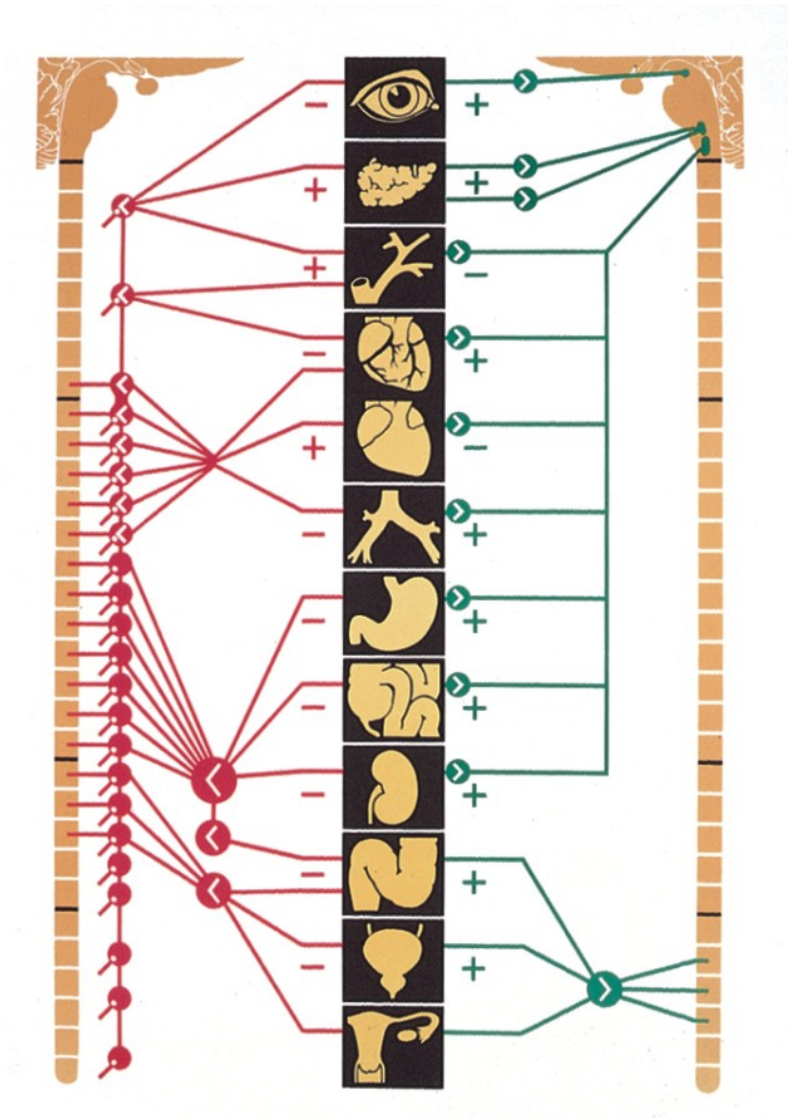
MINISTRY OF HEALTH SERVICE OF UKRAINE
ZAPOROZHYE STATE MEDICAL UNIVERSITY
THE DEPARTMENT OF NORMAL PHYSIOLOGY

NORMAL PHYSIOLOGY

Methodical manual for students

Module 1



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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.

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

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**
proteins		
fats		
carbohydrates		
water		
ions		

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 #1. Introduction in physiology. Physiology of the excitable tissues.

PRACTICAL LESSON2

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

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

The Initial level of knowledge

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

CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. 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.
11.

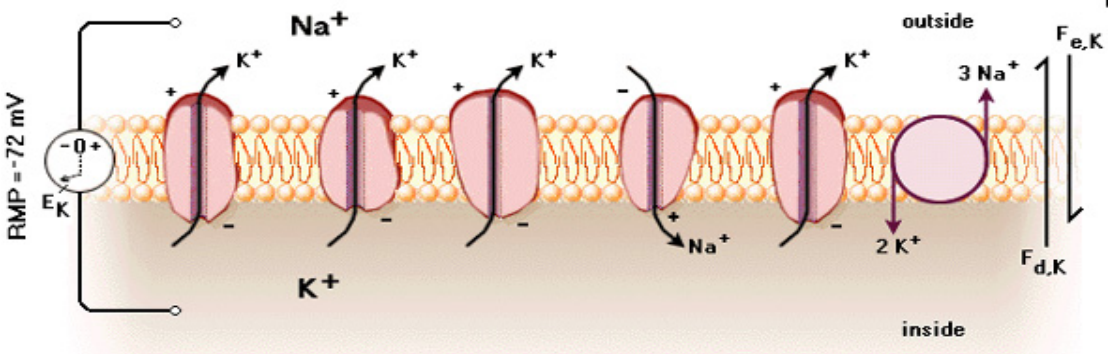
INDEPENDENT PRACTICAL WORK

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

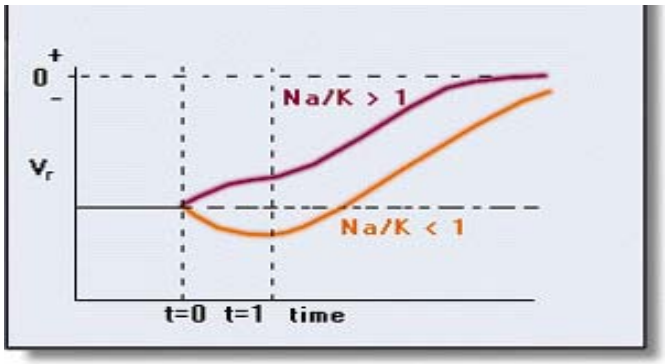
#	factors	factors' action
1.	The transmembrane ion distribution ….	
2.	The selective conductance of the membrane …	
3.	The transmembrane ion diffusion…	

4.	Na/K pump	

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

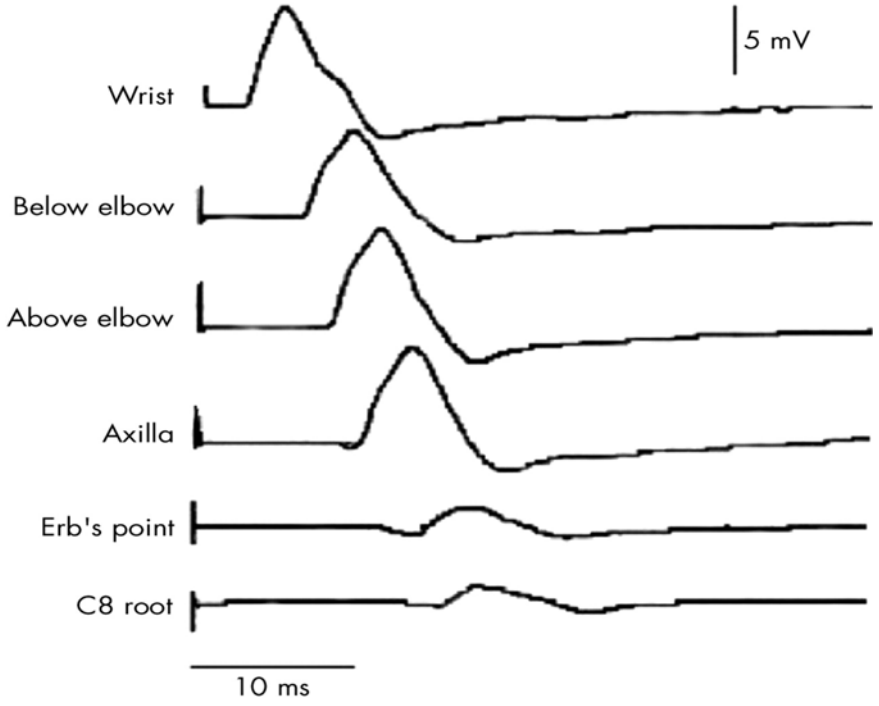


TASK 2. **Look at this figure. How can you explain effects of Inhibition of an Electrogenic Na/K Pump: total inhibition (you can see the red or green curve) and a depolarizing pump (you can see the orange or yellow curve). Write an explanation.**



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

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



a). You have to describe patient's results of microneurography in this table.

	an action potential	
Exam's region	***Amplitude (mv)***	***Time (ms)***
Wrist		
Below elbow		

Above elbow		
Axilla		
Erb's point		
C8 root		

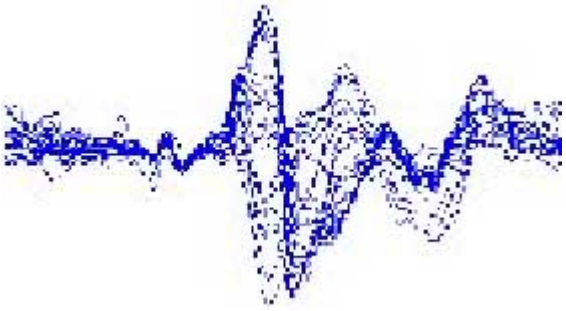
B). The action of nerves and muscle is essentially electrical. Information is transmitted along nerves as a series of electrical discharges carrying information in pulse repetition frequency. This may be in the range of 1 to 100 pulses/s. Contraction of muscle fibres is also associated with an electrical discharge which can be detected by measuring electrodes or brought about by electrical stimulation. Electromyography (EMG) is most often used when people have symptoms of weakness, and examination shows impaired muscle strength. It can help to differentiate primary muscle conditions from muscle weakness caused by neurological disorders. EMG can be used to differentiate between true weakness and reduced use because of pain or lack of motivation. EMG equipment consists of recording electrodes, preamplifiers (which are normally placed very close to the patient to avoid pick-up of electrical interference), amplifiers to provide the correct gain, calibration and frequency characteristics, a display system (usually a CRT), a range of integrators and averagers - partly to achieve some data compression (chart records may be very long and difficult to read), and a recording medium, which is often a photographic (fibre-optic) system.

The most typical method for testing uses a needle electrode inserted through the skin into the muscle. The electrical activity detected by this electrode is displayed on a display system (and may be displayed audibly through a speaker). Because skeletal muscles are isolated and often large units, each electrode gives only an average picture of the activity of the selected muscle. Several electrodes may need to be placed at various locations to obtain an accurate study. After placement of the electrode(s), the patient may be asked to contract the muscle (for example, by bending the arm). The presence, size, and shape of the wave form produced on the oscilloscope (the action potential) provide information about the ability of the muscle to respond to nervous stimulation. Each muscle fibre that contracts will produce an action potential, and the size of the muscle fibre affects the rate (how frequently an action potential occurs) and size (amplitude) of the action potential(s). A nerve conduction velocity test is often done at the same time as an EMG. There may be some discomfort with insertion of the electrodes (similar to an intramuscular injection). Afterward, the examined muscle may feel tender or bruised for a few days. Muscle tissue is normally electrically silent at rest. Once the insertion activity (caused by the trauma of needle insertion) quiets down, there should be no action potential on the oscilloscope. When the muscle is voluntarily contracted, action potentials begin to appear. As contraction is increased, more and more muscle fibers produce

action potentials until a disorderly group of action potentials of varying rates and amplitudes (complete recruitment and interference pattern) appears with full contraction.

Many EMG tests involve the use of stimulators to induce discharges in a nerve trunk, and detect the response by surface electrodes over a muscle served by that nerve. In this case the signals may be as large as 2 mV, and may be presented audibly or for recording on a high-speed chart recorder. Such evoked response tests might be for determining the nerve conduction time, or for assessing the performance of the neuromuscular control system. There are many different disorders of the nervous system and EMG examination has to be tailored to the particular requirements of the individual patient. Thus, these tests are normally carried out by a specialist in electromyography within the neurology department.

Muscle Response Test. A test to measure muscle response to nervous stimulation (electrical activity within muscle fibres).



