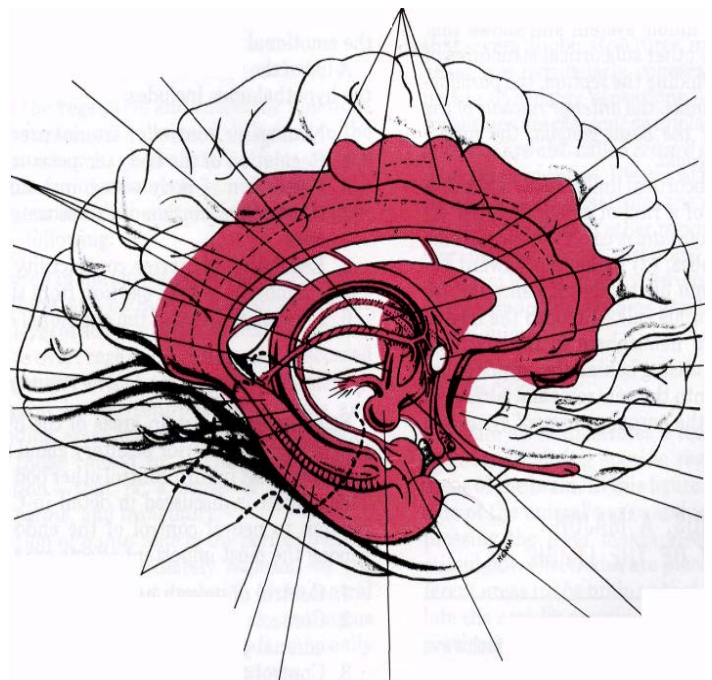
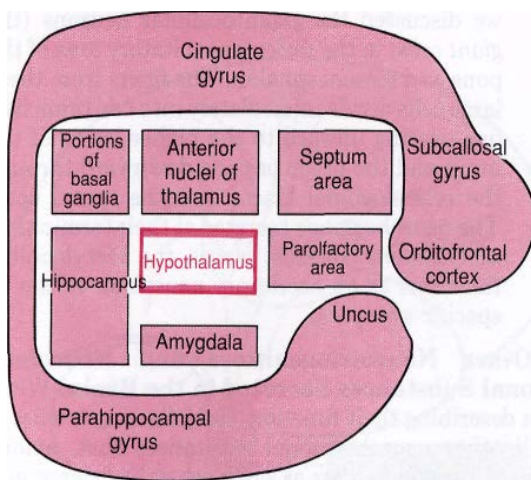


The excitatory-activating system of the brain. Also shown is an inhibitory area in the medulla that can inhibit or depress the activating system.

TASK2 Look at this figure. Note all morphological component, write an explanation of the Neurohormonal Control of Brain activity.



TASK3 Look at this figure. Note all morphological component of Limbic system, write an explanation of it function in development of emotion.



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 partialy.
24. Disposed to overestimate your strength.
25. Capable of catching new information quickly.
26. Unstable in your interests and inclinations.
27. Mistfortunes 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 a sleep 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 presents 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.

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

C – choleric person, S – sanguine 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 write 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 defence of self-made work.

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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PRACTICAL LESSON 19

Theme : Module control 1. Control of Practical Tasks

CREDIT-MODULE# 2: Physiology of visceral systems: blood, respiratory organs, blood Circulation

Thematic module #11. Blood system

PRACTICAL LESSON 1

Theme: Blood system. Analyze the physico-chemical qualities of the blood, erythrocytes and hemoglobin of the blood.

THE GOALS OF OCCUPATION:

To study the basic physical and chemical properties and functions of blood. To study a physiological role of Erythrocytes.

Initial level of the knowledge

1. Anatomy and histology of the Bone Marrow

THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

3. What do you know about the physiological functions of the Blood .
4. Describe the morphological structure of Erythrocytes.
5. The red Cell Fragility.
6. The Sedimentation rate .
7. Explain the role of the Spleen for the Red Cells.
8. Describe the morphological structure of Hemoglobin. The Colour test of the Red cell.
9. The reactions of Hemoglobin.. The Hemoglobin in the Fetus
10. Explain the abnormalities of Hemoglobin production.
11. The synthesis and catabolism of Hemoglobin.
12. The Transfusion reactions. The Inheritance of A and B Antigens. Other Agglutinogens.
13. The RH Group. The Hemolytic Disease of the Newborn.
14. What do you know about the physiological functions of the Plasma
15. The Plasma Proteins and its function. The Origin of Plasma Proteins. The Hypoproteinemia

16. What do you know about the Anemias and the Polycythemia?

PRACTICAL WORK

TASK 1. Research of the Red Cells resistance

Put the 10 test tubes in a support, number them by marker. Add the Distilled water in each test tube according to the table. Then add the 1 % solution of Sodium Chloride (NaCl) in test tubes according to the table and add in each test tube about two drops of tinned blood.

Cautiously mix contents of test tubes and leave to stand within 15 minutes. After that note, in what test tube takes place initial and final Hemolysis of Red Cells. Concentration of a solution in these test tubes is a parameter of osmotic resistance for Red Cells.

The maximal resistance of Red Cells or the bottom value of osmotic resistance is within the limits of 0,30 - 0,25

The minimal resistance or the top value of osmotic resistance changes within the limits of 0,45-0,40.

No test tubes	1	2	3	4	5	6	7	8	9	10
Solution's concentration	0,6	0,55	0,5	0,45	0,4	0,35	0,3	0,25	0,2	0,15
1% NaCl on ml	1,2	1,1	1,0	0,9	0,8	0,7	0,6	0,5	0,4	0,3
Distilled water on ml	0,8	0,9	1,0	1,1	1,2	1,3	1,4	1,5	1,6	1,7

RESEARCH PROBLEMS

- Describe a work. Write the results in the table. Use symbols ("-" - hemolysis is absent; "+" - hemolysis full; « + - » - hemolysis partial)
- Write a conclusion. Explain in conclusions:
 - The mechanism of an origin hemolysis
 - Estimate all results of research from the physiological point of view.

TASK 2. Examination of the Sedimentation rate

Collect the 5 %-s' Citrates of sodium solution to a level 50 (P) from a bottle. Release a solution on glass.

Lower a capillary in a bottle with blood. Collect the Blood in a capillary to a point 0(K). The Blood must be without air. Then release the blood in a Citrates of sodium solution on hour glass. Repeat procedure. Mix blood of a glass stick. Collect in a capillary a mix of blood with Citrates of sodium to a point 0(K). Close by a finger the top end of a capillary. .

Close a finger the top end of a capillary. The solution of blood should not follow. Put the bottom end of a capillary in the bottom rubber ring of device Panchenkova. Then insert the top end of a capillary into the top rubber ring.

Note the time. In one hour determine the height of a transparent plasma column. You should answer what distance the Red cells settled. This result is the velocity of sedimentation rate (SR).

At healthy men SR is about 3—7 mm/ hour. At healthy women SR is about 7—12 mm/ hour

RESEARCH PROBLEMS

1. Describe a work. Draw a device Panchenkova.
2. Write a conclusion. Explain in conclusions:
 - a) What physiological factors influence on SR;
 - b) Estimate all results of research from the physiological point of view.

TASK 3. Definition of quantity the Red cells in 1 liter of the blood

The glass chamber situated under a microscope and consider Goryaev's grid on it at small and big increase. Cover the chamber by a glass and fix it to the chamber Stop fixation of a glass when iridescent rings will appear. Ship a capillary Salli in tinned blood and collect the blood up to a level 0,02 ml. without air. Wipe the end of a capillary by filtering paper and transfer the blood to a test tube The test tube should be filled of 4 ml by 3 % sodium chloride. Mix all a glass stick.

Take a drop dissolved (in 200 times) blood a glass stick. Put a drop of blood on an average platform of the chamber. The Capillary forces should involve a drop under integumentary glass.

Put the chamber under a microscope and start to calculation. Consider at small objective (X8), but use eyepiece X 15.

Count up the Red cells in some 5 big squares, which located on a diagonal of Goryaev's grid. Draw on a paper of 5 big squares. Divide the each big square on 16 small, write the found number of cells in each small square .Count cells inside of a small square and on top and left its borders.

Write the found quantity of the Red Cells in the formula:

$$X = \{(\Theta \times 4000 \times 200)/80\} \times 10^6$$

Where is

x - number of Red Cells in 1 lit. of the Blood;

Θ - the sum of Red Cells in 80 small squares;

4000 - a volume of one small square;

200 - a mathematic degree for the blood;

10⁶ - a coefficient for recalculation in international system Si.

RESEARCH PROBLEMS

1. Describe a work. Draw the chamber and the Goryaev's grid.
2. Write a conclusion. Explain in conclusions:
 - a) What physiological factors influence on the level of Red Cells;
 - b) Estimate all results of research from the physiological point of view.

TASK 4. Definition of quantity of the Blood hemoglobin by Sali's method.

Sali's Hemometr it is a support. The back wall of the Hemometre is made of a matte glass. Three test tubes of identical diameter are inserted into a support. Two extreme test tubes are sealed. Two extreme test tubes are sealed. They contain a solution of Muriatic Hemathine. Average test tube wich has divisions, it is not closed. The capillary has a label (20 mm³).

Fill an average test tube with 0,1 N solution HCl to the bottom label. Collect the blood in a capillary to a label. Place blood on a bottom of an average test tube. The top layer of a hydrochloric acid should remain uncoloured. Strike a test tube in a bottom by a finger for mixing.

Leave it to stand for 5-10 minutes. This time should be used by blood's full transformation of Hemoglobin in Muriatic Hemathine. Add to a solution the distilled water on drop. Color of a solution in a test tube should not differ from standard.

The bottom meniscus of a solution is an equivalent of hemoglobin in blood in grammes on litre after multiply a result on 10 .

At healthy men the Blood hemoglobin is about 130—160 gr/ litre. At healthy women - about 120—140 gr/ litre

RESEARCH PROBLEMS

1. Describe a a work. Draw the Hemometre
2. Write a conclusion. Explain in conclusions:
 - a) What physiological factors influence on the level of the Blood hemoglobin;

- b) Estimate all results of research from the physiological point of view.

TASK 5. Calculation the color parameter of the blood

The color parameter characterizes a degree of saturation by hemoglobin of the Red Cells. Expect a parameter under the formula:

CP = { the Blood hemoglobin (gr/l) x 30 } / on first of 4 figures of quantity the Red Cells

RESEARCH PROBLEMS

1. Describe a work.
2. Write a conclusion. Explain in conclusions:
 - a) What physiological factors influence on the level of a color parameter of blood
 - b) Estimate all results of research from the physiological point of view.

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #11. Blood system

PRACTICAL LESSON 2

Theme: Protectional functions of the blood: the white blood cells and cooperative interactions between innate immunity and acquired immunity

THE GOALS :

to study the basic physiological functions of Immunity and to study a physiological role of White blood cells

Initial level of the knowledge

1. Anatomy and histology of the Bone Marrow
2. The histological structure of a White blood cell

THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

17. What do you know about the physiological functions of the White blood cell?
18. Describe the morphological structure and functions of *Granulocytes*.
19. The Mast Cells and its physiological functions.
20. The Monocytes and its physiological functions.
21. Explain the role of the Granulocytes and Macrophage Colony-Stimulating factors.
22. Describe the disorders of Phagocytes function.
23. The Lymphocytes and its physiological functions.

24. What do you know about the physiological functions of Immunity?
25. The Cytokines and its physiological functions.
26. The Complement system and its physiological functions.
27. Explain the difference between Innate immunity and Acquired immunity
28. What do you know about the development of Immunity system?
29. The Memory B-cells and T-cells and its physiological functions.
30. Explain the mechanisms of Antigen recognition and Antigen presentation.
31. The T-cell Receptors, B-cells and its physiological functions.
32. The Immunoglobulins, Monoclonal Antibodies and its physiological functions
33. What do you know about the Genetic Basis of Diversity in the Immunity system?
34. The recognition of the Self. The Autoimmunity, the Tissue transplantation and other Clinical Correlates.
35. The Antigenic properties of blood. The ABO system.
36. The Transfusion reactions.
37. The inheritance of A and B Antigens, other Agglutinogens.
38. The Rh Group. What you know about the Hemolytic Disease of the Newborn

PRACTICAL WORK

TASK1. Definition of quantity the White Blood cells in 1 liter of the blood

The glass chamber put under a microscope and consider Goryaev's grid on it at small and big increase. Cover the chamber by a glass and fix it to the chamber. Stop fixation of a glass when iridescent rings will appear. Ship a capillary Sally in tinned blood and collect the blood up to a level 0,02 ml. without air. Wipe the end of a capillary by filtering paper and to transfer the blood to a test tube. The test tube should be filled of 0,5 ml by 5 % s Acetic acid and Methylene dark blue for destruction of Red blood cells.

Mix all a glass stick. After that take a drop of blood by a glass stick and put a drop of the blood on an average platform of the chamber. The Capillary forces should involve a drop under integumentary glass.

Put the chamber under a microscope and start to calculation. Consider at small objective (X8), but use eyepiece X 15. Count up the Red cells in some 25 big squares, which located on a diagonal of Goryaev's grid. Draw on a paper of 25 big squares. Divide the each big square on 16 small, write the found number of cells in each small square. Count cells inside of a small square and on top and left its borders. Write the found quantity of the White Cells in the formula:

$$x = \{(L \times 4000 \times 20) / 400\} \times 10^6$$

Where is **x** — number of White Cells in 1 lit of the Blood; **L** — the sum of White Cells in 400 small squares; **4000** — a volume of one small square ; **20** — a

mathematic degree for the blood; 10^6 — a coefficient for recalculation in international system Si.

RESEARCH PROBLEMS

1. Describe a work.
2. Write a conclusion. Explain in conclusions:
 - a) What physiological factors influence on the level of White Blood Cells;
 - b) Estimate all results of research from the physiological point of view.

TASK2. Definition of groups of blood of the person

In red blood cells of the person there are specific antigens. They are called Agglutinogens. There are A Agglutinogens and B Agglutinogens in the human Blood. There are two types of antibodies in human plasma. They are called Agglutinin α and β . They stick together the Agglutinogens.

The necessity for work: cup of Petry, tinned blood, laboratory glasses, standard Serums of groups I, II, III. The I group of Serum contains two types of Agglutinins (α , β), the II group of Serum contains $-\beta$ Agglutinin, the III group of Serum contains $-\alpha$ Agglutinin.

Put the one drop of standard Serum (of I, II, III groups) on cup of Petry. Add in each Serum's drop the person's blood (in correlation 1:10). Mix by a glass stick.

Reaction of Agglutination comes in 15 minutes. Attributes of reaction - a drop of blood are transparent. Small lumps of the Red blood cells float in it.

RESEARCH PROBLEMS

Establish group of blood on presence or absence of Agglutination's reaction.

1. What group of the blood has a person?
2. Explain in conclusions:
 - a) What recipients can receive this blood?
 - b) What pathological transfusion Reactions can be observed?

TASK3. Definition of Rh-group

Put on the cup of Petry one drop of anti - **Rh** Serum by a pipette. It should be in 2 times more than a drop of person's blood and after that add a drop of blood and mix by a glass stick.

You can observe this result through 5 min.

Don't forget! Blood "Rh – positive" –when the Agglutination is present

Blood "Rh – negative" –when the Agglutination is absent

RESEARCH PROBLEMS

1. Describe a a work.
2. Write a conclusion.
- a) Explain all results of research from the physiological point of view.

TASK 4. Test on compatibility of the Blood between the "donor" and the "recipient"

Put 2 ml of the «recipient's" blood (from a bottle №1) in a test tube. Put a test tube in a centrifuge (1500 number of revolutions/minutes) for 5-8 minutes. Select Serum of blood by a pipette. Put a drop of this Serum in cup of Petry. Add a drop of "donor's" blood (from a bottle №2). It should be in 2 times less, than a drop of Serum. Mix by a glass stick. Look at the test in 15-20 minutes at room's temperature. Estimate "presence" or "absence" the reaction of Agglutination.

RESEARCH PROBLEMS

1. Draw a conclusion about compatibility of the Blood between the "donor" and the "recipient" by results of research.
2. Can a doctor transfuse this "donor's" blood to this "recipient"?
3. Describe a technique of the Biological test on compatibility of the Blood between the donor and the recipient.

TASK 5. Bring the information about the Examples of Cytokines and their clinical relevance in the table

Cytokine	Cellular	Major Activities	Clinical
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	Sources		relevance
Interleukin-1			
Interleukin-2			
Interleukin-4			
Interleukin-5			
Interleukin-6			
Interleukin-8			
Interleukin-11			
Interleukin-12			
Tumor necrosis factor α			
Tumor necrosis factor β			
Granulocyte-macrophage- colony-stimulating factor			
Interferon- α			
Interferon- β			
Interferon- γ			

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #11. Blood system

PRACTICAL LESSON 3

Theme: Homeostasis and Blood coagulation

THE GOALS:

To study the physiological functions of Platelets; to study the mechanism of Blood coagulation

Initial level of the knowledge

1. Histology of Platelets

2. The physiological functions of Blood's Proteins

THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. What do you know about the Physical and Chemical characteristics so physiological functions of Platelets?
2. What do you know about the term "Hemostasis"?
3. Response to Injury: vascular contraction; formation of the Platelet Plug and its mechanism.
4. Importance of the Platelet mechanism for Closing Vascular Holes.
5. What do you know about the Blood Coagulation in the Ruptured Vessels?
6. Mechanism of Blood Coagulation:
 - a). Conversion of Prothrombin to Thrombin;
 - b). Conversion of Fibrinogen to Fibrin- Formation of the Clot
 - c). Vicious Circle of Clot Formation;
 - d). Initiation of Coagulation: formation of Prothrombin Activator
7. Explain the Extrinsic Pathway for Initiating Clotting.
8. Explain the Intrinsic Pathway for Initiating Clotting.
9. Role of Calcium Ions in the Intrinsic and Extrinsic Pathway for Initiating Clotting
10. Prevention of Blood Clotting in the Normal Vascular system – Intravascular Anticoagulants:
 - a). Endothelial Surface factors;
 - b). Antithrombin Action of Fibrin and Antithrombin III;
 - c). Heparin and its function;
 - d). Plasmin and its function.
11. What do you know about the Anticoagulants for Clinical use?
12. What do you know about the Blood Coagulation Tests?
 - a). Bleeding Time;
 - b). Clotting Time;
 - c). Prothrombin Time.

PRACTICAL WORK

TASK1. Examination the Clotting Time

Take the blood from a caudal vein of a rat. Put a drop of blood on glass. Dip into a drop of blood a thin glass stick every 30 seconds. Determine the moment of occurrence of the first fibrinous string. Use a stop watch. The norm of Clotting Time is 6-10 minutes.

RESEARCH PROBLEMS

1. Describe a work.
2. Write a conclusion. Explain in conclusions:

- a) What physiological factors influence on the Clotting Time;
- b) Explain all results of research from the physiological point of view.

TASK2. Examination the Bleeding Time

Make an incision scissors in a tail at a rat. Note the time of the beginning of a bleeding by a stop watch. Remove a drop of blood every 30 seconds. Put to a drop of blood each new sector of filtering paper. Repeat procedure up to a full stop of bleeding.

Observe the rules of the work: a) don't press on bleeding tail; b) don't delete the first drop of blood; c) Don't concern by filtering paper of a wound. The norm of Bleeding Time is 1-6 minutes.

RESEARCH PROBLEMS

1. Describe a a work.
2. Write a conclusion. Explain in conclusions:
 - a) What physiological factors influence on the Bleeding Time;
 - b) Explain all results of research from the physiological point of view.

TASK3. Definition of Blood tolerance to Heparin Test

Heparin is Anticoagulant. It functions are opposite to Thrombin. Heparin prevents transformation the Fibrinogen to Fibrin .After that the Clotting Time is extended.

Place 3 drops of blood of a rat on glass with the help of a pipette. Add a drop of Heparin. Mix by a glass stick.

Dip into a drop of blood a thin glass stick every 30 seconds. Determine the moment of occurrence of the first fibrinous string. Use a stopwatch

RESEARCH PROBLEMS

1. Describe a a work.
2. Write a conclusion. Explain in conclusions:

- a) What physiological factors influence on the Blood tolerance to Heparin Test;
- b) Explain all results of research from the physiological point of view

TASK 4. Estimation of a degree of the capillaries resistance

Put a cuff of device Riva-Rochchi on patient's arm. Support pressure in a cuff at a level of the maximal arterial pressure. Squeeze the arm about 10 to 15 minutes.

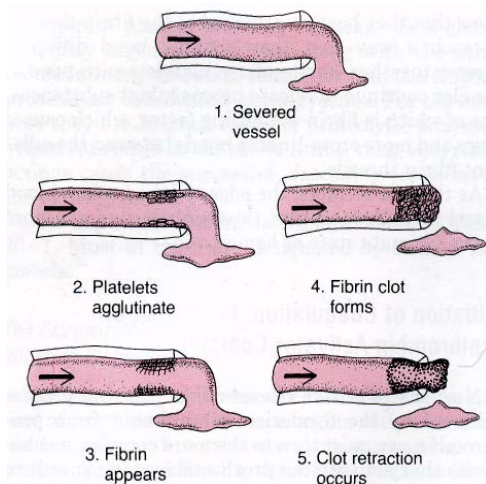
Individual hemorrhages can be in norm on a place of pressure.

If the fragility of capillaries is increased can be a lot of hemorrhages.

RESEARCH PROBLEMS

1. Describe a work.
2. Write a conclusion. Explain in conclusions:
 - a) What physiological factors influence on the fragility of capillaries;
 - b) Explain all results of research from the physiological point of view

TASK 5. Explain the scheme of the Clotting process in the traumatized blood vessels.

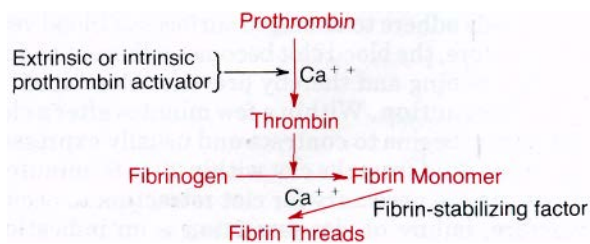


TASK 6. Explain the table of Clotting factors in the blood and their synonyms

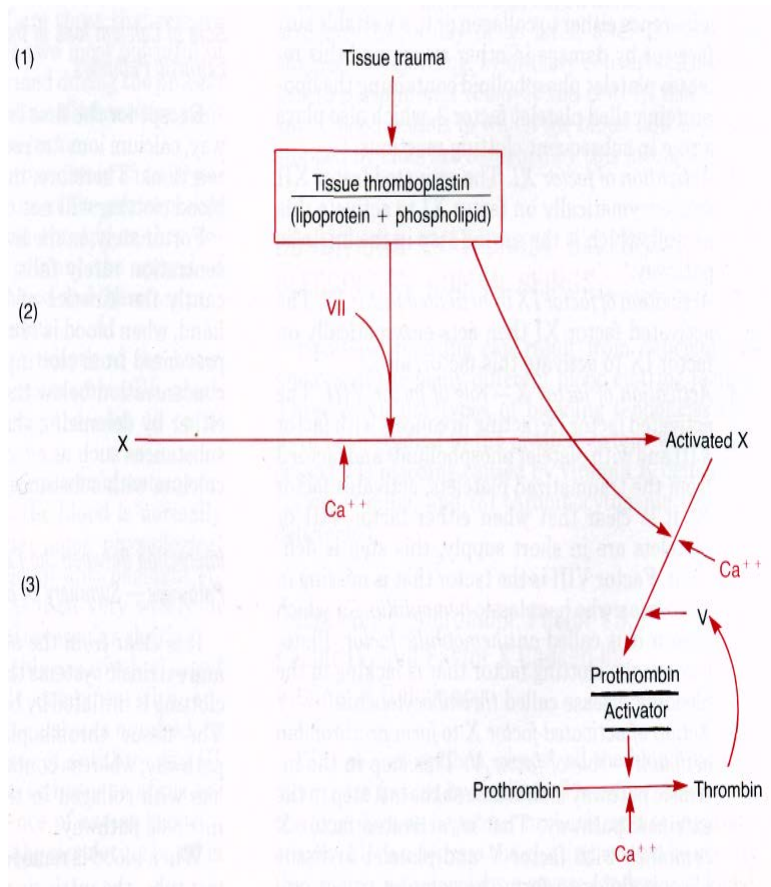
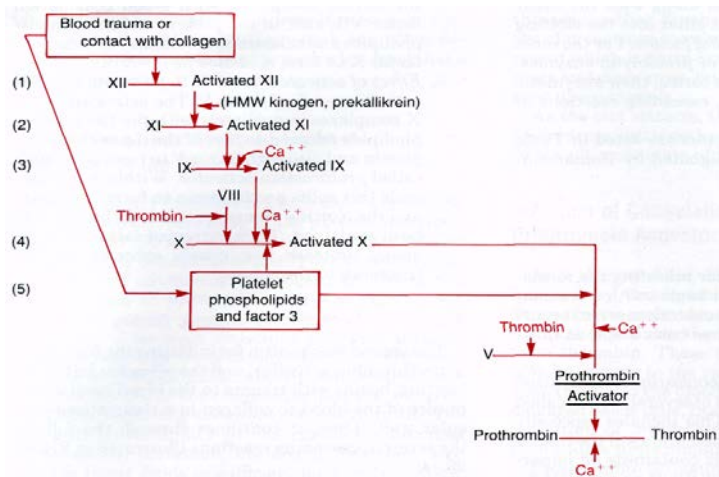
Table 26-1 CLOTTING FACTORS IN THE BLOOD AND THEIR SYNONYMS

Clotting Factor	Synonyms
Factor I	Fibrinogen
Factor II	Prothrombin
Factor III; tissue factor	Tissue thromboplastin
Factor IV	Calcium
Factor V	Proaccelerin; labile factor; Ac-globulin (Ac-G)
Factor VII	Serum prothrombin conversion accelerator (SPCA); proconvertin; stable factor
Factor VIII	Antihemophilic factor (AHF); antihemophilic globulin (AHG); antihemophilic factor A
Factor IX	Plasma thromboplastin component (PTC); Christmas factor; antihemophilic factor B
Factor X	Stuart factor; Stuart-Prower factor
Factor XI	Plasma thromboplastin antecedent (PTA); antihemophilic factor C
Factor XII	Hageman factor
Factor XIII	Fibrin-stabilizing factor
Prekallikrein	Fletcher factor
High molecular weight kininogen	Fitzgerald factor; HMWK
Platelets	

TASK 7. Explain the scheme of conversion of Prothrombin to Thrombin and polymerization of Fibrinogen to Fibrin



TASK 8. Explain the scheme of intrinsic pathway for initiating blood clotting.



9. Explain the scheme of extrinsic pathway for initiating blood clotting

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #12. Blood circulation system

PRACTICAL LESSON 4.

Theme: Origin of the Heartbeat. The Electrical activity of the Heart

THE GOALS:

Study properties of the Cardiac muscle. Study the characteristics of Heart Electrical activity.

The initial level of knowledge

1. Anatomical and histological structure of the Heart .

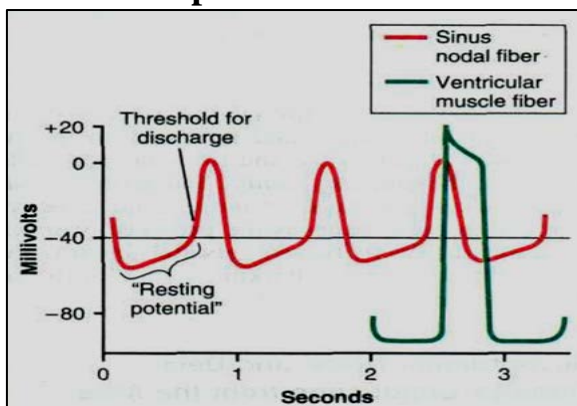
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Explain the physiological properties of Cardiac Muscle.
2. Explain the properties of the Resting Membrane and Action Potential of Cardiac Muscle.
3. Describe the Mechanical properties of Cardiac Muscle. The Contractile Response of heart muscle.
4. What do you know about the physiological Cardiac Hypertrophy?
5. What do you know about the Metabolism of Cardiac Muscle?
6. Explain the Morphology properties of Pacemaker tissue and Pacemaker Potentials.
7. Describe the Origin of Electrocardiogram.
8. What do you know about Bipolar and Unipolar Leads?
9. Describe the Normal ECG.
10. What you know about the Heart Monitoring?

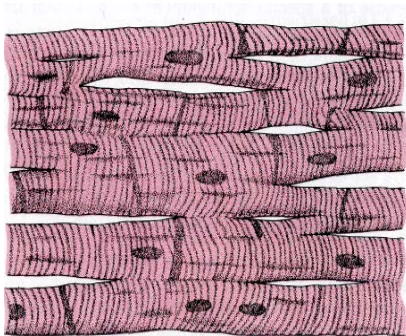
PRACTICAL WORK

TASK 1 Write an explanation about ionic basis of Action potential and Pacemaker potential in cardiac tissues. Put the results in this table.



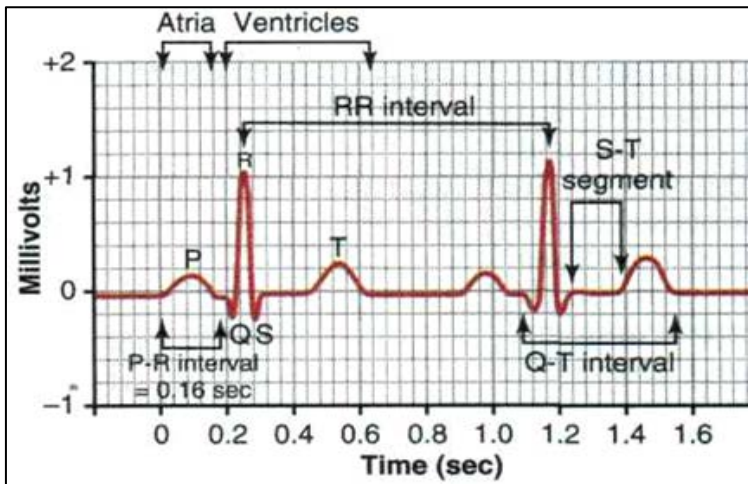
	ionic basis	
	Action potential	Pacemaker potential
<i>How does depolarization start?</i>		
<i>What's threshold level?</i>		
<i>Describe the depolarization phase</i>		
<i>Describe the initial rapid repolarization phase</i>		
<i>Describe the plateau phase</i>		
<i>Describe the repolarization phase</i>		

TASK 2. Look at this figure and write an explanation about the syncytium of Heart



<i>How many Mv is Action potential?</i>		
---	--	--

TASK 3. Look at this figure. What are the various waves, segments and intervals represented in normal ECG? What are their duration and amplitude? Put the results in the table.