When a muscle fiber loses its nerve supply, it exhibits a characteristic irritability manifested as spontaneous discharges at rest. Single muscle discharges, called FIBRILLATIONS have a short duration (.5 to 1.5 ms), low amplitude (50-300 microvolts) and a REGULAR rhythm. They are usually positive (downward) in their initial deflection.

b). How can Muscle Response change to nervous stimulation after Inhibition of an Electrogenic Na/K Pump by a special drug? Draw the curve of Action Potential for one. Write an explanation.

TASK 4. **Solving the clinical 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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PRACTICAL LESSON3

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

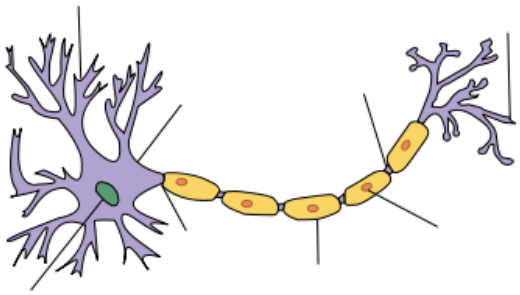
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

12. Explain what the morphology parts does neuron has?
13. Explain the structure of Myelinated Nerve Fibers. What functions do they have?
14. Describe the structure of Unmyelinated Nerve Fibers. What functions do they have?
15. Describe the mechanism of excitation and conduction in the Nerve Fibers.
16. Explain the origin of Resting Membrane Potential of the Nerve Fibers.
17. What do you know about ionic basis of Action Potential of the Nerve Fibers?
18. Explain the ionic basis of «All -or- None» Law.
19. Describe the Local response and firing level origin of the Nerve Fibers.
20. What do you know about the mechanism of Action Potential conduction along the Myelinated and Unmyelinated Nerve Fibers?
21. What do you know about the orthodromic and antidromic of Action Potential conduction?
22. 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 …**

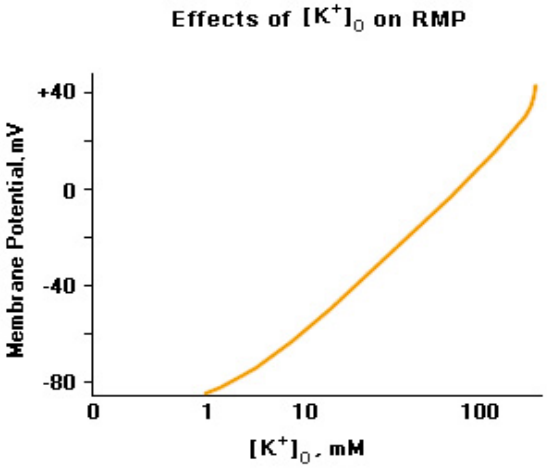


morphology structure	functions
Dendrite	
Axon	
Node of Ranvier	
Schwann cell	
Myelin sheath	

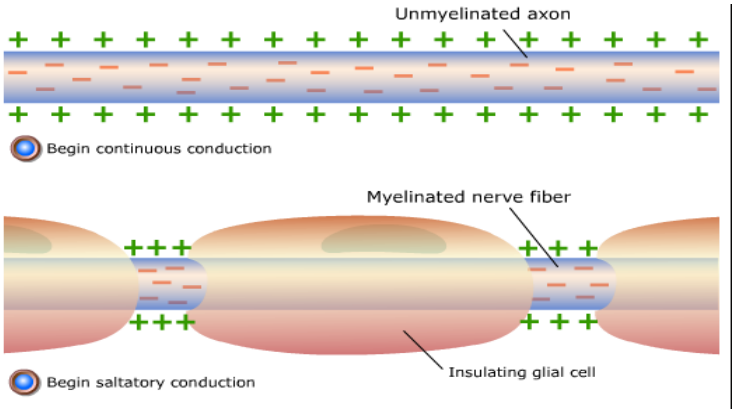
TASK 2. **Complete the table about the …**

nerve fiber	the regions of innervations
Unmyelinated Nerve	
Myelinated Nerve	

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



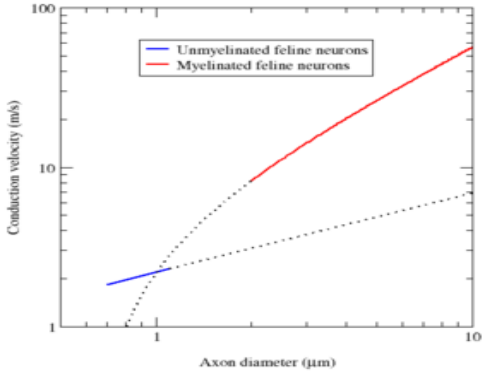
TASK 4. **Look at this figure. How can you explain the mechanism of Action Potential conduction along the Myelinated and Unmyelinated Nerve Fibers? Write an explanation.**



nerve fiber	ionic mechanism of AP conduction
Unmyelinated Nerve	
Myelinated	

Nerve	

TASK5 . **Look at this figure. How can Axon diameter and Myelin sheath impact in velocity of nerve impulses conduction? Write an explanation.**



TASK 7. **Solving the clinical task. Write an explanation.**

1. Which can a factor influence on quantity of a membrane potential of nerve fiber?

2. What plays an important role in mechanism of depolarization phase of nerve fiber?

THE CONTROL OF THE LEVEL OF KNOWLEDGE
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Thematic module #1. Introduction 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									

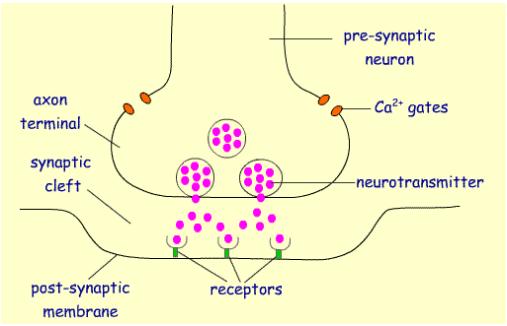
TASK2.**Registration of electromyography of a person.**

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).

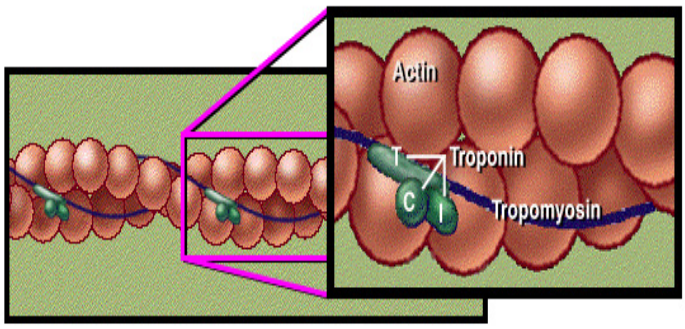
b). draw the biopotentials and compare the results before the physical loading and after it

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.**



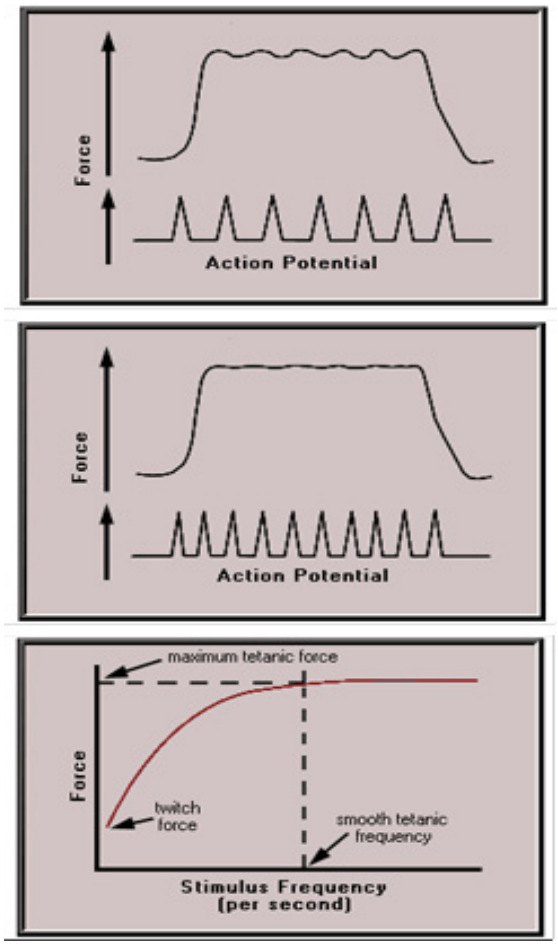
TASK5. **Solving the clinical tasks.**

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

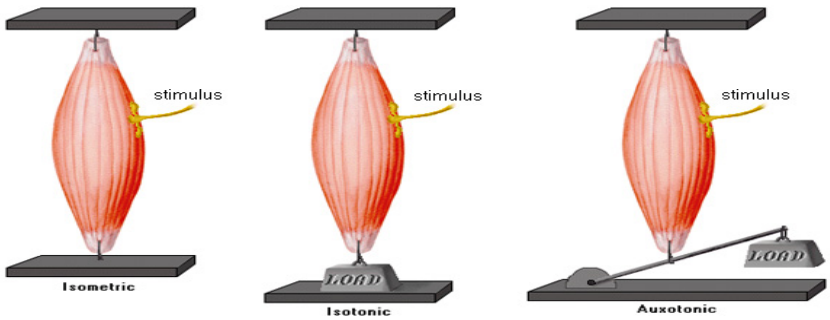
a). What should be an interval between the first and the second irritation for developing an incomplete tetanus ?

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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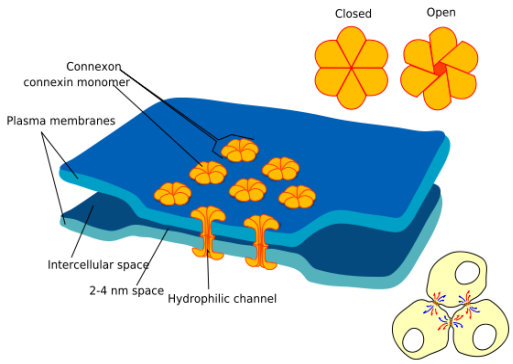
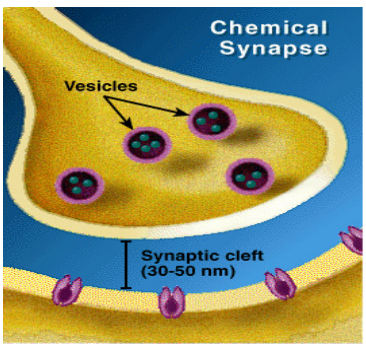
Thematic module #1. Introduction in physiology. Physiology of the excitable tissues
PRACTICAL LESSON 5
Theme: Synaptic and Junctional Transmission.
THE GOALS:
Study the mechanism of Synaptic and Junctional Transmission; study the properties of the nervous centers

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 o 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.**





an Electrical synapse	***a Chemical synapse***

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

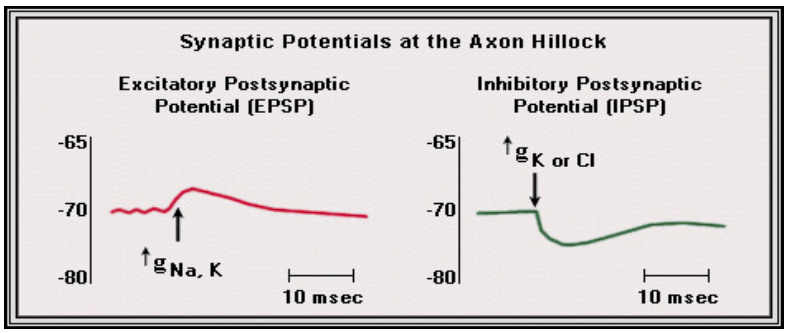
	The description	*an Electrical synapse*	*a Chemical synapse*
	Location		
	Synaptic Delay.		
	Unilateral transmission		
	Transfer of Excitation.		
	Transfer of Inhibition.		
	Neurotransmitters		

TASK 3. **Put the information about Neurotransmitters in the table**

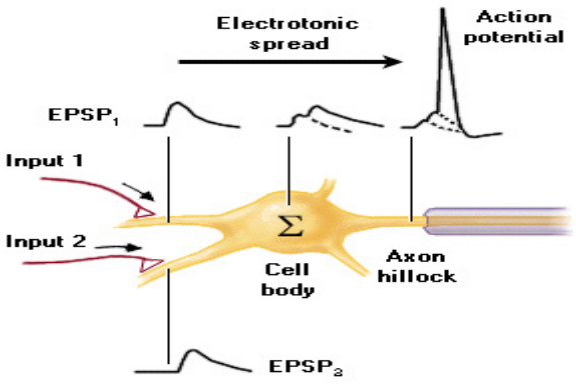
substance	*location*	*inhibition*	excitatory
Acetylcholine			
Dopamine			
Norepinephrine			
Glutamate			

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.**

	action	*synapse*	*neurotransmitter*	*mechanism*
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?