<i>ECG parameters</i>	<i>represent</i>	<i>duration</i>
P		
Q		
R		
S		
T		
RP		
QRS		
ST		
QT		

TASK 4. What is ECG and what is its basis? Demonstration of ECG record. How can you determine the heart rate, waves and intervals from an ECG tracing?

ECG graph paper

Timed interpretation of an ECG was once incumbent to a stylus and paper speed. Computational analysis now allows considerable study of heart rate variability. A typical electrocardiograph runs at a paper speed of 25 mm/s, although faster paper

speeds are occasionally used. Each small block of ECG paper is 1 mm². At a paper speed of 25 mm/s, one small block of ECG paper translates into 0.04 s (or 40 ms). Five small blocks make up 1 large block, which translates into 0.20 s (or 200 ms). Hence, there are 5 large blocks per second. A diagnostic quality 12 lead ECG is calibrated at 10 mm/mV, so 1 mm translates into 0.1 mV. A calibration signal should be included with every record. A standard signal of 1 mV must move the stylus vertically 1 cm that is two large squares on ECG paper.

Table of Frequency the Heartbeat per minute

R-R	Heart beat	R-R	Heart beat	R-R	Heart beat
1.50	40	1.02	58	0.70	86
1.48	41	1.01	60	0.69	87
1.46	41	1.00	60	0.68	88
1.44	42	0.99	60	0.67	90
1.40	43	0.98	61	0.66	91
1.38	43	0.97	62	0.65	92
1.36	44	0.96	62	0.64	94
1.34	44	0.95	63	0.63	95
1.32	45	0.94	64	0.62	97
1.30	46	0.93	64	0.61	98
1.28	47	0.92	65	0.59	102
1.26	48	0.91	66	0.58	103
1.24	48	0.90	66	0.57	105
1.22	49	0.89	67	0.56	107
1.20	50	0.88	68	0.55	109
1.19	50	0.87	69	0.54	111
1.18	51	0.86	70	0.53	113
1.17	51	0.85	70	0.52	116
1.16	52	0.84	71	0.51	118
1.15	52	0.83	72	0.50	120
1.14	53	0.82	73	0.49	122
1.13	53	0.81	74	0.48	125
1.12	54	0.80	75	0.47	128
1,11	54	0.79	76	0.46	130
1.10	54	0.78	77	0.45	133
1.09	55	0.77	78	0.44	136
1.08	55	0.76	79	0.43	139
1.07	56	0.75	80	0.42	142
1.06	56	0.74	81	0.41	146
1.05	57	0.73	82	0.40	150

1.04	57	0.72	83		
1.03	58	0.71	84		

You have to determine

- a) frequency the Heartbeat per minute by table;
- b) position of an electric axis of heart:
 - Measure the R wave's amplitude in all 3 standard limb leads (mm)
 - Horizontal position of an electric axis of the Heart – if $R_1 > R_2 > R_3$;
 - Intermediate position of an electric axis of the Heart t if $R_2 > R_1 > R_3$;
 - Vertical position of an electric axis of the Heart if $R_3 > R_2 > R_1$;
- c) amplitude and duration of waves of the electrocardiogram
- d) duration of intervals

<i>ECG parameters</i>	<i>Normal ECG</i>		<i>Patient's ECG</i>	
	<i>amplitude</i>	<i>duration</i>	<i>amplitude</i>	<i>duration</i>
P				
Q				
R				
S				
T				
RP				
QRS				
ST				
QT				

Make conclusions about your results:

TASK 5. What is the clinical importance of ECG? Write an explanation.

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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PRACTICAL LESSON 5

Theme: The Heart as a Pump.

THE GOALS:

Study the Heart Sounds, the mechanism of Cardiac cycle, the mechanism of Heart pumping regulation

The initial level of knowledge

1. Anatomy and Histology of Heart

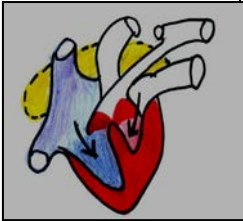

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

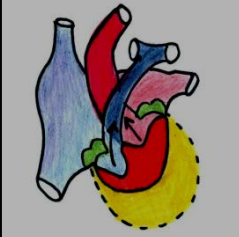

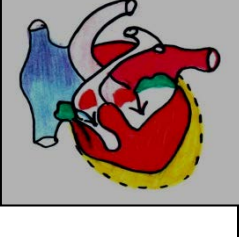
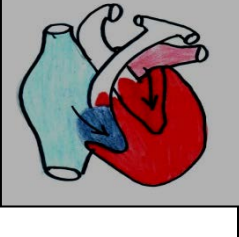
CONTROL QUESTIONS:

7. What do you know about the Mechanical Events of the Cardiac cycle? a). Events in Late Diastole; b). Atrial Systole; c). Ventricular Systole; d). Early Diastole.
2. Describe the Length of Systole and Diastole in Cardiac cycle.
3. Explain the mechanism of Arterial Pulse. Which do factors exert on Arterial Pulse?
4. What do you know about the origin of Arterial pressure?
5. Explain the physiological mechanism of Heart sounds origin. Describe the Echocardiography role in medicine.
6. What do you know about the Cardiac Output? a). Methods of Measurement; b). Cardiac Output in Various Conditions; c). Factors controlling Cardiac Output;
7. Explain the factors affecting the End- Diastolic Volume.
8. Explain the Integrated Control of Cardiac Output.
9. What do you know about the Oxygen consumption by the Heart?

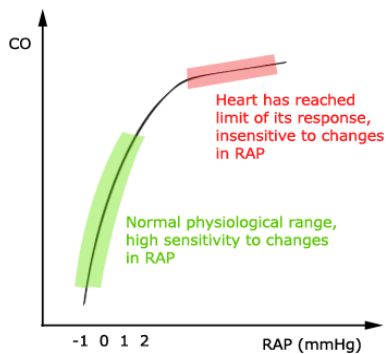
INDEPENDENT PRACTICAL WORK

TASK1. Look at these figures and write an explanation about the mechanism of Cardiac cycle. Put the results in this table.

		mechanism	duration
	Atrial systole		
	Isometric contraction		

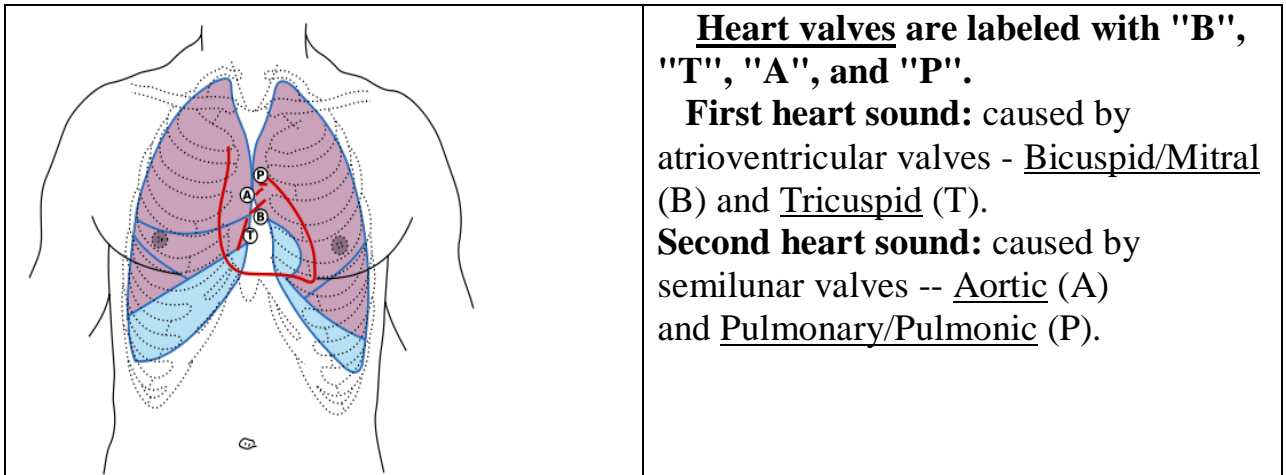
	Ejection period		
	Protodiastole		
	Isometric relaxation period		
	Rapid filling phase		

TASK2. What do you know about the Frank-Starling law? Look at this figure and write an explanation.



TASK3. Look this figure and describe the origin of Heart Sounds. Put the information in this table.

	<p>Front of <u>thorax</u>, showing surface relations of <u>heart</u> (red outline).</p>
--	--



Heart valves are labeled with "B", "T", "A", and "P".
First heart sound: caused by atrioventricular valves - Bicuspid/Mitral (B) and Tricuspid (T).
Second heart sound: caused by semilunar valves -- Aortic (A) and Pulmonary/Pulmonic (P).

Heart Sounds	Mechanism	duration
<i>The First Sound</i>		
<i>The Second Sound</i>		
<i>The Third Sound</i>		
<i>The Fourth Sound</i>		

TASK 4. Auscultation the heart sounds by a stethoscope. Describe your results.

<u>Pulmonary valve</u> (to <u>pulmonary trunk</u>)	second <u>intercostal space</u>	left <u>upper sternal border</u>
<u>Aortic valve</u> (to <u>aorta</u>)	second <u>intercostal space</u>	right <u>upper sternal border</u>
<u>Mitral valve</u> (to <u>left ventricle</u>)	fifth <u>intercostal space</u>	lateral to left <u>midclavicular line</u>
<u>Tricuspid valve</u> (to <u>right ventricle</u>)	fourth <u>intercostal space</u>	lower <u>left sternal border</u>

TASK 5. Write an explanation about the effects of Autonomic Nerve System, Potassium and Calcium Ions for the Heart work. Put the information in this table.

Controlling factors	action
<i>Sympathetic nerves</i>	
<i>Parasympathetic nerves</i>	
<i>Potassium Ions</i>	
<i>Calcium Ions</i>	

TASK 6. Examine the arterial pulse in the subject provided and comment on your findings.

The radial artery is palpated with the tips of three fingers compressing the vessel against the head of radius bone. The subject's forearm should be slightly pronated and the wrist slightly flexed. The index finger varies the pressure on the artery; the middle finger feels the pulse, while the distal finger prevents reflections of pulsations from the palmar arch of arteries. The following observations are made:

rate of pulse	rhythm	character and form	types of arterial pulse	volume	tension	condition of the vessel wall	delay

Explain your results.

TASK 7. Solving the Clinical task and write an explanation

1. Does the sportsman have tachycardia before the competitions? Why?

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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PRACTICAL LESSON 6

Theme: Regulation of heart activity.

THE GOALS: Study the regulatory Central and Humoral mechanisms for Blood Circulation System

The initial level of knowledge

1. Physiological function of the Central Nervous system, Autonomic Nervous system, Endocrinology system.

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. What do you know about the Local regulation of the Blood Circulation System?
2. Describe the Myogenic and Metabolic theories of Auto regulation:
 - a) Vasodilatator metabolites;
 - b). Localized the Vasoconstriction.
3. Substances secreted by the Endothelium:
 - a) Endothelial cells;
 - b) Prostacyclin and Thromboxane A₂;
 - c. Nitric Oxyde, Carbon monoxyde;
 - d) Endothelins.
4. Describe the Systemic regulation by Hormones:
 - a) Kinins, and Adrenomedullin;
 - b) Natriuretic hormones, Circulating Vasoconstrictors.
5. Explain the Systemic regulation by Nervous system:
 - a). Neural regulatory mechanism;
 - b) Innervation of the blood vessels;
 - c) Cardiac innervation;
6. Describe the Vasomotor control:
 - a) Afferents to the Vasomotor Area;
 - b) Somatosympathetic Reflex;
 - c) Baroreceptors: Carotid sinus, Aortic Arch;
 - d) Buffer Nerve Activity;
 - e) Baroreceptors resetting. Effect of Carotid clamping and Buffer Nerve section;
7. Explain function of the Atrial Stretch receptors and mechanism of Bainbridge reflex.
8. The role of Left ventricular and pulmonary receptors in blood circulations.
9. Explain the Effects of chemoreceptor stimulation on the Vasomotor Area.
10. What do you know about Sympathetic Vasodilator System and mechanism for Control of Heart Rate?
11. Physiology Circulation through Special regions: Cerebral circulation; Coronary circulation; splanchnic circulation; Cutaneous circulation; Placental Circulation.
12. Exercise and Muscle Blood Flow.

INDEPENDENT PRACTICAL WORK

TASK1. Draw a scheme and write an explanation about the mechanism of parasympathetic action for Heart work.

TASK2. Draw a scheme and write an explanation about the mechanism of sympathetic action for Heart work.

TASK3. Write an explanation about the central regulation of circulation system. Draw the scheme.

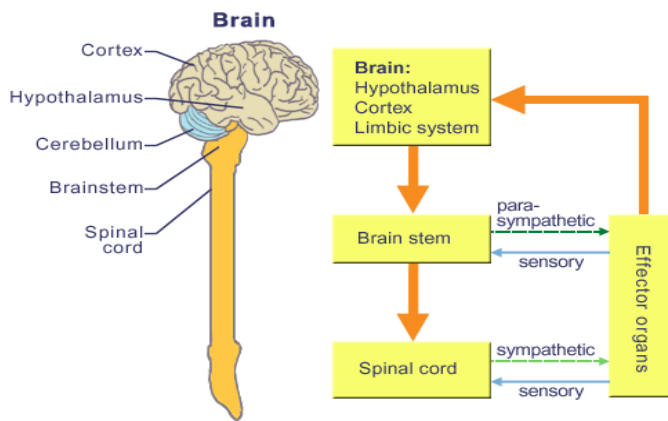
TASK4. What is physiological tachycardia and bradycardia and what are its causes? Put your explanations in this table.

N.B. An increase in heart rate above 100/min is called *tachycardia*.

A decrease in heart rate below 60/min is called *bradycardia*.

factors	Physiological bradycardia is seen in	Physiological tachycardia is seen in
<i>Emotional excitement, nervousness, and apprehension</i>		
<i>Muscular exercise</i>		
<i>In the newborns</i>		
<i>Sex</i>		
<i>Diurnal variations</i>		
<i>Athletes</i>		
<i>Sleep and meditation</i>		

TASK4. Look this figure and write the explanation about mechanism of Vascular Autonomic Reflex.



TASK5. Cardiac efficiency tests (exercise tolerance tests). Put your results in the table and make a resume.