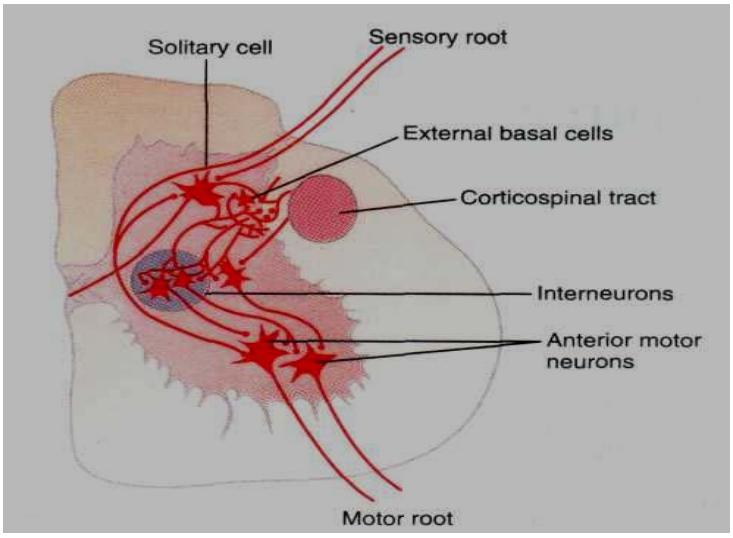
6. Describe the Clinical applications of the Stretch reflex (Biceps tendon reflex, Triceps tendon reflex, Knee Jerk Reflex, and Achilles tendon reflex).

7. Explain the Clasp Knife Phenomenon; the Flexion (Withdrawal) Reflex; the Crossed Extensor reflex.

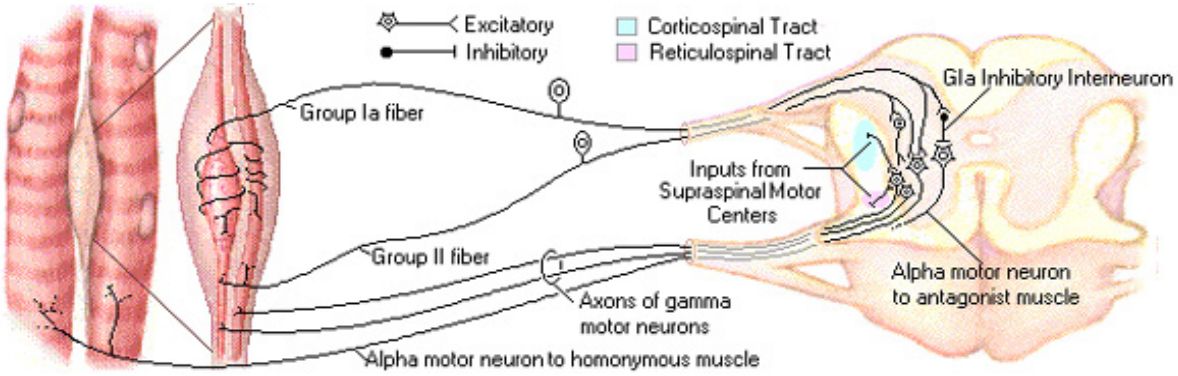
8. The Spinal Shock and it origin. What Complications can be after the Cord Transection?
9. What kind of Responses can be in Chronic Spinal Animals and Humans?

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.

	Upper limb (right)	***Upper limb(left)***	***lower limb(right)***	***lower limb(left)***
No sportsmen	(sm)	(sm)	(sm)	(sm)
Sportsmen	(sm)	(sm)	(sm)	(sm)
Resume				

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

THE CONTROL OF THE LEVEL OF KNOWLEDGE
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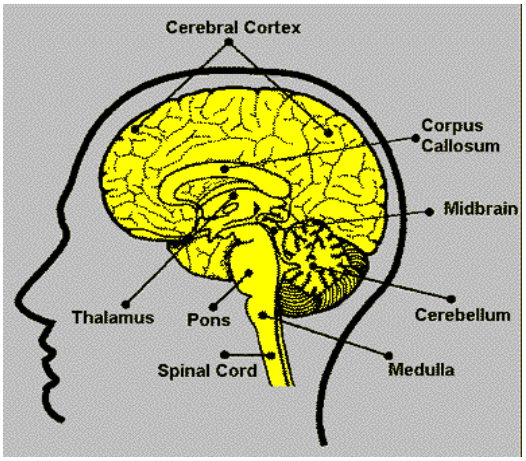
PRACTICAL LESSON 7.

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.

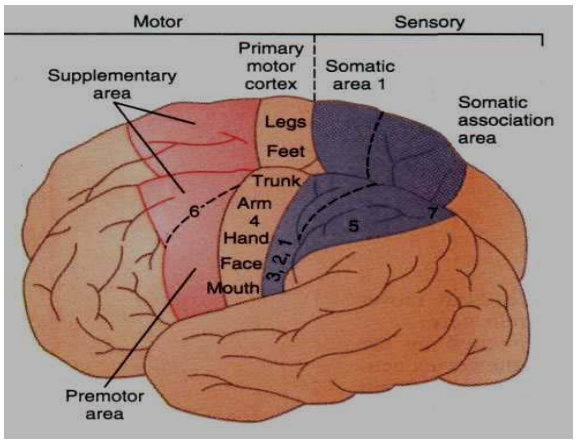
INDEPENDENT PRACTICAL WORK
TASK1.**Look at this figure and put the explanations about motor functions of Cerebrum in this table.**



#	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.**



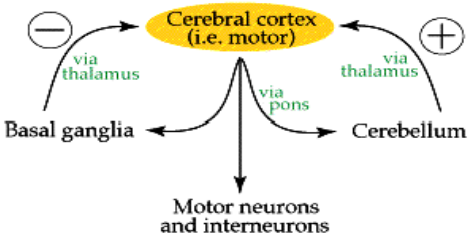
#	*Part of cortex*	*Motor Functions*
1.	***Premotor area***	
2.	***Supplementary area***	
3.	***Primary motor area***	

TASK3. **Put the information about the Cerebral Postural reflexes in the table**

Reflex	***Stimulus***	***Response***	***Receptor***	***Integrated in…***
Stretch reflex				
Positive supporting reaction				
Negative supporting reaction				
Tonic labyrinthine reflexes				
Tonic neck reflexes				
Labyrinthine righting reflexes				
Neck righting reflexes				
Body on head righting reflexes				
Body on body righting				

reflexes				
Optical righting reflexes				
Placing reactions				
Hopping reactions				

TASK4. **Look at this scheme and write the explanations about Anatomical relations of the basal ganglia to the cerebral cortex**



TASK5. **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.

TASK6. **Perform the Test of muscle coordination in the lower limbs. Explain your results.**
1. The subject is asked to walk along a straight line. The examiner watches carefully as the subject turns to walk back. The subject may also be asked to walk along a line, placing the heel of one foot immediately adjacent to the toes of the foot behind (tandem walking). If incoordination is present, the subject soon deviates to one or the other side and takes a zigzag course like that of a drunk.

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

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

TASK7.**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.

TASK8. **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 pat of the Spinal cord. **.**Can you explain “Way”? Write an explanation

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Amount module #4. 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:

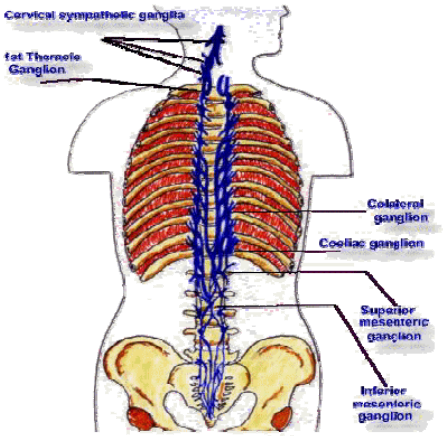
5. What do you know about Structure of peripheral nervous system?
6. What is the role of Somatic and Autonomic nervous system?

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?

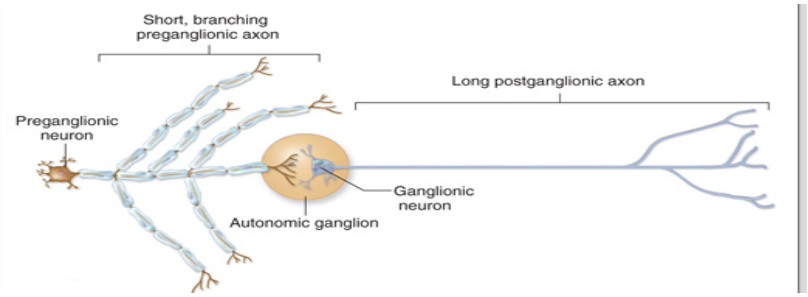
6. What do you know about the Chemical transmission at Autonomic junctions?
7. Explain the Chemical Divisions of the Autonomic nervous system. The transmission in Sympathetic Ganglia. Describe the Preganglionic and Postganglionic transmitter substances of Sympathetic division.
8. The responses of effector 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 organization of Sympathetic nerve system.**



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



TASK 3. **Put the information about the response of effectors organs to Sympathetic nerve impulses in this table.**

An effector organ	**Cholinergic impulse response**	**Noradrenergic impulse response**	**Type of receptor**	**Noradrenergic Reflex ark**	**Cholinergic Reflex ark**
the eyes					
salivary glands					
bronchi					
systemic Blood					

Vessels					
heart					
stomach					
pancreas					
intestine					
colon					
rectum					
gallbladder					
urine bladder					

TASK 4. **The response of the skin to mechanical injury: the "triple response". Explain results after person's examination; draw the reflex ark 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 H_1 receptors. A common example of the triple response is the finger-marks left on the skin of the face following a hard slap.

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

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

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

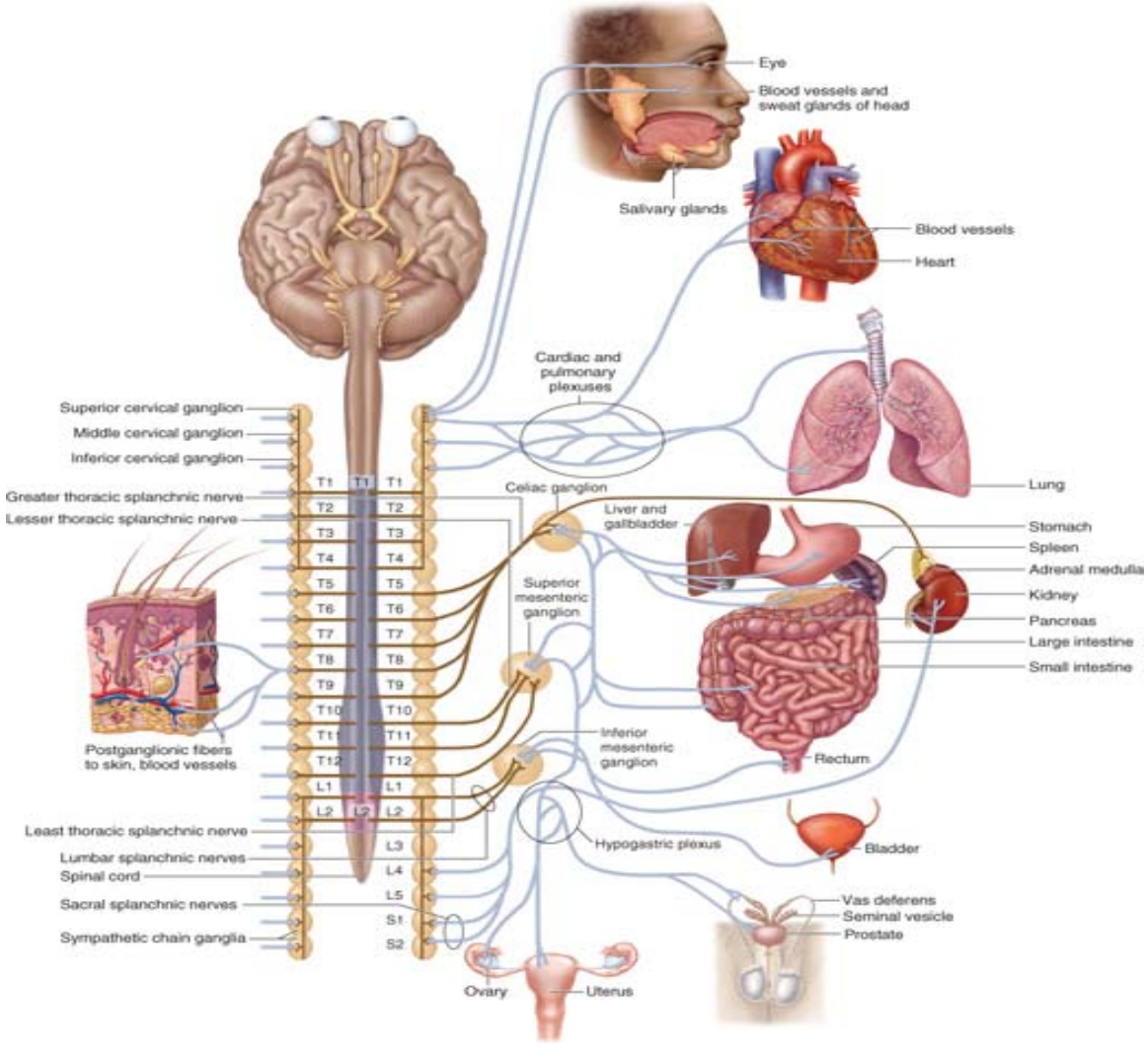
1. If there is any squint—the patient should also be asked if he/ she sees double (diplopia).
2. The condition of the pupils—whether they are equal in size and regular in outline, whether they are abnormally dilated or contracted, and their reaction to light and accommodation.

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

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

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

TASK 6.**Look at this figure and write the explanations about the postganglionic pathways of Sympathetic nerve system.**



THE CONTROL OF THE LEVEL OF KNOWLEDGE

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Amount module #4. 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.

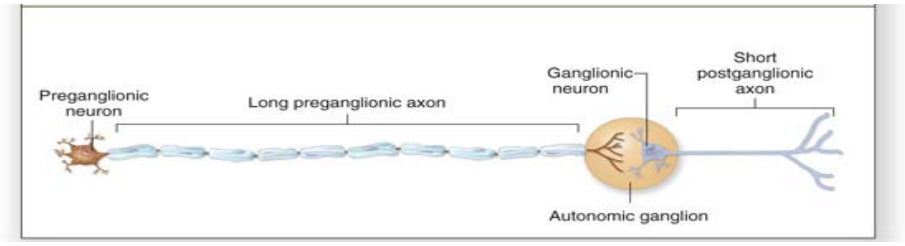
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

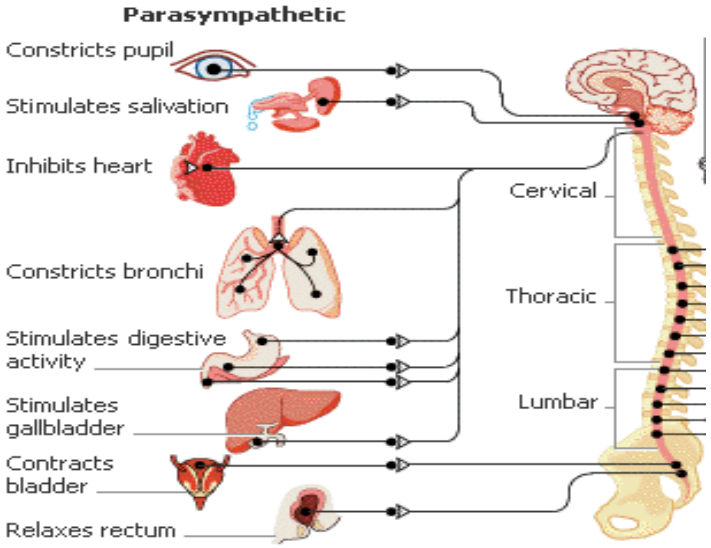
1. Describe the anatomic organization of Parasympathetic Autonomic out flow.
4. Explain the Physiologic structure and functions of Preganglionic and Postganglionic Parasympathetic Neurons.
5. What can you tell about Preganglionic and Postganglionic pathways of Parasympathetic nerve system?
6. What do 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	Noradrenergic impulse response	receptor	Noradrenergic Reflex ark	Cholinergic Reflex ark

			r		
the eyes					
saliva ry glands					
bronc hi					
system ic Blood Vessel s					
heart					
stoma ch					
pancr eas					
intesti ne					
colon					
rectu					

m					
gallbl adder					
kidney					
urineb ladder					
ovary					
uterus					
penis					
scrotu m					
…					

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. **Read the article and Put the information about Central autonomic network in this table.**

Central autonomic network

Peripheral ANS is controlled by the CNS via complex neuronal interconnections functioning in relation to each other to form a functional entity called central autonomic network (CAN). The CAN has tonic, reflex and adaptive control over autonomic functions. In addition, it regulates endocrine, behavioral motor and pain-controlling responses and contributes to the regulation of attention and emotional as well.

During the past several years, the rapid development of research techniques has provided the framework for the current understanding of the functional anatomy of the CAN. Neuronal activity within the CAN both controls and is affected by arterial pressure, respiration and other physiologic variables . Activity within the CAN is state dependent and affected by the sleep-wake cycle, attention, and other internal influences.

Transmission of information within the CAN involves virtually all neuroactive chemical substances so far described. In general, excitatory (e.g. L-glutamate) and inhibitory (e.g. GABA) substances mediate rapid communication within the central autonomic circuits e.g. baroreflex pathways. Monoamines exert a more diffuse neuromodulatory effect, whereas neuropeptides commonly coexist with other neurotransmitters both in local and diffuse projecting pathways and may be involved in longer-term modulation and function as circulating signals. Nitric oxide has been recognised as an important intercellular messenger. On the other hand, steroid hormones rapidly cross the blood-brain barrier and have access to specific receptors abundantly distributed throughout the CAN.

Disorders involving the CAN may manifest themselves as autonomic hyperactivity, e.g. hypertension, arrythmias, hyperhidrosis, or as autonomic failure, e.g. orthostatic hypotension, impotence, gastrointestinal tract dysmotility and neurogenic bladder. Some of these manifestations may be asymptomatic and detectable only on clinical examination or autonomic testing. Moreover, others may be life threathening such as ventricular arrythmias or produce severe impairment in daily activities such as orthostatic hypotension. In general, autonomic hyperactivity tends to occur in the context of acute neurologic disease, whereas neurodegerative disorders are most commonly associated with autonomic failure.

Insular cortex

The insular cortex, lying deep in the temporal lobe is mainly a viscerosensory cortex. Electrical stimulation of the insular cortex in a variety of mammals elicits changes in BP, HR, respiration, gastrointestinal activity and epinephrine secretion as well as piloerection and pupillary dilatation. In fact, in one experimental study with rats, prolonged stimulation of the insular cortex generated progressive degrees of heart block, increased plasma norepinephrine, and asystole resulting in death. Accompanying cardiac structural changes, myocytolysis and subendocardial hemorrhages, suggested that increased cardiac sympathetic activity was the reason for the observed changes.

Recently, functional MRI was used to identify regions of the human brain that were activated in response to tests designed to activate cardiovascular receptors. These tests included maximum inspiration, Valsalva´s maneuver, and maximum handgrip to elevate arterial BP. These maneuvers consistently resulted in discrete changes in activity in the anterior insular cortex with a time-course corresponding to the changes in arterial BP and HR they produced. There is also some evidence that stimulation of the insular cortex in humans elicits different results from each hemisphere. Left insular cortex seems to be predominantly responsible for parasympathetic effects, whereas right insular cortex is more likely to produce sympathetic responses.

Prefrontal cortex

Autonomic regions of the prefrontal cortex include ventromedial prefrontal cortex and the anterior cingulate gyrus. The ventromedial prefrontal cortex is involved in the regulation of high level emotional and cognitive functions whereas the anterior cingulate (infralimbic) cortex may constitute an autonomic premotor area .

The specific role of the prefrontal cortex in autonomic control is incompletely understood. However, various experimental studies suggest bradycardia and hypotension as the main results of the stimulation of the infralimbic cortex, and even a complete cessation of heart beat may occur in monkeys during stimulation of the cingulate gyrus.

The amygdala

In the midbrain amygdala with adjacent areas (extended amygdala) integrates autonomic responses with emotional factors. Its functions are to interpret the emotional significance of

incoming sensory information and to generate the appropriate autonomic, behavioral, motor, endocrine, and pain-suppressing responses to enviromental stimuli.
The amygdala receives cardiopulmonary information and has direct projections to autonomic control sites, such as hypothalamus, parabrachial nucleus, NTS and the dorsal motor nucleus of the vagus which may be the anatomical substrate for descending control over the ANS. The amygdala is also an important cardiovascular control center within the limbic system with reciprocal connections with the insular cortex and direct projections to other autonomic control centers in the hypothalamus, pons and medulla.
Stimulation of the central nucleus of the amygdala produces changes in BP, HR, respiration and gastric secretion and motility. In humans, electrical stimulation of the amygdala has been shown to produce fear sensations, and seizures evolving amygdala and its connections may result in various autonomic manifestations, including serious cardiac arrhythmias.

The hypothalamus

The preoptic region and the hypothalamus form an anatomicofunctional unit essential for integration of autonomic, endocrine, and behavioral responses critical for homeostasis and reproduction.
In hypothalamus, the periventricular area controls neuroendocrine functions as well as biological rhythms. The medial area has regulatory function over homeostasis and reproduction, and the dorsomedial nucleus especially contributes to the integration of cardiovascular responses to stress. The lateral area of the hypothalamus regulates behavioral functions, as well as vagal functions including cardiovascular regulation, gastrointestinal motility, and secretion, and insulin release. The zona incerta merging ventromedially with the lateral hypothalamic area has been implicated in arousal, locomotion, and autonomic regulation.
The paraventricular nucleus has been called the ”master controller” of the autonomic system because it innervates all autonomic centers. It is a critical site for integrated responses to stress and it exerts multiple actions, including regulation of the cardiovascular function, energy metabolism and immune responses. The circumventricular organs located in the anterior wall of the third ventricle region are an integral component of the hypothalamic control of autonomic and endocrine function. These special sites of the ventricle walls lack blood-brain barrier and are highly vascularized.