The response of the cardiovascular system to standardized exercise (*exercise tolerance test*, also called "*stress testing*") is the single and the best test for assessing the efficiency of the heart. During exercise, there is a progressive increase in the heart rate (HR) and blood pressure (BP). However, after the exercise is over, these values return to the pre-exercise levels during the next few minutes. The fact that, compared to a trained person, there is **a greater** increase in the heart rate and BP in an untrained individual during exercise, and that these values take a longer time to return to basal levels, forms the basis of exercise tolerance tests. The response to physical exercise depends on the cardiac reserve, (ie, efficiency of the heart), muscle power, training, motivation, and the state of nutrition. Therefore, the cardiac efficiency tests can also be used to test physical fitness in **an** individual.

I. Record the basal pulse rate, then ask the subject to hop 20 times on each foot, raising the shoulders 6 inches at each step.

If the heart is healthy, there should be little disturbance of breathing and the pulse rate should not increase by more than 10-20 beats per minute, and should return to pre-exercise level in about a minute.

Record these timings in your work book.

II. Harvard Step Test

Caution This is a test for physical fitness and should not be used in patients.

Protocol Record the basal pulse rate. Then ask the subject to alternately step up and down, lifting each foot about 20 inches (16 inches in females) off the ground, at a rate of 30 double steps per minute, for a period of 5 minutes. (Alternately, the subject may step up and down a 50 cm bench (40 cm in females), at a frequency of 30 times/min for 5 minutes). Stop the test if the subject feels breathless and exhausted and is unable to continue the **test**.

Count the pulse rate 1 minute after the end of the exercise. The pulse rate is inversely proportional to the degree of cardiac efficiency. To obtain an approximate idea of the cardiac efficiency index, count the pulse rate at the following intervals:

- i. Between 1 and 1,5minutes= /min (a)
- ii. Between 2 and 2,5minutes= /min (b)

iii. Between 3 and 3,5minutes= /min (c)

iv. Time after which the pulse rate returns to basal levels =minutes

Duration of exercise in seconds (300)

$$\text{Cardiac efficiency} = \frac{\text{Index}}{\text{a+b+c}} \times 100$$

	pulse rate	time
a	Between 1 and 1,5minutes	per/min
b	Between 2 and 2,5minutes	per/min
c	Between 3 and 3,5minutes	per/min
	Time after which the pulse rate returns to basal levels	min
	Cardiac efficiency index	

In normal individuals, the cardiac efficiency index is nearly 100 per cent, but is more in sportspersons.

Efficiency index Over 50%- Efficiency is excellent; 81-90% - Efficiency is good'
55-80% - Efficiency is average; Below 55%-Efficiency is poor

Resume:

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #12. Blood circulation system

PRACTICAL LESSON 7

Theme: Dynamics of Blood and Lymph Flow

THE GOALS:

Study the mechanism of Blood and Lymph Flow. Study examination of the arterial pressure, arterial pulse and results of sphygmography

Initial level of the knowledge

1. Anatomy of the Circulation system

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. What do you know about the Arteries, Arterioles and Capillaries functional characteristics?

2. What do you know about the Lymphatic, Arteriovenous Anastomoses, Venules and Veins functional characteristics?

3. Describe the physiological mechanism of Arterial and Arteriolar circulation:

a). Velocity and Blood flow;

b). Arterial pressure; c). Methods of Blood pressure measuring;

d). Normal Arterial Blood pressure

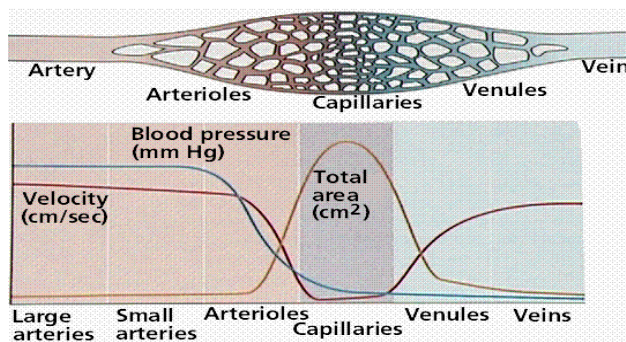
4. Describe the physiological mechanism of Capillary Circulation:

a). Methods of study;

- b). Capillary pressure and flow;
 - c). Active and Inactive capillaries.
5. Lymphatic circulation and interstitial fluid volume:
- a). Lymphatic circulation and Lymphatic System functions;
 - b). Interstitial fluid volume.
6. Describe the Venous circulation:
- a). Venous pressure and flow;
 - b). Thoracic pump and effects of Heartbeat;
 - c). Venous pressure in the Head, Air Embolism;
 - d). Venous pressure Measuring.

INDEPENDENT PRACTICAL WORK

TASK1. Look at this figure and write an explanation about changes in blood pressure, velocity, and the area of the arteries, capillaries, and veins of the circulatory system.



TASK2. Recording of blood pressure

The term "*blood pressure*", used unqualified, refers to the lateral pressure exerted by the moving column of blood on the walls of the systemic arteries. Its measurement is an important clinical procedure as it provides valuable information about the cardiovascular system under normal and abnormal conditions

Auscultatory Method (Korotkoff)

Ordinarily, no sounds are heard when a stethoscope is applied over the brachial or any other artery. However, if the cuff **pressure** is raised above the expected systolic pressure level, and then gradually lowered, a series of sounds, called the Korotkoff sounds, are heard in the brachial artery below the cuff.

1. Locate the bifurcation of the brachial artery (it divides into radial and ulnar branches) in the cubital space, just medial to the tendon of the biceps muscle, and mark this point with a felt-tip pen. Place the diaphragm of the stethoscope on this point and keep it in position with your fingers and thumb. (The diaphragm, when

in use, should not rub against the cuff or the rubber tubes or on the skin because the disturbing noises will interfere with auscultation of the sounds).

2. Inflate the cuff slowly (some sounds will be heard as the cuff pressure rises) and raise the pressure to 40-50 mm Hg above the systolic level as determined by the palpatory method.

Lower the cuff pressure slowly until the Korotkoff sounds are heard. *Phase I* sounds are clear, sharp, and tapping and last for 10-12 mm Hg fall in mercury column. *The first of these sounds, a clear tap, indicates the systolic pressure.* As the pressure falls, the character of the sounds changes (one must listen carefully to the sounds); they first become murmurish (*Phase II*), then clear and banging (*Phase III*), until they suddenly become muffled (*Phase IV*), indistinct, dull and faint, as if coming from a distance) and disappear (*Phase V*; no sounds). The muffling of sounds and their disappearance occurs nearly at the same time, there being a difference of 4-5 mm Hg between them.

The pressure at which the sounds become muffled marks the diastolic pressure. Note the reading at muffling and at disappearance of sounds, after which deflate the cuff quickly.

3. Record the blood pressure first in the supine position. Then record the pressure in the standing position immediately after the subject assumes erect position from supine posture.

6. Disconnect the metal connection on the tube connecting the cuff and the mercury reservoir, then ask the subject to do muscular exercise (eg, spot running) for 5-6 minutes. Record the pulse and blood pressure immediately after the end of exercise and then at 2-minute intervals till the pulse and BP return to resting levels.

4. Record the blood pressure with the arm raised above the head, and then with the arm hanging down below the level of the heart. Tabulate your results, showing the various readings.

Note The BP readings are seldom identical in the two arms. It has been suggested that both arms be used, preferably the right and then the left, and that the lowest reading be recorded.

Put your results in the table. Make a resume.

position	Left arm	Right arm
sitting position		
supine position		
standing position		
arm raised above the head		
arm hanging down below the level of the heart		
after the end of exercise		

TASK3. What is mean arterial pressure and what is its significance? Why does the blood exert a pressure on the arterial walls? Write an explanation.

TASK4. What are the physiological variations in blood pressure? Put your explanation in the table.

factors	action
<i>age</i>	
<i>sex</i>	
<i>Muscular exercise</i>	
<i>Diurnal variations</i>	
<i>Digestion</i>	
<i>Emotional stress</i>	
<i>Posture</i>	

TASK5. What is pulse pressure and what is its significance? Write an explanation.

TASK7. Draw the figure about Venous blood flow and write an explanation about the mechanism of one.

TASK8. Demonstration of Venous blood flow

The flow of blood through the veins of the forearm and the presence of valves in these veins can be demonstrated by a simple experiment. William Harvey originally described it as one of the proofs for his theory of circulation, in his 68-page book "Exercitatio Anatomica de motu cordis et sanguinis in Animalibus", published in Latin in 1828.

Procedures

1. Seat the subject on a stool with his arm resting on a table. Apply the BP cuff on his upper arm and inflate it to 30-40 mm Hg. The superficial veins of the forearm will become prominent.
2. Place the tip of your right index finger (call it "R") over one of the veins, and mark the position of the valve (call it "V") above it, with a felt pen.
3. Keeping the finger "R" in the same position, and using your left index finger, squeeze out the blood from this vein towards the elbow. Note that the segment of the vein between points "R" and "V" remains collapsed and that there is no backflow of blood. However, the vein above the valve "V" is distended and the valve becomes prominent.
4. Keeping the finger "R" in position, place the left index finger above the valve "V" and try to squeeze the blood downwards towards the finger "R". It will be noticed that the blood cannot be forced backwards across the valve "V" unless a pressure that would be enough to rupture the valve "V" is applied.

What are the functions of the valves in the veins? Write an explanation.

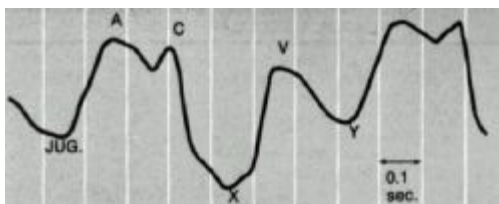
TASK9. What is pulse pressure and what is its significance? Use this formula. Write an explanation about your result

1).
$$Pp = Ps - Pd$$

Where is **Pp** - pulse pressure;

P_s - systolic pressure; P_d - diastolic pressure

TASK 10. What is meant by jugular venous pulse? How is record of this event obtained? Name the various waves recorded in the JVP tracing. Draw this figure and write an explanation



Normal jugular venous pulse: A, a positive wave due to contraction of the right atrium; C, a positive deflection due to bulging of the tricuspid valve toward the atria at the onset of ventricular contraction; X, a negative deflection due to atrial relaxation; V, a positive deflection due to filling of the right atrium against the closed tricuspid valve during ventricular contraction; Y, a negative deflection due to emptying of the right atrium upon ventricular relaxation.

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #12. Blood circulation system

PRACTICAL LESSON 8

Theme: The Cardiovascular Regulatory mechanism .Circulation through special Regions.

THE GOALS: Study the regulatory Central and Humoral mechanisms for Blood Circulation System

The initial level of knowledge

1. Physiological function of the Central Nervous system, Autonomic Nervous system, Endocrinology system.

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. What do you know about the Local regulation of the Blood Circulation System?
2. Describe the Myogenic and Metabolic theories of Auto regulation:
 - a) Vasodilatator metabolites;
 - b) Localized the Vasoconstriction.
3. Substances secreted by the Endothelium:
 - a) Endothelial cells;
 - b) Prostacyclin and Thromboxane A₂;
 - c) Nitric Oxide, Carbon monoxide;
 - d) Endothelins.
4. Describe the Systemic regulation by Hormones:
 - a) Kinins, and Adrenomedullin;
 - b) Natriuretic hormones, Circulating Vasoconstrictors.
5. Explain the Systemic regulation by Nervous system:
 - a) Neural regulatory mechanism;
 - b) Innervation of the blood vessels;
 - c) Cardiac innervation;
6. Describe the Vasomotor control:
 - a) Afferents to the Vasomotor Area;
 - b) Somatosympathetic Reflex;

- c) Baroreceptors: Carotid sinus, Aortic Arch;
- d) Buffer Nerve Activity;
- e) Baroreceptors resetting. Effect of Carotid clamping and Buffer Nerve section;
- 7. Explain function of the Atrial Stretch receptors and mechanism of Bainbridge reflex.
- 8. The role of Left ventricular and pulmonary receptors in blood circulations.
- 9. Explain the Effects of chemoreceptor stimulation on the Vasomotor Area.
- 10. What do you know about Sympathetic Vasodilator System and mechanism for Control of Heart Rate?
- 11. Physiology Circulation through Special regions: Cerebral circulation; Coronary circulation; splanchnic circulation; Cutaneous circulation; Placental Circulation.
- 12. Exercise and Muscle Blood Flow.

INDEPENDENT PRACTICAL WORK

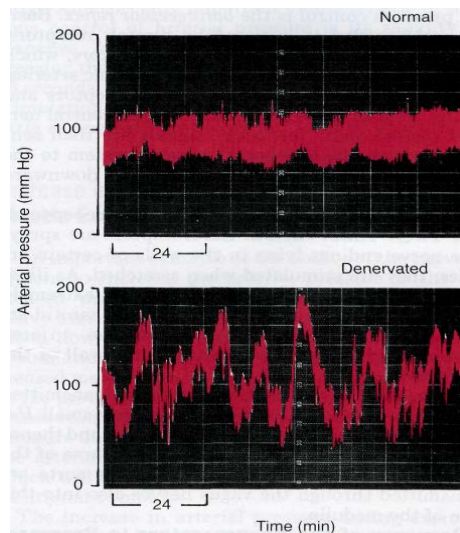
TASK1. Demonstration of Carotid sinus reflex Write an explanation about mechanism of Carotid sinus reflex.

Stretch receptors in the walls of carotid sinus and aortic arch (and probably in other large arteries of thorax) continuously monitor or sense the blood pressure. Within physiological limits, a rise or fall of BP brings about appropriate reflex changes in cardiac activity and peripheral resistance to restore the BP toward the normal levels.

Procedure

1. Ask the subject to lie down supine on the examination couch. Loosen his collar and lay the neck bare. Locate the anterior edge of sternomastoid muscle and feel the pulsations of the common carotid artery which lies deeper and medial to it. Locate the upper border of the thyroid cartilage, and feel the pulsations in the carotid sinus which is a small dilation of the internal carotid artery just above the bifurcation of the main trunk (the sinus lies just below the angle of the jaw).
2. Palpate the radial artery with your left hand and, with the thumb of your right hand press the carotid sinus against the vertebral bodies *for 2 seconds only*. The pulse can be felt at this site as well as in the radial artery.

TASK2. What do you think about this figure? Write an explanation and make a resume.



Figures 1. Two-hour records of arterial pressure in a normal dog (above) and in the same dog (below) several weeks after the Baroreceptors had been denervated.

TASK3. Which hormones are hypertonic or hypotonic for blood pressure? Put your results in the table and write an explanation.

<i>hormones</i>	Mechanism for hypertonic effect	Mechanism for hypotonic effect
Adrenaline		
Bradykinin		
Prostaglandin		
Thyroxin		
Aldosterone		
Histamine		
Vasopressin		
Natriuretic peptide		
Angiotensin		
Serotonin		
Vasoactive intestinal polypeptide		

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #13. Respiration system

PRACTICAL LESSON 9

Theme: The Respiratory System. Research of external breath

THE GOALS OF OCCUPATION:

Study the biomechanics of breath, parameters of external breath, and observation methods of the external breath.