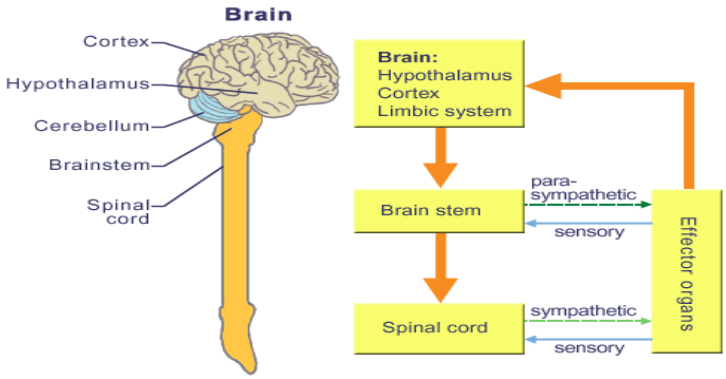
Other components of the central autonomic network

All the midbrain areas are in connection with the autonomic centers in the brain stem and spinal cord. Periaquaductal gray matter in the midbrain integrates autonomic responses with antinociceptive and behavioural reactions. The parabrachial region in the pons functions as a mediator in processing visceral and somatosensory information and it plays a major role in cardiorespiratory regulation, and stimulation of it produces an increase in arterial BP and inhibition of the baroreflex. The lateral part of the parabrachial nucleus has connections to cerebellum, and the cerebellar uvula has been implicated in the control of cardiovascular and respiratory function, particularly in the setting of alerting or orienting responses. A5 group of the ventrolateral pons may be important in the integration of somatosensory and autonomic responses. Stimulation of the norepineprine-synthesizing neurons of the A5 group produces complex cardiovascular responses.
In the medulla oblangata nucleus of the solitary tract (NTS) plays a critical role in medullary reflexes, and relays viscerosensory information to all regions of the CAN. Afferents from arterial, cardiac and pulmonary baroreceptors and carotid and aortic chemoreceptors are carried by branches of glossopharyngeal and vagus nerves, and relay in the NTS. The dorsolateral subnucleus of the NTS contains neurons that discharge in phase with the cardiac cycle and

initiate vasodepressor and bradycardiac responses. The nucleus ambiguus also contributes to the innervation of the heart.
There are several areas in the medulla that participate in the control of vasomotor tone, cardiac function and respiration. Neurons of the rostral ventrolateral medulla constitute an important station for various influences affecting central sympathetic activity. Stimulation of these neurons increases arterial BP, HR, sympathetic nerve activity, and releases adrenomedullary catecholamines. On the other hand, the caudal ventrolateral medulla is a ”depressor” area containing sympathoinhibitory neurons and thus being an integral component of the baroreflex.

components of the central autonomic network	responses
Insular cortex	
Prefrontal cortex	
The amygdale	
The hypothalamus	
Other components	

TASK 7. **Look at this figure and write the explanations for Gastrointestinal autonomic reflex.**



THE CONTROL OF THE LEVEL OF KNOWLEDGE
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PRACTICAL LESSON 10.

Theme: Introduction to Endocrinolodgy. 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

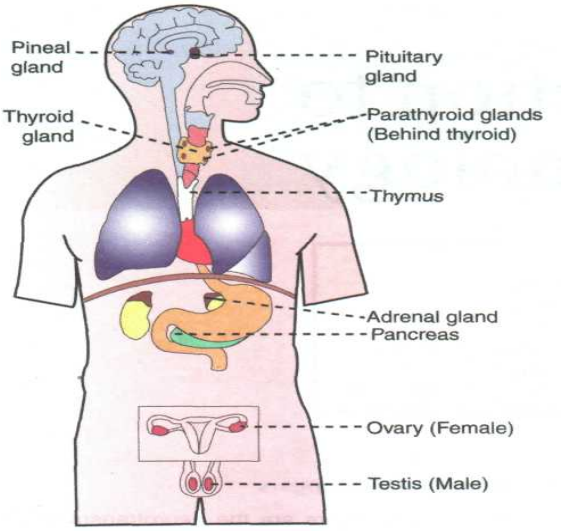
10. What do you know about the symptoms of hyperfunction and hypofunction of Hypothalamus, Pituitary and Thyroid gland?

INDEPENDENT PRACTICAL WORK

TASK1. **Put the information about chemical messengers in this table.**

substances	major functions
Endocrine messenger	
Neurocrine messenger	
Paracrine messenger	
Autocrine messenger	

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



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

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

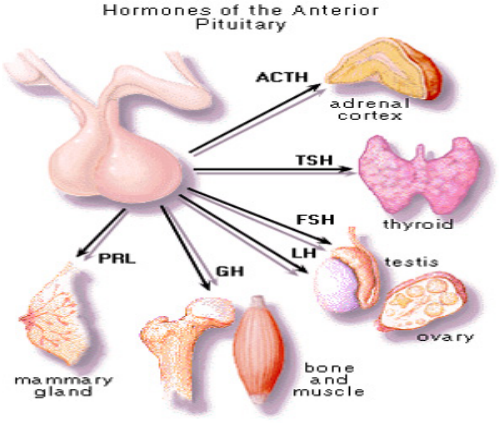
	mechanisms	**an example**
Positive/Negative Feedback Mechanisms		
feed-forward loop Mechanisms		
Push/Pull systems		

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

Hormone	**Chemical structure**	**action**	**Target organ**
Growth hormone releasing hormone			
Growth hormone releasing polypeptide			
Growth hormone inhibitory hormone			

Thyrotropic releasing hormone			
Corticotropin releasing hormone			
Gonadotropin releasing hormone			
Prolactin inhibitory hormone			

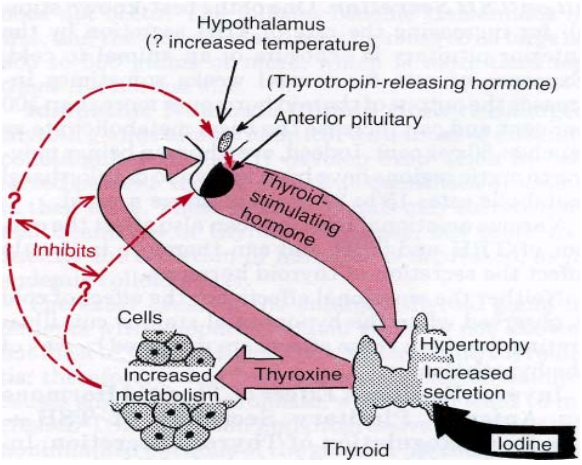
TASK 6. **Look at this figure and write an explanation about function of anterior Pituitary hormones .**



TASK7. **Put the information about the intermedium and posterior Pituitary hormones in this table.**

hormone	chemical structute	action
Melanocyte-stimulating hormone		
Vasopressin		
Oxytocin		

TASK8. **Draw the scheme of Regulation of the Thyroid secretion and write an explanation.**



TASK 9. **Put the information about the Physiologic effects of Thyroid hormones in the table**

target tissue	effect	mechanism
Heart		

Adipose tissue		
Muscle		
Bone		
Nervous system		
Gut		
Lipoprotein		

THE CONTROL OF THE LEVEL OF KNOWLEDGE
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PRACTICAL LESSON 11

Theme: The endocrine functions of the Parathyroid gland, thePancreas, 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, Parathyreoid gland, the Pineal gland , the Reproductive system.

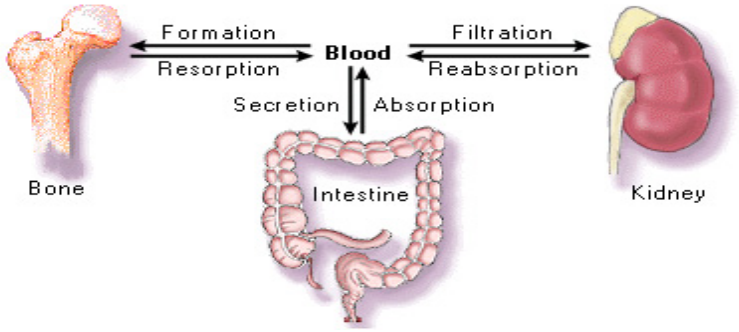
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

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

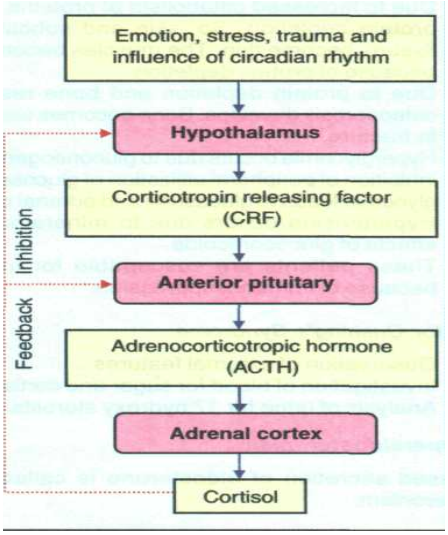
TASK 4. **Put the information about the factors affecting Glucagon secretion**

Stimulators	Inhibitors

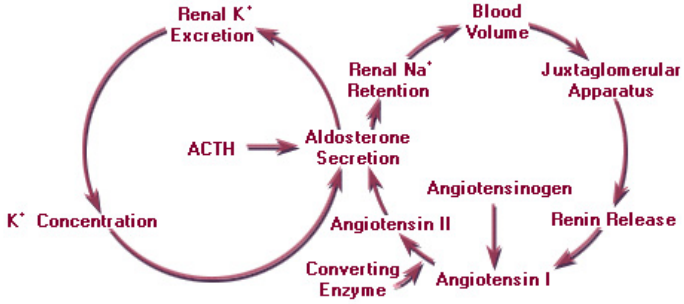
TASK 5. **Put the information about the effects of Glucocorticoids on various tissues in this table**

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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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

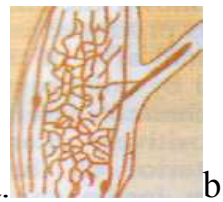
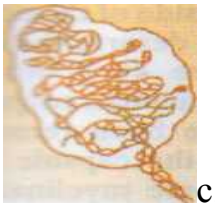
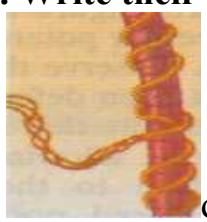
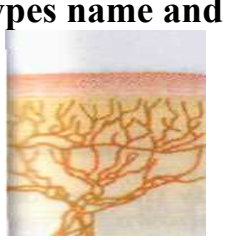
TASK1 **Write the information about "Classifications of Sensory receptors" in the table.**

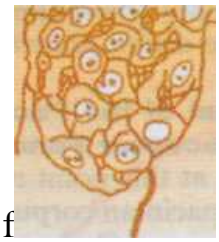
Table1.Classifications of Sensory receptors

organs	**Sensory receptors**	**Types of sensory**

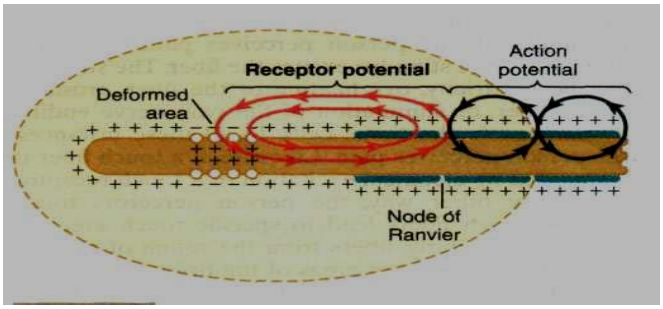
		receptors
for example: taste	Receptors of taste buds	chemoreceptors
	Merkel's discs	
	Vestibular receptors	
	Meissner's corpuscles	
	Cool receptors	
	Free nerve endings	
	Muscle spindles	
	Golgi tendon receptors	
	Pacinian corpuscles	
	Sound receptors of cochlea Equilibrium	
	Warm receptors	
	Baroreceptors	
	Krause's corpuscles	
	Ruffini's endings	
	Nociceptors	
	Receptors of olfactory epithelium	
	Rods, Cones	

TASK2. **Look at these figures. Write their types name and describe all functions**

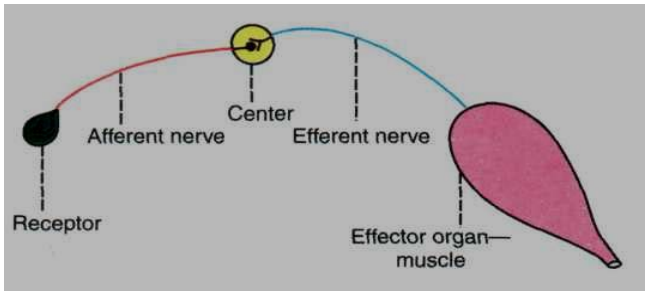
a.  b.  c.  d. 

e.  f 

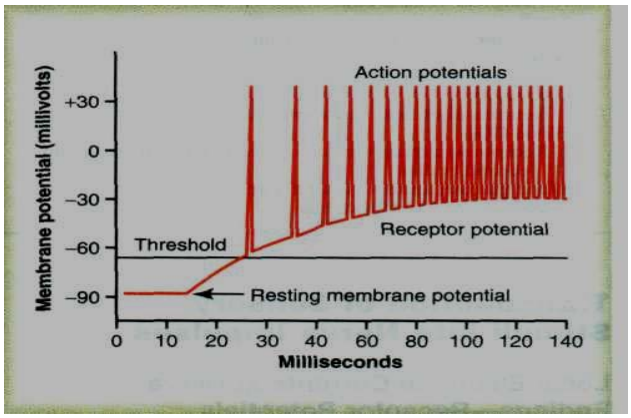
TASK3. **Look at this figure. Write an explanation about excitation of a sensory nerve fiber by a receptor potential produced in a Pacinian corpuscle**



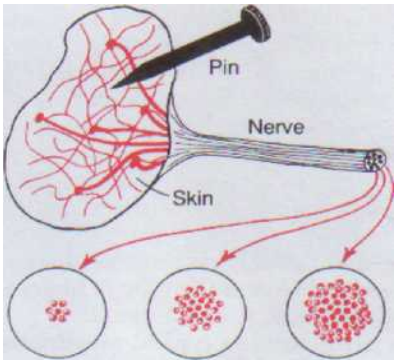
TASK4. **Look at this scheme and write an explanation.**



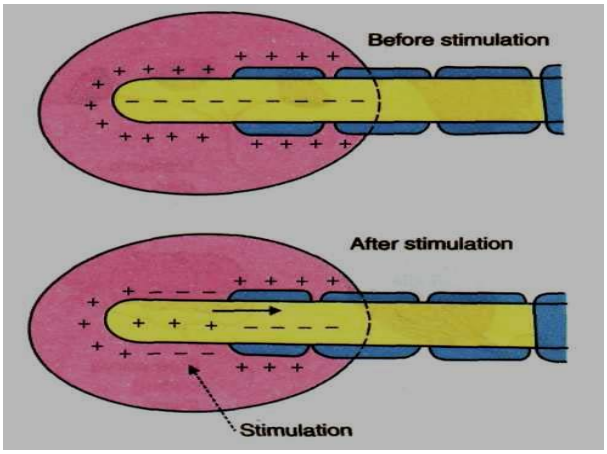
TASK5. **Look at this scheme and write an explanation of the typical relationship between receptor potential and action potential when the receptor potential rises above the threshold level.**



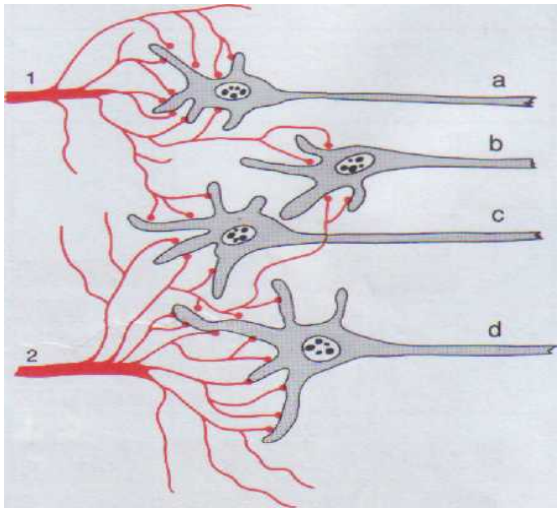
TASK6. **A. Look at this figure. Write an explanation about the pattern of stimulation of pain fibers in a nerve trunk leading from an area of skin by a pin.**



B. **Look at this figure. How does action potential direct through a nerve fiber? Write an explanation.**



TASK7. **A. Look at this figure. Write an explanation about the organization of neuronal pool. Where are "input" and "output" fibers?**



TASK8. **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 differents between "Divergence" and " Convergence".

The TASK9. **Write the explanation of clinical tasks.**

1. Why don't we usually feel clothe 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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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:

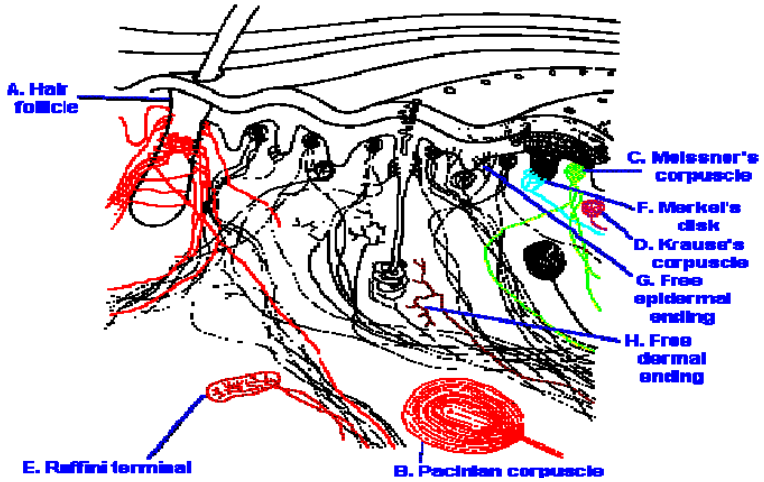
a). tactile receptors;

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.

INDEPENDENT PRACTICAL WORK

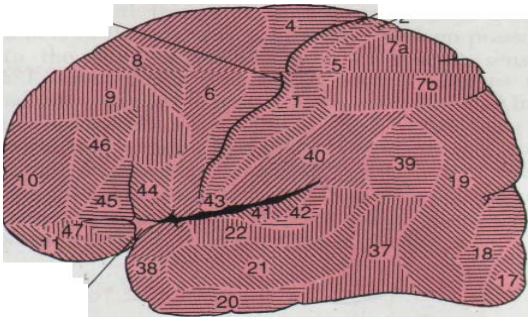
1. **Look at this figure**. **Write an explanation about the function of tactile receptors. Put information in this table.**



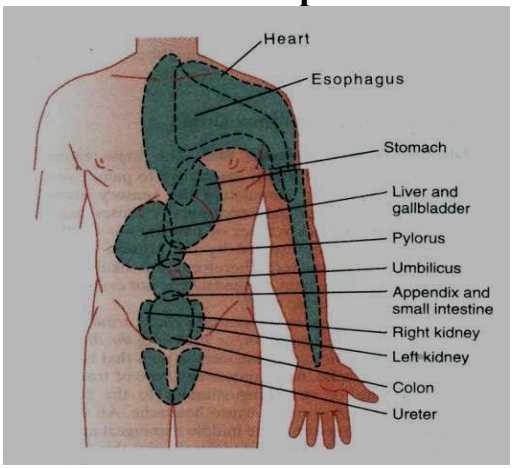
	receptor	tactile function
	Ruffini terminal	

	Pacinian corpuscle	
	Krause's corpuscle	
	Free nerve ending	
	Meissner's corpuscle	
	Mercel's disk	

TASK2. **Look at this figure. What kind of functions can specifically areas (1, 2, 3 ,5, 7) of the brain have? Describe an explanation.**



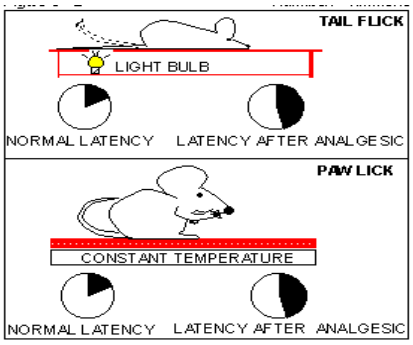
TASK3. **Look at these figures. Write the explanations about the reasons for referred pain. Put information about the sites of referred pain in this table.**



#	organ	region of referred pain
	Heart	
	Esophagus	
	Stomach	
	liver and goldbladder	
	appendix and small intenstine	
	right kidney	

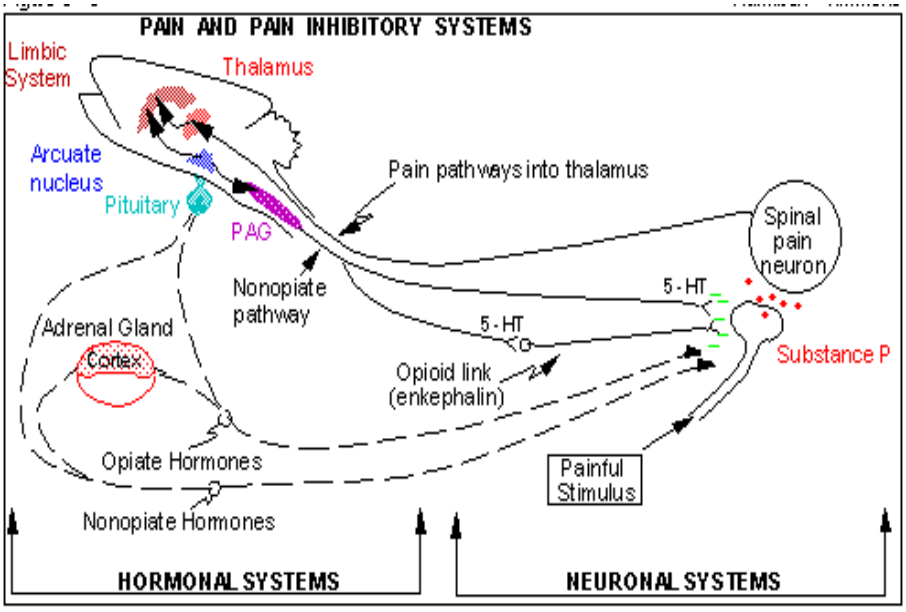
	left kidney	
	colon	
	Ureter	

TASK4. **Look at these figures. What do you think about these figures? Write an explanation.**

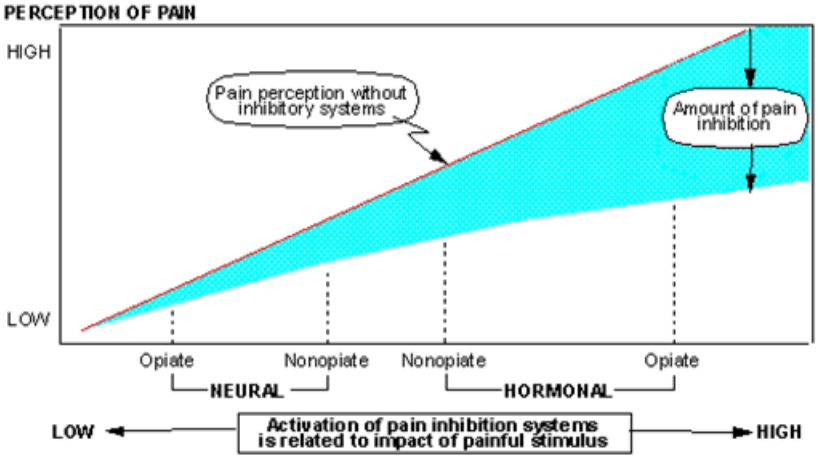


TASK5. **Look at these figures. Write the explanations about the pain inhibitory system. Put information in this table.**

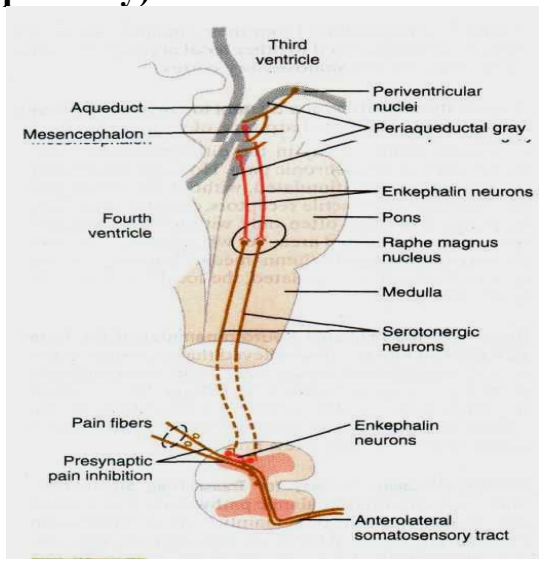
#	**Hormonal pain inhibitory system**		**Neuronal pain inhibitory system**	
	Substance	**action**	**substance**	**action**



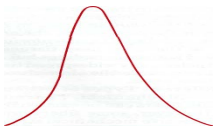
TASK6.**Look at this figure. What do you think about this diagram? Write an explanation.**



TASK7. **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).**



TASK8. **Look at this figure**. **Write an explanation about it.** Distribution of curve obtained from a large number of persons shoving the minimal skin temperature that will cause pain.