The initial level of knowledge

1. Anatomic and histological structure of Respiration System.

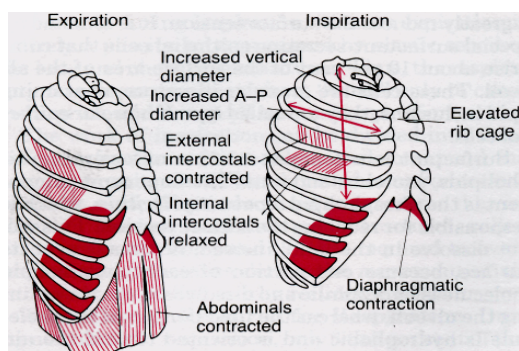
CONTROL THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. What do you know about the Properties of Gases and Partial pressure?
2. Explain the Anatomy of the Lungs:
 - a). air passages;
 - b). the physiology features of bronchi and their innervation;
 - c). Pulmonary circulation.
3. Describe the Mechanics of Respirations:
 - a). inspiration and expiration; What is the mechanism of deglutition apnea?
 - b). Lung volumes;
 - c). respiratory Muscles;
 - d). Bronchial tone, Compliance of the Lung and Chest Wall.
5. The Alveolar Surface Tension. Surfactant and its function.
6. Work of Breathing.
7. Differences in Ventilation. Blood flow in different parts of the lung.
8. The Dead space. Uneven Ventilation

INDEPENDENT PRACTICAL WORK

TASK1. Look this figure and write an explanation about differences between expansion and contraction of the thoracic cage during expiration and inspiration.



TASK2. Determination of breath holding time (BHT)

Relevance Breathing can be held for a variable period of time by different individuals depending upon the functional status of lungs, development of

respiratory muscles, practice, age and sex. Breath holding time (BHT) is a simple test which can provide useful information in health and disease of the lungs.

PROCEDURES

As the students work in batches of two, one becomes the subject and the other acts as the observer.

1. The subject should sit quietly for a few minutes, breathing normally, before the BHT exercises are started. The observer uses a stop watch and records the time for each determination.

2. Ask the subject to pinch his nostrils with the thumb and forefinger, and hold his breath after a normal inspiration. Note the time for which the breath can be held. Make 3 observations at intervals of 5 minutes.

Using the same procedure, record the BHT after (i) a normal expiration; (ii) a deep inspiration; (iii) a deep expiration; (iv) hyperventilation (deep and fast breathing) for 20 times; (v) rebreathing from a large polythene bag for 15-20 seconds, with a nose clip on. (Discontinue if there is discomfort);

Tabulate your results and record these in your work book.

BHT Time					
	after a normal expiration	after a deep inspiration	after a deep expiration	after hyperventilation (deep and fast breathing)	after rebreathing from a large polythene bag for 15-20 seconds
BHT					

N.B. The normal BHT after a deep inspiration may vary from 40 seconds to over a minute.

TASK2. What are the factors which increase or decrease the breath holding time? Put information in this table.

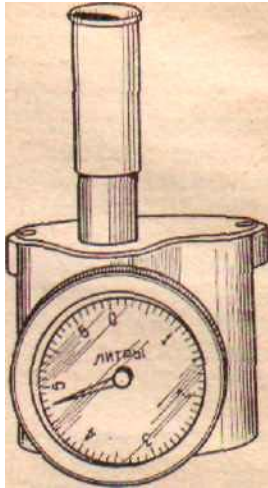
factors which increase BHT		factors which decrease BHT	
N		n	

TASK3. Vital capacity and peak expiratory flow rate

Relevance Estimation of vital capacity is an important determination for assessing the ventilatory functions of the lungs in health and disease. Vital capacity is also employed as a criterion of physical fitness.

Definition

Vital capacity (VC), also called *forced vital capacity (FVC)*, or *forced expiratory volume (FEV)*, is the largest amount of air a person can expel from the lungs with maximum effort after first filling the lungs by a deepest possible inspiration. The subject inspires to total lung capacity (TLC) and then forcibly exhales to residual volume (RV).



A **simple spirometer** is generally available for student work

1. Ask the subject to breathe normally for a few times. Then ask him to inspire as deeply and fully as possible and, while keeping the nostrils closed with his thumb and finger, to expire with a maximum effort into the mouthpiece which is held tightly between the lips. The pointer on the spirometer indicates the volume of expired air. The forced expiration should be deep and quick but without undue haste.

2. Record the vital capacity in the standing, sitting, and lying down positions in order to study the effect of posture.

Take 3 readings, at intervals of 5 minutes, for each determination.

The purpose of taking three reading is not to get their average, but to familiarize the subject with the procedure, the third reading being usually the maximum in most cases. The subject can also be motivated to improve his performance.

For report: Maximum value = .Liters

3. Tabulate your results showing the three readings in each of the standing, sitting, and supine postures, and indicate the maximum value in each case.

4. Write the resume.

	in the standing	in the sitting	in the supine postures
Vital capacity (VC)	L	L	L

4. Define the:

a) TV (tidal volume). There is the volume of air inspired or expired with each normal breath; it amounts to about 500 milliliters in the average young adult.

b) ExRV (expiratory reserve volume). There is the extra amount of air that can be expired by forceful expiration after the end of a normal tidal expiration; this normally amounts to about 1100 milliliters.

c) InsRV (inspiratory reserve volume). There is the extra volume of air that can be inspired over and beyond the normal tidal volume; it is usually equal to approximately 3000 milliliters

d) RV (residual volume). There is is the volume of air still remaining in the lungs after the most forceful expiration. This volume averages about 1200 milliliters

e) standard parameter by the formula:

For the man: $VC = [27,63 - (0,112 \times \text{age in years}) \times \text{height in sm}]$

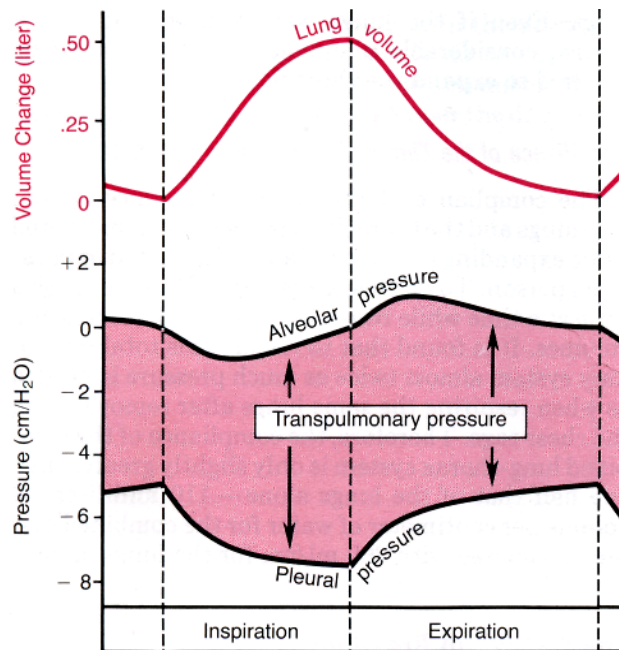
For the women: $VC = [21,73 - (0,101 \times \text{age in years}) \times \text{height in sm}]$

N.B. The normal VC ranges from 3.5 to 4.5 liters, the values being about 20% lower in the females. Since the VC depends on (he age, sex, body build, occupation, etc various formulae have been devised to predict VC in a given person.

5. Write the resume

TASK4. Look at this figure and write the explanation.

Changes in lung volume, alveolar pressure, pleural pressure, and transpulmonary pressure at the beginning of inspiration is approximately — 5 centimeters of water, which is the amount of suction that is required to hold the lungs open to their resting level. Then, during normal inspiration, the expansion of the chest cage pulls the surface of the lungs with still greater force and creates a still more negative pressure down to an average of about — 7.5 centimeters of water.



These relationships between pleural pressure and changing lung volume are illustrated in this Figure.

TASK5. What does surfactant function have? Put information in this table.

	function
Surfactant	

--	--

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Thematic module #13. Respiration system

PRACTICAL LESSON 10

Theme: The gas exchange in the Lungs. Pulmonary circulation. The gas transport between the Lungs and tissues

THE GOALS:

Study the physiological mechanisms of the gas transport between the Lungs and tissues.

Initial level of the knowledge

1. Anatomy of Pulmonary Blood vessels.

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

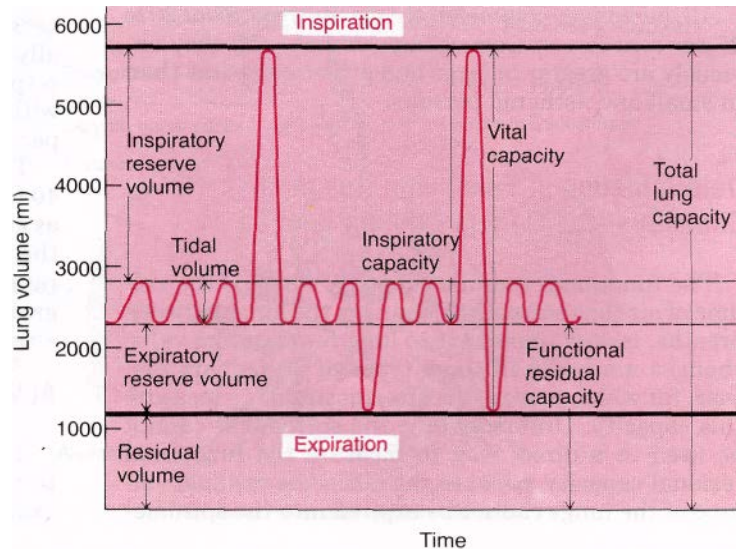
CONTROL QUESTIONS:

1. What do you know about the gas exchange in the Lungs:
 - a) Sampling Alveolar air and composition of Alveolar air ;
 - b) Diffusion across the Alveolocapillary membrane;
2. Describe the Pulmonary circulation:
 - a) Pulmonary Blood vessels;
 - b) Pressure, volume and flow;
 - c) Capillary pressure, effect of Gravity;
 - d) Ventilation and Perfusion ratios;
 - e) Pulmonary reservoir.
3. Regulation of Pulmonary flow.
4. Lung defense mechanism.
5. The metabolic and endocrine functions of the Lungs.
6. Oxygen transport:
 - a) Oxygen delivery to the tissues;
 - b) Reaction of Hemoglobin;
 - c) Factors affecting the affinity of Hemoglobin for Oxygen;
 - d) Myoglobin
7. Describe the Carbon Dioxide transport:
 - a) Fate of Carbon Dioxide in Blood;
 - b) Chloride shift;

c) Summary of Carbon Dioxide transport.

INDEPENDENT PRACTICAL WORK

TASK1. Demonstration of computer Spirometry method. Look at this curve. Which volumes and capacities are not recorded on a spirometer? Write an explanation.



TASK2 .Find out the physiological dead space, expiratory reserve volume, residual volume, inspiratory reserve volume, and functional residual capacity from the given data. Make resume.

Data

- a). Tidal volume = 450ml
- b). Alveolar air PCO₂ = 40 mm Hg
- c). Expired air PCO₂ = 26 mm Hg
- d). Total lung capacity = 5200 ml
- e). Inspiratory capacity = 3000 ml
- f). Vital capacity = 4000 ml

Physiological dead space = $\frac{\text{Alveolar air PCO}_2 - \text{Expired air PCO}_2}{\text{Alveolar air PCO}_2} \times \text{Tidal volume}$;

Expiratory reserve volume = Vital capacity - Inspiratory capacity;

Residual volume = Total lung capacity - Vital capacity;

Inspiratory reserve volume = Inspiratory capacity - Tidal volume;

Functional residual capacity = Residual volume + Expiratory reserve volume

TASK3. Look at this figure and write an explanation for one.

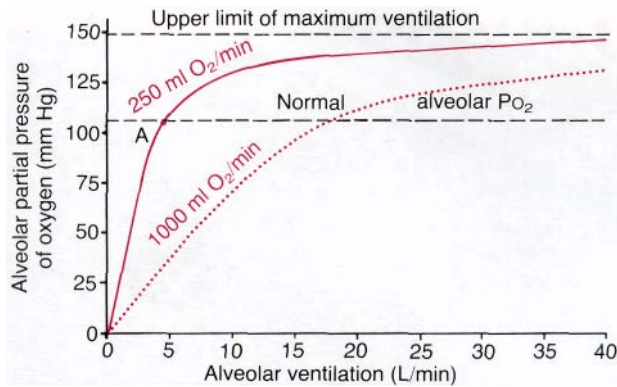


Figure 1. Effect of alveolar ventilation and of two rates of oxygen absorption, 250 ml/min and 1000 ml/min, from the alveoli on the alveolar PO₂

TASK 4. Look at this figure and write an explanation for one.

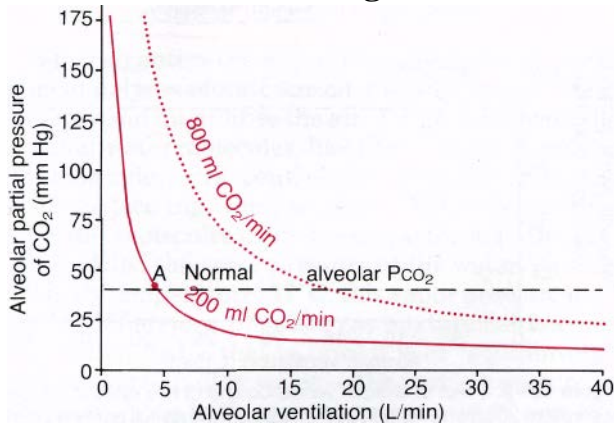
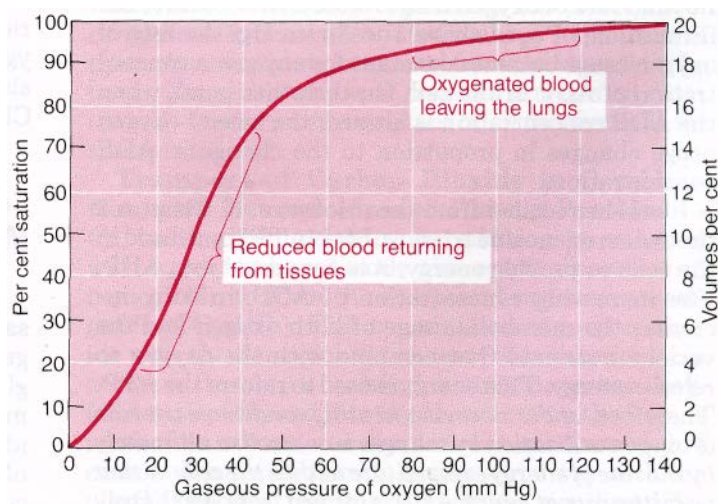


Figure 2. Effect on alveolar Pco₂ of alveolar ventilation and rate of carbon dioxide excretion from the blood

TASK 5. Look at these figures. Write an explanation for oxygen- hemoglobin dissociation curve.



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Thematic module #13. Respiration system

PRACTICAL LESSON 11

Theme: Regulation of Respiration. Respiratory Adjustments in health.