43 44 45 46 47

temperature (C°)

TASK9. **Look at this figure "Areas of headache". Note its morphologic zones and write an explanation about reasons of headache.**

TASK10. **Write the explanations for clinical tasks**

1.What is the hyperesthesia, analgesia, parestesia?

2. What kind of viscero - receptive reflexes do you know?

TASK11. **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

TASK12. **The examinations of touch, pressure and vibration.**

Procedures Touch Perception

1. Seat the subject near a table. Draw 3 cm squares on the palm of the hand near the base of the thumb, back of the hand, and ventral forearm—one hairy and the other hairless. Divide each square into 4 squares each. If Von Frey's hair esthesiometer is available, it should be used for testing touch perception. Horsehairs or nylon bristles mounted in hypodermic needles also give good results.
2. Draw similar grid charts in your work book, preferably on a larger scale for recording touch-sensitive and touch-insensitive spots within the squares drawn on the skin. The purpose of the grid is spatial location of touch spots and not an indication of their size.
3. Ask the subject to close his eyes, and tell him to respond with a 'yes" or no". Gently touch the skin regions with the test object and note the results in your work book, showing touch-sensitive spots.

4 Stroke a wisp of cotton lightly over the palm and the back of the hand and ask the subject to compare this sensation with that a roused by the hair esthesiometer. (A wisp of cotton is used for testing the sensation of touch during clinical examination).

Adaptation time for light touch

Ask the subject to close his eyes. Using the point of a pencil, or a pin, very carefully displace one hair on his forearm and carefully maintain the displacement. Ask the subject to report the moment he is aware of the displacement (touch perception) and the instant the touch sensation is no longer present (though the hair is kept displaced). Carefully time the duration of the sensation in at least 5 different hairs. Record the result in your work book and calculate the average duration.

Localization of light touch

Ask the subject to close his eyes, and again displace a hair; mark its position with a colored sketch pen. Ask the subject to try to touch with a different color, the base of the displaced hair. Record the distance between the point he touches and the base of the displaced hair. Repeat the test 5 times on the same or nearby hairs and determine the average error for localization of touch. Tabulate your results.

Two-point discrimination (tactile discrimination)

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

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

Localization of touch

Have the subject close his eyes. Lightly touch the skin, with a colored sketch pen, on different areas on the fingers, arms, legs, and back (choose areas which the subject can reach easily), one at a time, and ask the subject to mark the respective spots with a different color. Test at least 5 different sites in each of the skin areas. Measure in mm the error in localization for each of tho 5 trials in each of the areas. Tabulate your results to show the average error for these areas.

Results:

TASK14. **The examination of pain.**

This experiment is concerned with the fast component (or first pain) of the pain sensation. The stimulus for pain is potential or actual damage to the tissues. Note, however, that in the following experiment very little pressure is needed to elicit this type of pain.

Draw a 3 cm square on the back of one of the subject's hands, and divide it into a 4 squares. Blindfold the subject, or have him close his eyes. Using a blood lancet, or a sharp pin, apply brief and light stimuli within the squares. Map out the pain-sensitive spots within the grids (the areas in between the pain spots will be pain-insensitive). Note that the subject should report with a "yes" when the stimulus elicits pain and not when the stimulus can be detected as causing only touch/pressure sensation. Record your results in the grids drawn in your work book.

Results:

TASK15. **The examination of temperatute.**

Prepare three jars of water in the order—hot (40˚C), warm (25˚C), and cold (10˚C). 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.

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THE CONTROL OF THE LEVEL OF KNOWLEDGE
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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

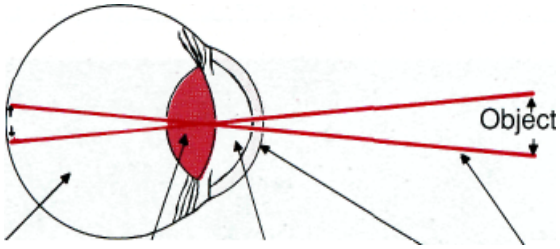
THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

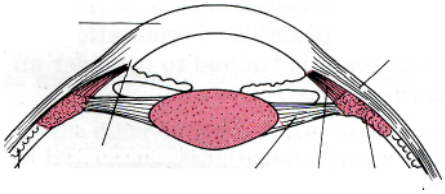
1. The structure of the eye:
a).general description of the eyeball;
b). wall of the eyeball;
c). fundus oculi; intraocular fluid and pressure; lens;
d). ocular muscles and movements.
2. The visual process:
a).image forming mechanism;
b).neural basis of visual process (structure and functions of rods 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.

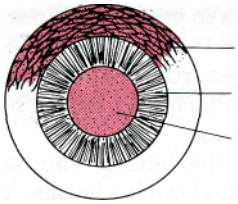
PRACTICAL WORK

TASK1. **Look at this figure and indicate the morphological components of the eye. Write an explanation about the structure of the eyeball.**

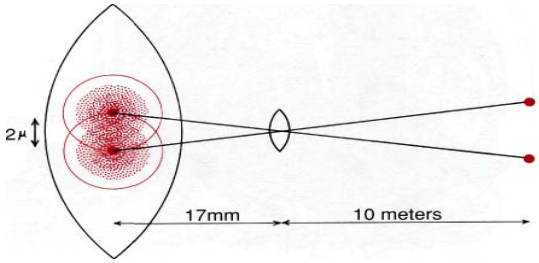


TASK2. **Look at these figures and indicate their morphological components. Write an explanation about the mechanism of accommodation.**

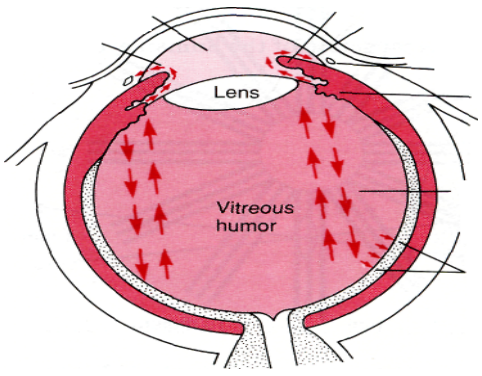




TASK3. **Draw this figure. Write an explanation about the maximal visual acuity for two-point**



TASK4. **Look at this figure and indicate their morphological components. Write an explanation about the formation and flow of fluid of an eye.**



TASK5. **Make 5 tests to the studies № 15. There should be 5 variants of answers in each test. There can be correct only one variant of answer.**

TASK6. **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)** .

TASK7. **Test the peripheral field of vision of the subject provided, using the confrontation test.** ,

It is a rough test to compare a person's visual fields with the examiner's own (presuming his own to be normal). The subject and the examiner sit facing each other about 3 feet apart. When testing the subject's left eye, he places his cupped right hand over his right eye, and with the left eye he fixes his gaze on the examiner's right eye, while the examiner closes his left eye. The subject is instructed not to move his left eye in any direction. The examiner then holds out his right arm to its full extent, midway between himself and the subject, and asks the subject to say "yes" when he sees any movement of the examiner's finger. If no movement is perceived, the hand is moved in, kept still and the finger moved once again. In this way, the examiner compares his own *first sighting* of the movement with that of the subject.

Using this procedure, the peripheral field is tested in all the four quadrants—temporal, upper, lower and nasal. The subject's right eye is tested in a similar manner. The normal peripheral field of vision extends beyond 90° on the temporal side, about 50° in the vertical direction, about 55° on the nasal side, and about 65° downwards. Only gross changes in the field of vision can be detected with this method. Scotomas (blind areas within the field of vision) are impossible to locate, for which a perimeter is employed.

When testing vision for color and visual fields, it is essential to ensure that any refractive error is corrected and that no other disease affecting acuity of vision or visual fields is present.

TASK8. **Test the conjugate movements of the eyes in the subject provided.**

Normally the movements of the eyes are simultaneous and symmetrical so that the visual axes meet at a point at which the eyes are directed. This is called *conjugate movements* of the eyes.

To test the eye movements, the head of the patient must be fixed with the left hand and he/she must be asked to follow the examiner's index finger to the right, to the left, upwards and downwards as far as possible in each direction. Normally, the eyes move 50° outwards, 50° downwards, 50° inwards, and 33° upwards. The rotatory movements should also be tested. It is observed if there is any limitation of movement in any direction.

(The brain stem centers of 3rd, 4th, and 6th cranial nerves probably control reflex movements of the eyes, while conjugate movements of voluntary origin are under the control of higher cortical centers via the corticonuclear tracts).

TASK9.**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.

TASK10.**Demonstrate the reaction of the pupil to accommodation for near vision.**
The subject is asked to look at the far wall of the room. The observer then suddenly brings his finger, holding it vertically, about 15 cm in front of the subject's nose and the subject is asked to look at it. The response is convergence of the eyes and pupillary constriction as he accommodates for the finger. The pupils dilate as the finger is moved away.

TASK11.**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. *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.

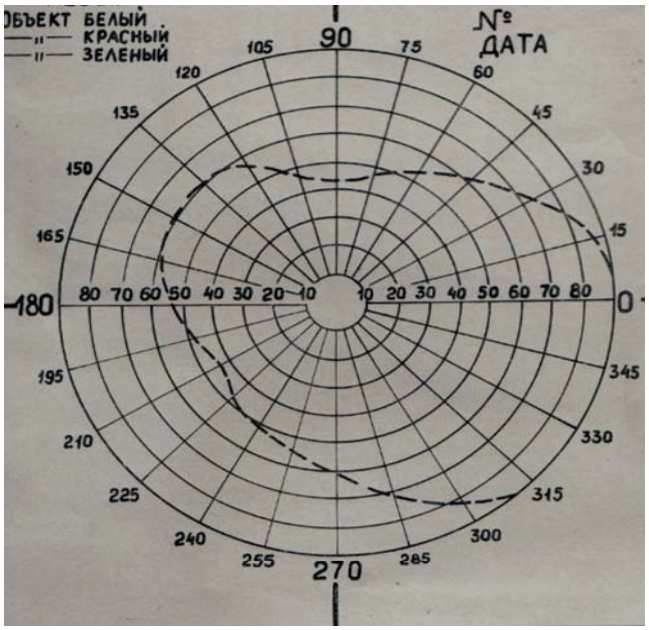


Figure A.