THE GOALS:

Study the regulation mechanisms of respiration.

Initial level of the knowledge

1. Anatomy of Autonomic and Central nervous systems, physiology of Endocrine system.

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. What do you know about the neural control of Breathing?
 - a) Medullary systems;
 - b). Pontine and Vagal influences.
2. Regulation of Respiratory activity.
3. Chemical control of regulation:
 - a) Carotid and Aortic bodies;
 - b) Chemoreceptors in the Brainstem.
4. Ventilatory responses to changes in Acid – Base balance;
5. Ventilatory responses to CO₂;
6. Ventilatory responses to Oxygen Lack.

7. Effects of Hypoxia on the CO₂ response curve.
8. Effect of H on the CO₂ response.
9. Breath Holding. Hormonal effects on respiration
10. Non chemical influences on respiration:
 - a) Responses mediated by receptors in the air ways and Lungs;
 - b) Coughing and Sneezing;
 - c) Responses in patients with Heart-Lung Transplants;
 - d). Afferents from “Higher centers”, from Proprioceptors;
 - e) Respiratory components of Visceral reflexes;
 - f) Respiratory effects of Baroreceptor stimulation and effects of Sleep
11. Respiratory Adjustments in health. Effects of Exercise:
 - a) Changes in Ventilation;
 - b) Changes in the tissues;
 - c) Exercise tolerance and Fatigue.

INDEPENDENT PRACTICAL WORK

TASK1. Determine the oxygen carrying capacity and oxygen content of arterial and venous blood samples from the data provided below:

Data

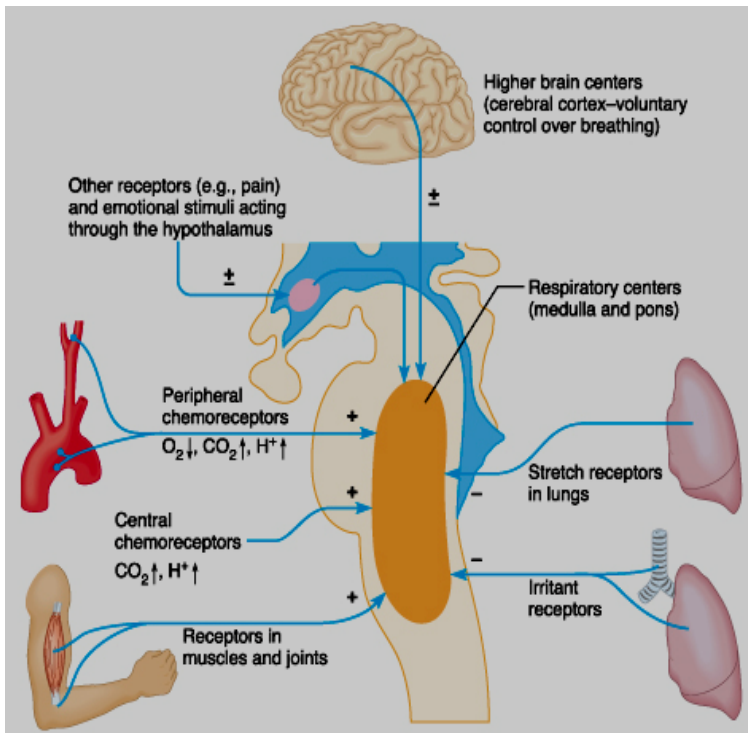
- a). Percentage saturation of arterial blood with oxygen=97%
- b). Percentage saturation of venous blood with oxygen=75%
- c). Hemoglobin concentration=14.5g /dl

Oxygen carrying capacity of blood (ml/100ml)
 = Hg% x 1.34=.....(ml/dl)

Formula for oxygen content of blood= (Percentage saturation x capacity)/ 100

TASK2. What is the normal alveolar ventilation? How is it regulated? Write an explanation.

TASK3. Look this figure and write an explanation about the Central and Humoral mechanisms of breath regulation.



TASK4. Look at this figure and write the explanation about it.

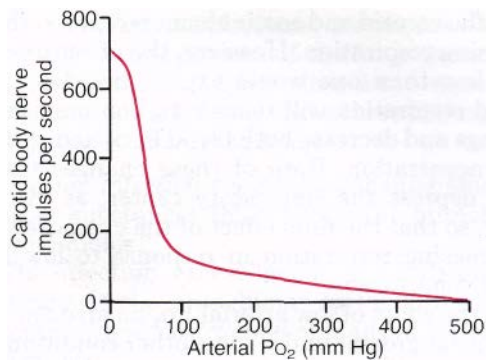


Figure 1. Effect of arterial PO_2 on impulse rate from the carotid body of a cat

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Thematic module #14. Digestion system

PRACTICAL LESSON 12

Theme: Gastrointestinal function .Digestion and absorption of substances.

Digestion into the Mouth.

THE GOALS OF OCCUPATION:

To study the digestion and absorptium of Carbogydrates, Proteins, Lipids, absorptium of Water and Electrolites, Vitamins and Minerals.

Initial level of the knoveledge

1. Anatomy of Alimentary tract.

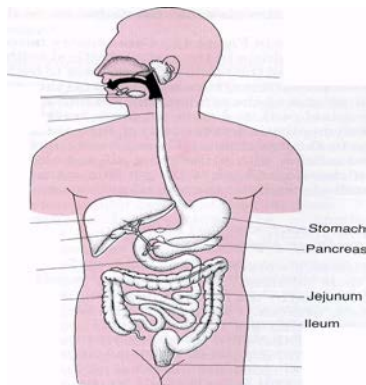
THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. What you know about the general function of Alimentary tract.
2. Carbohydrates : digestion and absorption.
3. Proteins and Nucleic acids: digestion and absorption.
4. Lipids: digestion and absorption.
5. Absorption of Water and Electrolytes.
6. Absorption of the Vitamins and Minerals.
7. Characteristics of the Gastrointestinal wall;
 - a). the gastrointestinal smooth muscle;
 - b). Gastrointestinal circulation;
 - c). the Enteric nervous system, Extrinsic innervation;
 - d). peristalsis, basic electrical activity and regulation of Motility;
 - e) migrating motor complex.
8. Gastrointestinal hormones:
 - a). enteroendocrine cells;
 - b). Gastrin and its function;
 - c). Cholecystokinin – Pancreozymin and their function;
 - d). Secretin, GIP, VIP, peptide YY, Ghrelin, Motilin, Somatostatin and other Gastrointestinal Hormones and their function.
9. Digestion into the mouth: mastication; ionic composition of Saliva; control of salivary secretion.

INDEPENDENT PRACTICAL WORK

TASK 1 Look and note at this figure the Mouth, the Salivary and Parotid glands, the Esophagus, the liver, all parts of the Colon, the Anus. Describe their function.

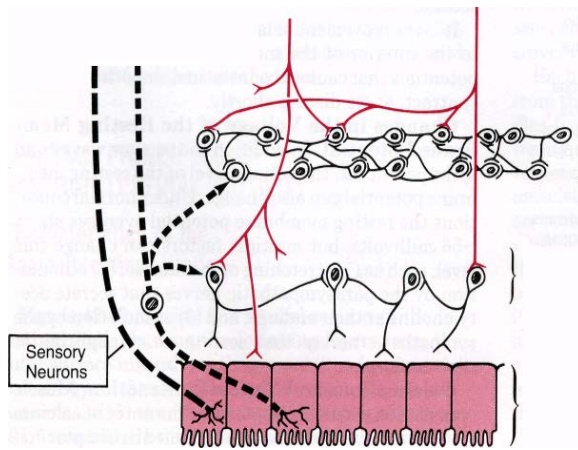


TASK 2. Look and note at this figure the Myenteric plexus, the Submucosal plexus, Epithelium. Explain and describe their function.

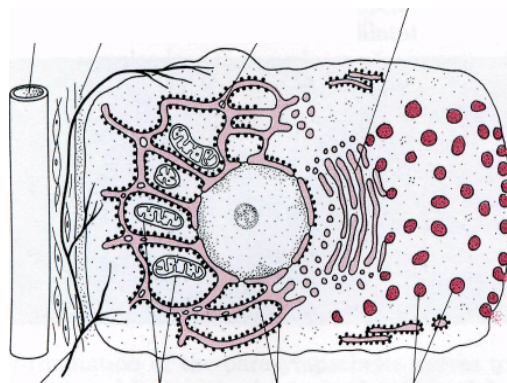
To prevertebral ganglia,

Spinal cord and brain stem Sympathetic
(mainly postganglionic)

Parasympathetic
(preganglionic)



The TASK3. Look and note at figure the Capillary, the Basement membrane, the Endoplasmic reticulum, the Golgi apparatus, the Nerve fiber, the Mitochondria, the Ribosomes and the Zymogen granules. Explain their function



Typical glandular cell.

TASK4. Studying of reaction on Mucin.

During 1-2 minutes rinse a mouth of distilled water of 20 ml. Repeat manipulation 3 times. Filter the collected saliva through a filtering paper. Add to 2 ml of a saliva some drops of an acetic acid. After that Mucindrops out as a white sediment. And the saliva loses viscosity.

RESEARCH PROBLEMS

1. Describe this research and write a conclusion on value of saliva's Mucin.

TASK5. Studying of saliva's pH

Eat one sweet before performance of work. Then, collect 2 ml of a saliva in a test tube. Place a strip of a display paper in a test tube with the help of a tweezers. Take out a strip and immediately compare the received colouring to a scale.

RESEARCH PROBLEMS

1. Describe this research and write a conclusion by the received results

TASK6. Write the information in the table

source	enzyme	activator	substrate	Catalytic function or products
	Salivary α -amylase			
	Lingual lipase			
	Pepsins			
	Gastric lipase			
	Trypsin			
	Chymotrypsins			
	Elastase			
	Carboxypeptidase			
	Colipase			
	Pancreatic lipase			
	Bile salt –acid lipase			
	Cholesteryl ester hydrolase			
	Pancreatic α -amylase			
	Ribonuclease			
	Deoxyribonuclease			
	Phospholipase A2			
	Enteropeptidase			
	aminopeptidases			
	Carboxypeptidases			
	Endopeptidases			
	Dipeptidases			
	Maltase			
	Lactase			

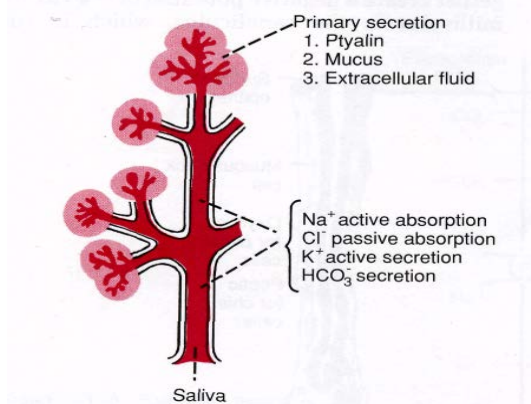
	Sucrase			
	A-Dextrinase			
	Trehalase			
	Nuclease and related enzymes			
	Various peptidases			

TASK7. Write the information about normal transport of substances by the intestine and location of maximum absorption or secretion in this table

	Small intestine			
Absorption of	Upper	Mid	Lower	Colon
Sugars				
Amino acids				
Water-soluble and fast-soluble vitamins				
Betaine, sarcosine				
Antibodies in newborns				
Pyrimidines				
Long-chain fatty acid absorption and conversion to triglyceride				
Bile salts				
Vitamin B12				
Na⁺				

K^+				
Ca^+				
Fe^+				
Cl^+				
SO_4^{2-}				

TASK8. Look at this figure and write an explanation about the formation and secretion of saliva by a salivary gland.



THE CONTROL OF THE LEVEL OF KNOWLEDGE

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PRACTICAL LESSON13

Theme: Digestion functions of Stomach and Pancreas

THE GOALS:

Study the digestion function of Stomach and Pancreas

Initial level of the knowledge

1. Anatomy of Esophagus, Stomach and Pancreas

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Functional anatomy of Stomach.
2. The glands of Stomach and their functions.
3. Functions of Stomach.
4. Properties and composition of Gastric juice.
5. Functions of Gastric juice: digestive, hemopoetic and protective functions.
6. Pepsinogen and Hydrochloric acid secretion.
7. Gastric motility and emptying. Hunger contractions
8. Regulation of the Gastric Secretion. Cephalic, Gastric and Intestinal influences.
9. Regulation of Gastric motility and Emptying.
10. Anatomic considerations of the Pancreas and Pancreatic juice composition.
11. What do you know about the pancreas role in digestion function?
12. Regulation of the Pancreatic juice secretion.

INDEPENDENT PRACTICAL WORK

TASK1. Put information about the Stomach functions in this table.

#	<i>Stomach functions</i>	<i>your explanation</i>
1.	Storage function	
2.	Mechanical function	
3.	Digestive function	
4.	Protective function	
5.	Hemopoetic function	
6.	Excretory function	

TASK2. Two years ago Bob developed cancer and a doctor removed his Pylorus. What happened with Stomach secretory function after that? Write an explanation.

TASK3. Put information about the Gastric enzymes role for digestive in this table.

	<i>Food types</i>	<i>Final products of digestion</i>
Gastric amylase		
Gastric gelatinase		
Pepsin		
Gastric lipase		
Rennin		

TASK4. Analysis Basal Acid Output (BAO) AND Maximal Acid Output (MAO) in Gastric juice.

The specimen is collected over a 2½ hour period. The first 60 minutes, collected in 15-minute intervals is called the Basal Acid Output (BAO). The amount of gastric juice collected from a normal patient will range from 30 mLs to 80 mLs. After chemical stimulation with pentagastrin, histalog, or histamine, the following continuous 60 minutes of 15-minute interval collections is called the Maximal Acid Output (MAO). These four consecutive 15-minute samples are used for the MAO value. Normal values for basal and maximal acid output are as follows:

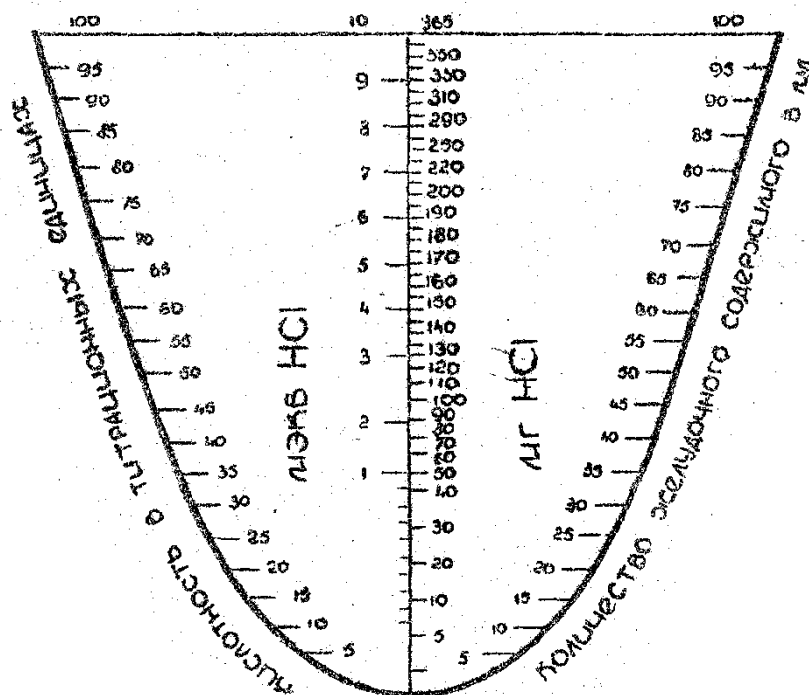
	BAO mMol/hr	MAO mMol/hr	Typical ratio of BAO to MAO
man	0-10	7-48	~20%
women	0-6	5-30	~20%
Gastric ulcer	>2	1-20	20%-40%
Gastric cancer	>2	0-20	~20%

Pernicious anemia	0	0	0
-------------------	---	---	---

There were about three parenteral introductions of substances and Vagal stimulation for an animal. How can BAO and MAO change after experiment? Put information in this table.

substances	BAO mMol/hr	MAO mMol/hr	Typical ratio of BAO to MAO
Gastrin			
Histamine			
Enterogastrone			
Vagal stimulation			

TASK5 . Definition the debit of hydrochloric acid in gastric juice by a nomogram.



Nomogram

Mark volume of gastric juice (ml) in the right branch of this curve. Then mark acidity of this one (T/unit) in the left branch. Connect these two points by a ruler. The point of intersection between the ruler and vertical line of Nomogram is quantity of hydrochloric acid (ml).

The amount of hydrochloric acid in gastric juice collected from a normal patient will range from 40 to 150 mg (during the first 60 minutes of gastric secretion) and from 40 to 220 mg (during the second 60 minutes of one).

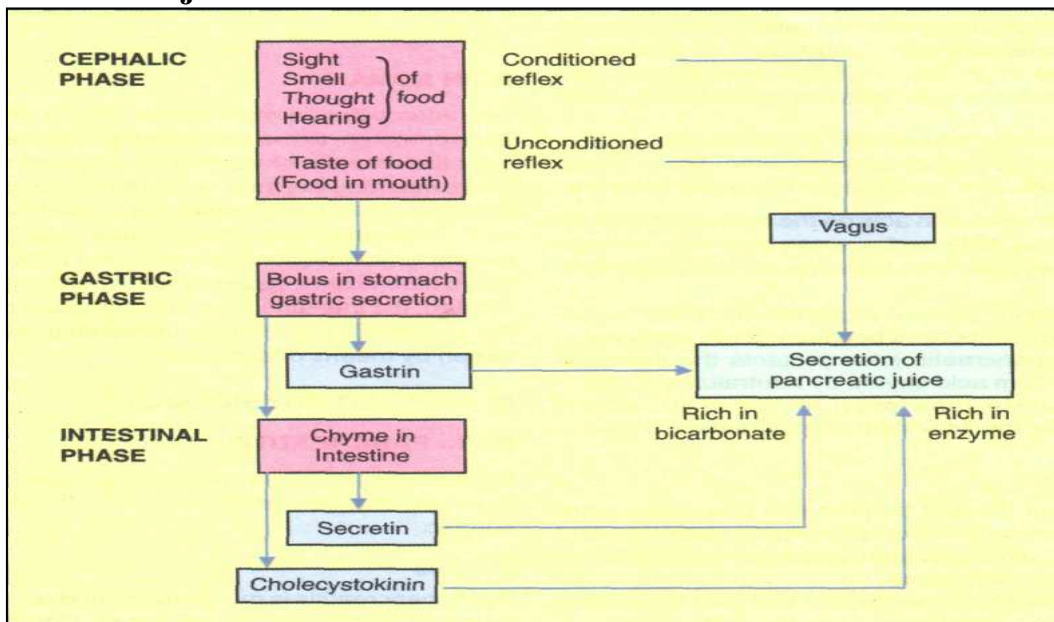
The patient's second portion of gastric juice (90ml) contains about 60 T/unit of acidity. How many mg of hydrochloric acid are there in his specimen? Explain your result and write an explanation.

TASK 6. Write your explanations for these clinical situations.

a). The patient has got gastric juice hyper secretion. Why can't he eat a fried meat?

b).The acidity of patient's gastric juice was increase. Can he eat meat-broth?

TASK7. Look at this figure and write your explanation for this clinical situation. The person's Secretin level was increase. How can it change the Pancreatic juice Ph?



THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #14. Digestion system

PRACTICAL LESSON 14

Theme: Digestion functions of Liver, Small Intestine and Colon.

THE GOALS:

Study the digestion function of Liver, Small Intestine and Colon

Initial level of the knowledge

1. Anatomy of Liver, Small Intestine and Colon

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. What do you know about the functional anatomy of the Liver and Biliary system?
2. Synthesis of Plasma proteins by Liver.
3. Bile and its digestion function: a). Bilirubin metabolism and excretion; b). Jaundice and other substances conjugated by Glucoronyltransferase; c). other substances Excreted in the Bile.
4. What do you know about the role of gallbladder in digestion? The Gallstones and effects of Cholecystectomy
4. Regulation of the biliary secretion.
5. The anatomic considerations of Small intestine and Colon.
6. What can you tell about intestinal mucus and intestinal motility? Regulation of intestinal secretion
7. Transit time in the Small intestine to Colon. Describe the mechanism of motility and secretion in the colon. Regulation of Colon secretion
8. Absorption in the colon. Intestinal bacteria.Feces.Defecation.

INDEPENDENT PRACTICAL WORK

TASK1. Put information about the functions of Liver in this table.

#	<i>Liver functions</i>	<i>your explanation</i>
1.	Metabolic function.	
2.	Storage function	
3.	Synthetic function	
4.	Secretion of Bile	
5.	Excretory function	
6.	Heat production	
7.	Hemopoetic function	
8.	Hemolytic function	

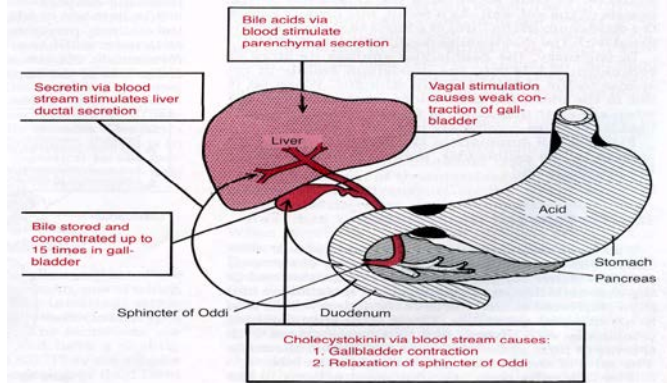
9.	Inactivation of Hormones and Drugs	
10.	Defensive and detoxification functions	

TASK2. Put information about the Bile functions in this table.

#	<i>Bile functions</i>	<i>your explanation</i>
1.	Digestive function.	
2.	Absorptive function	
3.	Excretory function	
4.	Laxative action	
5.	Antiseptic action	
6.	Choleretic action	
7.	Maintenance of pH in gastrointestinal tract	
8.	Prevention of Gallstone formation	
9.	Lubrication function	
10.	Cholagogue action	

TASK3. Study the bile action to fat filtration. Take two test tubes with funnels. Put filters paper into the funnels. Moisten the first filter with bile but the second one with water. Fill about a ml of oil into the each o two. Oil is faster to filter off through the bile layer then through moist paper. Why? **Describe this experiment. Writeen explanation**

TASK 4. Look at this figure. Write an explanation about the regulation of Liver secretion and gallbladder emptying.



TASK5. Two years ago Den developed Gallstone and a doctor removed his gallbladder. What happened with digestion function after that? Write an explanation.

TASK6. Put information about the Intestine enzymes role for digestive in this table.

<i>Enzymes type</i>	<i>Food types</i>	<i>Final products of digestion</i>
<i>Proteolyticenzymes</i> : such as aminopeptidase, dipeptidase and tripeptidase		
<i>Amylolyticenzymes:</i> such as lactase, sucrase, maltase, dextrinase and trehalase		
<i>Lipolyticenzymes:</i> such as intestinal lipase		

TASK7. Put information about the regulation of succus entericus secretion in this table.

	type of regulation	mechanism	effect
1.	Nervous regulation :		
a).	Stimulation of parasympathetic nerves		
b).	Stimulation of sympathetic nerves		
c).	The local nervous reflexes		
2.	Hormonal regulation:		
a).	cholecysto-kinin		
b).	secretin		
c).	enterocrinin		

TASK 8. Study the parietal digestion in rat's Intestine.

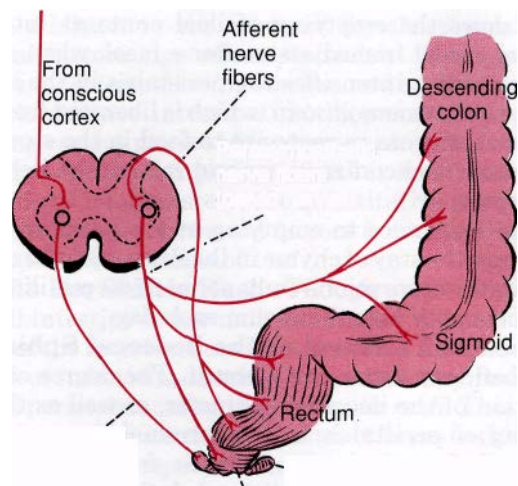
Put about a ml of physiological solution and 0, 5 ml of starch slurry in two test tubes. Add a piece of rat's crushed intestine into the first of the two. Put these test tubes in a thermostat (at 37 ° C) for 20 minutes. Then add about a drop of iodine solution in both ones. Estimate the Amylase activity by color change. **Describe this experiment. Write an explanation.**

TASK9. The person's Secretin level was decrease. How can it change the succus entericus secretion?

TASK10. Put information about the Colon functions in this table.

<i>Large intestine functions</i>	<i>your explanation</i>
Digestive function.	
Absorptive function	
Formation of feces	
Excretory function	
Secretory function	
Synthetic functions	

TASK 11. Look at this figure. Write an explanation about the afferent and efferent pathways of the parasympathetic mechanism for the defecation reflex.



External anal sphincter

Internal anal sphincter

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Thematic module #15. Energy metabolism.

PRACTICAL LESSON 15

Theme: Regulation of the Energy metabolism

THE GOALS:

Study the mechanisms of energy exchange, methods of computation of basic exchange.

Initial level of the knowledge

1. Aerobic and anaerobic oxidization of matters.
2. Final products of oxidation: proteins, oils and carbohydrates.

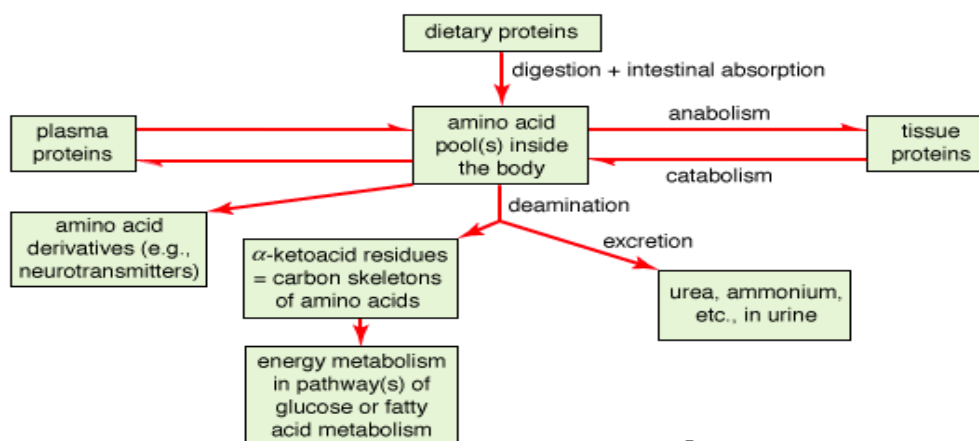
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Release of Energy from foods and the concept of “free energy”.
2. Metabolism of Carbohydrates and formation of Adenosine triphosphate (ATP).
3. Lipid metabolism.
4. Protein metabolism.
5. Regulation of feeding. Obesity and starvation.
6. Vitamins and mineral requirements
7. Energetics and metabolic rate
8. Dietary balances.

INDEPENDENT PRACTICAL WORK

TASK1. Look at this scheme. What kind of factors can increase or decrease the proteins metabolism in a man? Put information in this table.



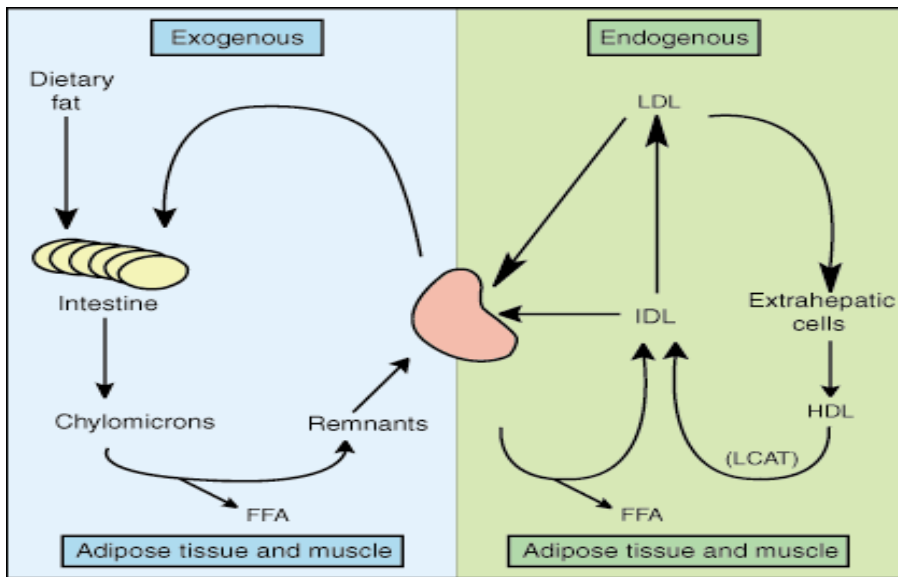
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The factors	High proteins metabolism	Low proteins metabolism	Physiology mechanism
hungry			
n.....			

TASK2. What central and humoral mechanisms do the Carbohydrates metabolisms change? Put information in this table

the factors	High carbohydrates metabolism	Low carbohydrates metabolism	Physiology mechanism
hungry			
n.....			

TASK3. Look at this scheme. What kind of factors can increase or decrease the lipid metabolism in a man? Put information in this table



The factors	High lipid metabolism	Low lipid metabolism	Physiology mechanism
hungry			
n.....			

--	--	--	--

TASK4. Calculate of daily caloric requirements from data provided.

Data: Subject awake for 17 hours; Light type of work for 6 hours; Body weight=58 kg; Body surface area=1.6 m²; BMR=38 Calories/h/m²; Ambient temperature=15° C. *Total caloric requirements of the subject per day=e+f+g ?*

Preparation a diet sheet.

The aim of nutrition is to determine the type and amount of foods that would not only supply the energy and materials for growth, repair, and enzymatic activities, but also promote health and well being. This includes the problem of undernutrition in economically poor countries and overnutrition in rich people.

An optimal diet includes adequate calories, proteins, fats, carbohydrates, enough water, minerals, and vitamins.

Planning a diet In planning an adequate diet, the following criteria are taken into account:

1. It must be palatable and satisfying.
2. It must have sufficient energy value (calories) to maintain body weight, physical and mental efficiency, and body temperature.
3. It must contain proper proportions of proteins, carbohydrates, and fats.
4. It must maintain nitrogenous equilibrium.
5. It must contain proper proportions of minerals, vitamins, and enough water.

Total Caloric Requirements

The caloric values of foods, ie, the energy released when 1 gram of a particular food is metabolized, is given below:

Type of food	Caloric value (kcal/g)	
Proteins	4.1	For practical purposes, the caloric value of proteins, carbohydrates, and fats are taken as 4,4, and 9 respectively. Knowing the quantities of these foods in the diet, the total caloric intake can be calculated.
Carbohydrates	4.1	
Fats	9.3	

Calculation of Total Caloric Requirements

1. Body surface area (BSA) is determined from the height and weight of the person from a chart (nomogram) provided for the purpose, (see appendix)
2. Basal metabolic rate (BMR) is determined from the age, sex, and the BSA of the individual from a chart provided for this purpose.
3. Since BMR = Calories expended per hour per m² BSA,
- Calories expended per hour = BMR x BSA
4. A person is awake for 16 hours in a day,
- *Calories expended during waking hours = BMR x BSA x 16 (a)*

5. A person sleeps for 8 hours during which the caloric requirement is 90% of BMR

$$\text{- Calories consumed during sleep} = \text{BMR} \times \text{BSA} \times 8 \times 90/100 \quad (\mathbf{b})$$

6. Work allowance: the calories consumed during the working period are dependent upon the type of work, as shown below:

Type of work Calories/hr/kg body weight

Light 1.7

Moderate 2.5

Heavy 5.0

A person normally works for 8 hours a day; therefore, work allowance is calculated as under for a person doing moderate type of work-

$$\text{Work allowance} = 8 \times 2.5 \times \text{Body weight in kg} (\mathbf{c})$$

7. Non-working allowance for the energy requirements of daily activities such as taking a bath, donning clothes, talking or other movements which a person performs while awake.

This allowance is taken as 400 kcal per day. (d)

8. Total calories required per day:

This is calculated as follows: $a + b + c + d$ (as mentioned above) (e)

9. Specific dynamic, or calorogenic, action of food (SDA):

Depending on the types of foodstuffs burnt in the body, 10-15% of the total caloric needs is added. (f)

10. Climate: A correction for ambient temperature during the day is required after calculating the figure (f) above. If the environmental temperature is about 25° C, no correction is required. If it is higher by 5-10° C, the caloric requirement is reduced by 5%. If the temperature is lower by 5-10° C, the caloric requirement is increased by 3%. (g)

11. Extra calories are required during pregnancy (250-350 Calories/day) and during lactation (550-600 Calories/day).

TASK5. Find out the basal metabolic rate (BMR) of the subject from the data given below. Write a conclusion.

Date

- a). Oxygen consumption in 6 minutes = 1470 ml
b). Body surface area (BSA) of the subject = 1.6 m²
c). Standard BMR for the age and sex of the subject = 40 Cal/m²BSA/hour
-

Oxygen consumption in 1 hour = 14.70 liters

When 1 liter of oxygen is consumed, 4.8 Calories are released.

Calories released from consumption of 14.7 liter of oxygen = ?

BMR = Calories consumed per hr / BSA ; BMR = ?

Standard BMR for the subject = 40 cal/m²BSA/hour; Calculated BMR is in excess or decrease by n calories/m²BSA/hour

Percentage excess or decrease = $n / 40 * 100\% = \dots\%$
Normal range = $\pm 15\%$

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Thematic module #16. Thermoregulation.

PRACTICAL LESSON 16

Theme: Physiology of thermoregulation

THE GOALS:

Study the mechanism of thermoregulation

Initial level of knowledge

1. Biochemistry of thermoregulation
2. Principles of temperature regulation in poikilothermic and homothermic animals

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

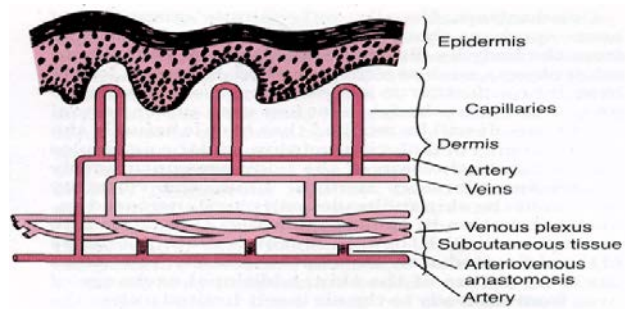
1. Normal body temperature.
2. Heat production.
3. Heat loss: a). heat conduction; b). convection; c.) radiation.
4. Temperature regulation and Fever. Hypothermia.
5. Role of the CNS in regulation of body temperature.
6. Behavioral control of Body temperature.

INDEPENDENT PRACTICAL WORK

TASK1. Put information about factors for Heat production and Heat loss.

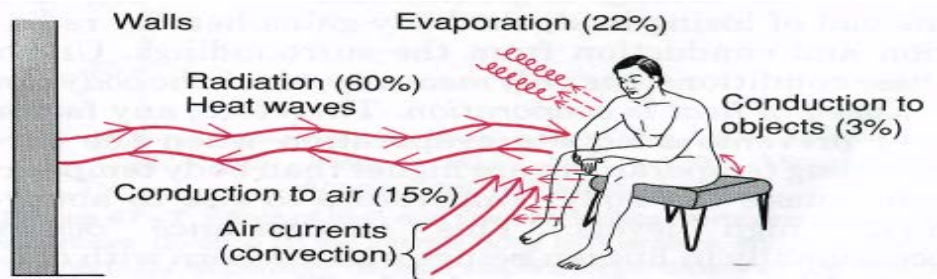
Heat production		Heat loss	
<i>factors</i>	<i>mechanism</i>	<i>factors</i>	<i>mechanism</i>

TASK2. Look at this figure. Write explanation about the role of blood vessels in regulation of body temperature.



TASK3. What do you know about the control of Heat conduction to the skin by the Sympathetic nervous system? Write explanation.

TASK4. Look at this figure and describe the mechanisms of heat loss from the body. Use this table.



factors	mechanism
radiation	
conduction	
convection	
evaporation	

TASK5. What do you know about the role of Aldosterone for acclimatization of the sweating mechanism to Heat? Write an explanation.

TASK6. What do you know about the role of the Hypothalamus in regulation of body temperature? Write an explanation .Use this table.

Structure of the brain	function
<i>Anterior Hypothalamic-Preoptic area</i>	
<i>Posterior Hypothalamus</i>	
<i>receptors</i>	

TASK7. Write an explanation about behavioral control o body temperature.

TASK8. Clinical testing of temperature sensation.

I. Prepare three jars of water in the order—hot, warm, and cold. The hot water should be as hot as can be easily tolerated by a finger without evoking pain. Ask the subject to dip his right index finger in the cold water, and the left in the hot water. After about 30 seconds, ask him to dip both index fingers in the warm water. Ask him to describe the sensations resulting from the experiment.

II. "Cold" and "Warm" spots: Satisfactory thermal probes can be made by taping the two inches of the blunt ends of pithing needles with electrician's insulation tape (the plastic serves as an insulated handle). Pack 3-4 such probes each in a 500 ml beaker filled with hot water and another beaker filled with crushed ice and water.

Make a 3 cm square with a sketch pen on the dorsum of the subject's hand, and divide this into 4 squares. Ask him to close his eyes. Very gently touch the skin within the squares with a probe. The subject is to report "cold" or "hot" as the case may be. Select hot and cold probes at random and test for hot and cold spots until the entire square has been mapped. Mark the locations where the subject reports hot sensations with red dots and those of cold sensations with blue dots. (Dry each probe before use, and return it to the beaker after use). Several other areas may be tested in a similar manner. Use the same colored dots to show hot and cold spots within the grid drawn in your work book.

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #17. Kidney system. Physiology of the main periods of human evolution

PRACTICAL LESSON 17

Theme: The role of kidneys in urine formation. Glomerular filtration and its regulation

THE GOALS:

Study the mechanism of urine formation and its regulation.

Initial level of knowledge

1. Anatomy of kidneys; innervation of kidneys.
2. Renal blood vessels.
3. Osmotic and oncotic pressure.

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Physiology of excretory system, its composition and function.
2. Describe the kidney functions.
3. What do you know about the functional anatomy of
 - a). Nephron;
 - b). Juxtaglomerular apparatus;
 - c). Renal circulation?
3. Describe the mechanism of Urine formation (Glomerular filtration, tubular reabsorption, tubular secretion)
4. What do you know about the Glomerular filtration?
 - a). Glomerular filtration rate;
 - b). Filtration fraction;
 - c). pressures determining filtration;
 - d). filtration coefficient.
5. Plasma clearance.

INDEPENDENT PRACTICAL WORK

TASK 1. Put information about functions of kidneys in this table.

#	Functions	...about this function
1.	Role in homeostasis:	
a).	Excretion of Waste products	
b).	Maintenance of water balance	
c).	Maintenance of electrolyte balance	
d).	Maintenance of acid base balance	
2.	Hemopoetic function	
3.	Endocrine function	
4.	Regulation of blood pressure	
5.	Regulation of blood calcium level	

TASK 2. Look a picture and write an explanation about structure and functions of nephron.

TASK3. What do you know about the factors regulating Glomerular filtration rate? Put information about ones in this table.

#	Factors	...about this factor
1.	Tubuloglomerular feedback mechanism	
2.	Glomerular capillary pressure	
3.	Colloidal osmotic pressure	
4.	Hydrostatic pressure in Bowman's capsule	
5.	Renal blood flow	
6.	Constriction of afferent arteriole	
7.	Constriction of efferent arteriole	
8.	Systemic arterial pressure	
9.	Sympathetic stimulation	
10.	Surface area of capillary membrane	
11.	Permeability of capillary membrane	

TASK 4. What is it effective filtration pressure? Write an explanation. Calculate the effective filtration pressure from the data given below.

Data

- a). Glomerular capillary hydrostatic pressure = 55mmHg
 - b). Glomerular capillary blood osmotic pressure = 30mmHg
 - c). Bowman's capsular fluid pressure = 15mmHg
 - d). Bowman's capsular fluid osmotic pressure = 0mmHg
- effective filtration pressure = a – (b+c)**

TASK 5. What is it Glomerular filtration (GFR) rate? Write an explanation. Calculate the Glomerular filtration rate from the data provided below.

Data

- a). Concentration of inulin in plasma (P) = 0,24 mg/ml
b). Concentration of inulin in urine (U) = 34 mg/ml
c). Rate of urine formation (V) = 0,9ml/min
GFR (...ml/min) = U*V/ P

TASK 6. Write an explanation for these clinical tasks

1. The osmotic blood pressure increases. How will the urine formation change?

2. Substance V normally can not be found in the urine. Does it mean that it can not be filtrated and can not be secreted?

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Thematic module #17. Kidney system. Physiology of the main periods of human evolution

PRACTICAL LESSON 18

Theme: The role of kidneys in urine formation. Physiology of reabsorption and secretion

THE GOALS:

Study the main mechanism of urine formation and its regulation.

Initial level of the knowledge

1. Classification and mechanisms of transport through cell membrane.
2. Features of kidneys blood circulation.

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Tubular reabsorption:
 - a) Selective reabsorption;
 - b) the mechanisms of reabsorption;
 - c). the mechanisms of reabsorption Na⁺, glucose, amino acids, proteins, water.

2. Tubular reabsorption and secretion:
 - a). reabsorption and secretion urea;
 - b). reabsorption and secretion K^+ ;
 - c). Secretion H^+ ;
 - d). ammonia secretion.
3. Concentration of urine.
4. Determination the tubular reabsorption.
5. Regulation of reabsorption processes.
6. Incretory function of kidneys
7. Process of urine excretion and its regulation
8. Kidneys and hemopoiesis
9. Physiology of micturition

INDEPENDENT PRACTICAL WORK

TASK 1. Calculate the urea clearance from the given data. Write an explanation for your results.

Data

Concentration of urea in urine (U) = 20 mg/ml

Concentration of urea in blood (B) = 38 mg/100ml

Rate of urine flow (V) = 1,5ml/min

Since the urine flow is less than 2.0ml/min, the formula of “standard” urea clearance is

$$= \frac{U \times \sqrt{V}}{B} \times 100$$

Since the urine flow is more than 2.0ml/min, the formula of “maximum” urea clearance is

$$= \frac{U \times V}{P}, \text{ where P is concentration of inulin in plasma}$$

Data

Concentration of urea in urine (U) = 40 mg/ml

Concentration of inulin in plasma (P) = 0,24 mg/ml

Rate of urine flow (V) = 3ml/min

NB: The value for maximum clearance is 65-100ml/min; while the normal value for standard clearance is 40-65ml/min

TASK 2. Write an explanation for clinical tasks

1. The oncotic blood pressure increases. How will the urine formation change?

- The patient suffers from primary aldosteronism. It means that secretion of aldosteron is increased. It usually caused by the tumor of adrenal cortex. How will the concentration of renin in plasma change?

**TASK3. The analysis of kidney l function by test of Zemnickii:
The urine of the patient was taken during the day**

Daytime diuresis

test	time	Amount of the urine	Specific gravity
1.	6-9 a.m	270 ml	1012
2.	9-12 a.m	220 ml	1014
3.	12-15 p.m	210 ml	1016
4.	15-18 p.m	200 ml	1013
General amount of urine:			

Nighttime diuresis

test	time	Amount of the urine	Specific gravity
5.	18-21 p.m	180 ml	1017
6.	21-24 p.m	120 ml	1027
7.	24-3 a.m	180 ml	1014
8.	3-6 a.m	120 ml	1024
General amount of urine:			

NB: The daily diuresis is bigger than nightly in healthy person.

Draw graphs (diagrams) of change in specific gravity, amount of the urine during day. Write an explanation for these diagrams.

Daily diuresis

spec.
gravity

Nightly diuresis

amount.
of urine

PRACTICAL LESSON 19

Theme : Module control 2. Control of Practical Tasks

Recommended literature

Basic:

1. Physiology : textbook for students of higher medical institutions with the IVth level of accreditation / V. M. Moroz [et al.] ; ed. by.: V. M. Moroz, O. A. Shandra ; рец.: L. M. Karpov, S. S. Tkachuk, O. G. Rodinsky. - Vinnytsya : Nova Knyha Publishers, 2016. - 728 p.
2. Guyton, Arthur C. Textbook of Medical Physiology : учебник / А. С. Guyton. - Philadelphia : Elsevier Inc., 2006. - 1152 с.
3. Hall J. E. Guyton and Hall Textbook of Medical Physiology / John E. Hall ; ed. by.: M. Vaz, A. Kurpad, T. Raj. - 13th ed. - India : Elsevier, 2016. - 927p.

Additional literature:

1. K.Sembulingam. Essentials of Medical Physiology. Jaypee, 2013, 895p.