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 abject in the carrier and take it to the end of the arc, switch on the light. Ask the subject to the 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 than 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.**

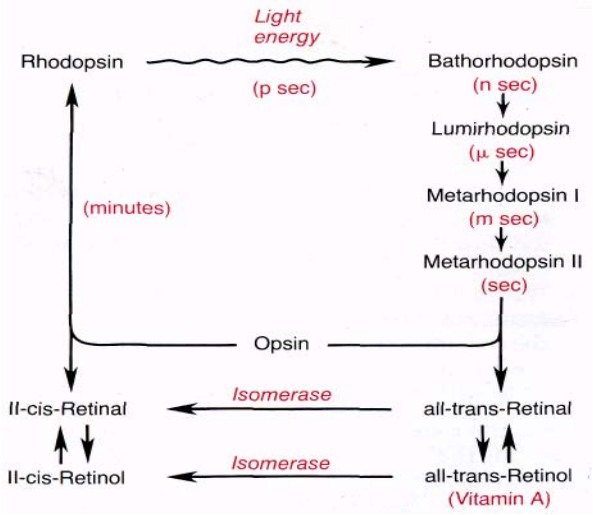
Table1. The average person's results

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

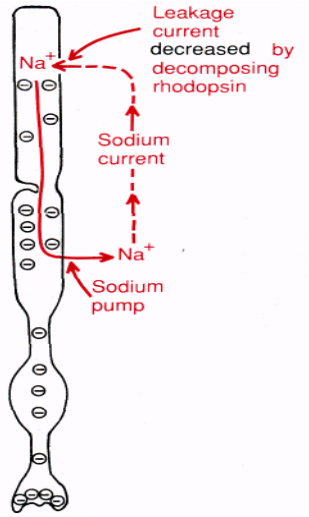
. Table2.

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

TASK12. **Look at these figures. Write the explanations.**



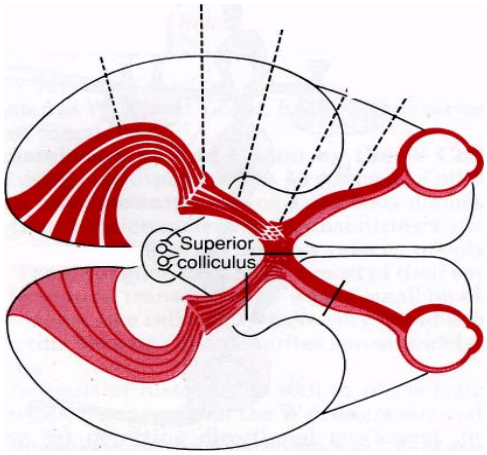
A.



B.

TASK13. **Draw the scheme of different variants of eye's accommodations. Explain the approach to its correction.**

TASK16. **Draw this figure. Note morphological components. Write an explanation Visual pathway.**



THE CONTROL OF THE LEVEL OF KNOWLEDGE
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PRACTICAL LESSON 15.

Theme: Physiology of Hearing and Vestibular apparatus

THE GOALS:

To study the physiology of the Hearing and Equilibrium

Initial level of the knowledge

1. Anatomy of the Ear

THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

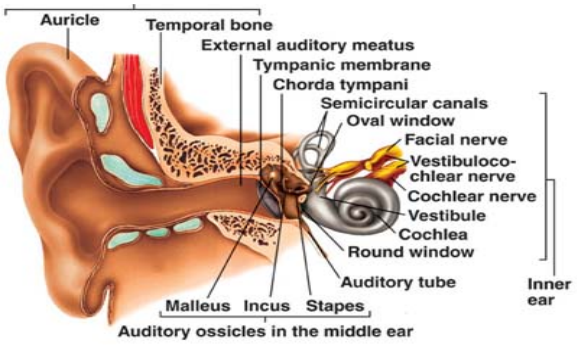
CONTROL QUESTIONS:

1. The anatomic structure and physiological functions of an external Ear: auricle of pinna;

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

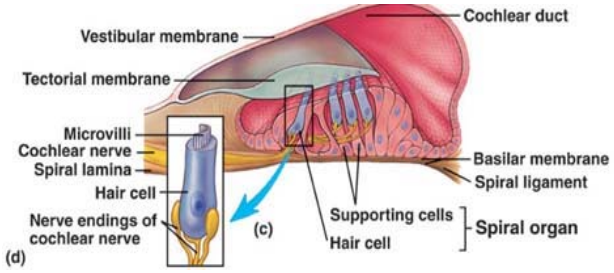
PRACTICAL WORK

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

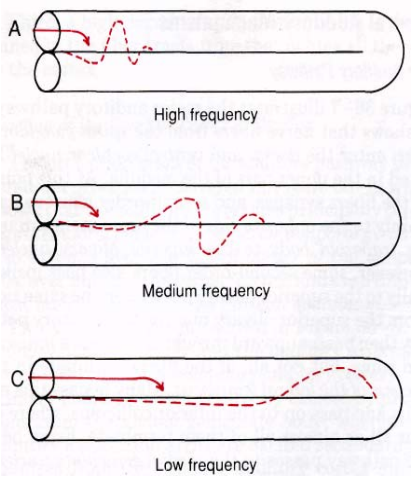


	morphological structure	**function**
	auricle of pinna	
	external auditory meatus	
	tympanic membrane	
	auditory ossicles	
	m. tensor tympani	
	m.stapedius	
	Eustachian tube	

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 membrne 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 = 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 = Rinne positive (Compare normal ear).

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

II. Weber's Test: This test compares the bone conduction of the subject in his two ears.

1. Set the tuning fork into vibration and place its base in the midline on the top of the subject's head or on his forehead. Ask the subject if he hears the sound equally well in both the ears, or louder on one side. A normal subject hears bone-conducted sounds equally loud in the two ears.

2. Close one ear (say, left) of the subject with your finger. Then set the fork into vibration once again and place it on his head. A normal subject will hear the sound better in the closed ear due to bone conduction. Closing his ear produces a situation of conductive deafness, and demonstrates the masking effect of sounds in the environment. Thus, *in conductive deafness,* the sound is better heard in the deaf or deaffer ear, while *in nerve deafness,* the sound is quieter on that side than on the normal side, ie, the patient localizes the sound to the healthy side.

III. Schwabach's Test: This test compares the subject's bone conduction with the examiner's bone conduction. It is assumed that the examiner's hearing is normal.

1. Set the tuning fork into vibration as before and place its base on the subject's mastoid

process. Ask him to indicate, by raising his hand, when the sound stops.
2. After the subject stops hearing the sound, place the fork on your own mastoid process. Normally, the subject's and your own bone conduction is nearly the same. But if you can still hear the sound after the subject stops hearing it, his bone conduction is reduced and the diagnosis would be *nerve deafness.*

In *conductive deafness,* the subject's bone conduction will be better than that of your own bone conduction. (The fork is placed first on your own mastoid process and then on that of the subject).***Note*** The Weber's and Schwabach's tests demonstrate the important masking effect of environmental noise on the auditory threshold.

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.

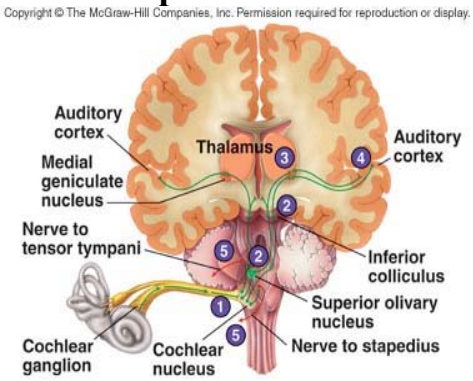
The human ear can gauge the direction of a sound's origin on a 0.00003-sec difference in its interval at the two ears. When we want to localize a sound coming from a distance, we turn our head until the sound is equally loud in the two ears. The direction in which we are facing is the direction of the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

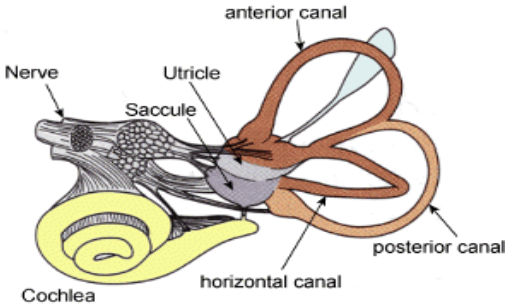
TASK7. **Look at this figure and write explanation about the auditory pathway**.



TASK 7. **Salve the tasks. Write an explanation.**

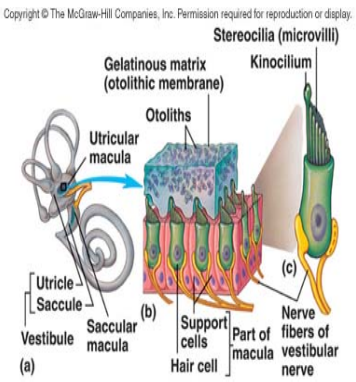
1. Choose the limit of frequencies of sound which man can hear: 20 – 20.000 cycles per second; 15000 cycles per second; 16 - 4000 cycles per second.
2. How does age influence to audiogram's parameters? How can you explain these?
3. What are the eyes' and head's Nystagmus? When does this phenomenon appear?

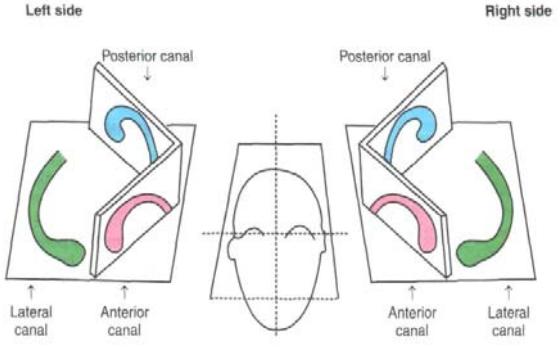
TASK 8. **Look at this figure and write an explanation about the functions of an each morphological part of Labyrinth. Put information in this table.**



Morphological components	function	Morphological components	function	Morphological components	function
Anterior semicircular canal		*Posterior semicircular canal*		*sacculus*	
Lateral semicircular canal		*ampulla*		*Vestibular nerve*	

TASK 9. **Look at these figures and write the explanations about the mechanism of receptor potential (figure A) and change of position of semicircular canal (figureB).**





figureA. **figureB.**

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

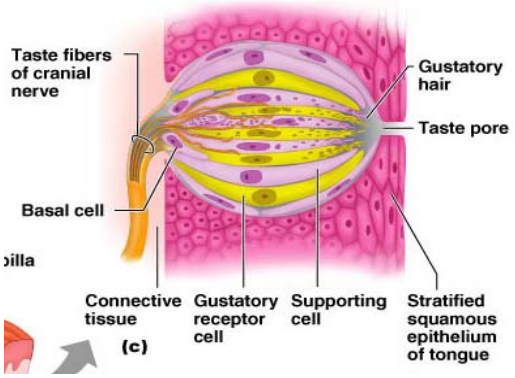
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

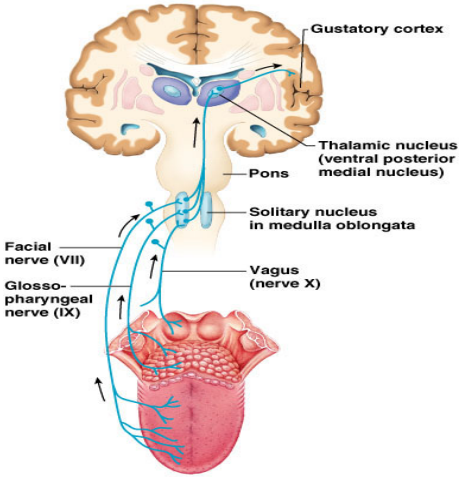
1. Sensation of the Taste:
a). taste buds (situation of taste buds; structure of taste bud);
b). taste pathway (receptors; the first, second and third order neurones; taste center);
c). primary taste sensations;
d). discrimination of different taste sensations;
e). taste sensations and chemical constitution (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.

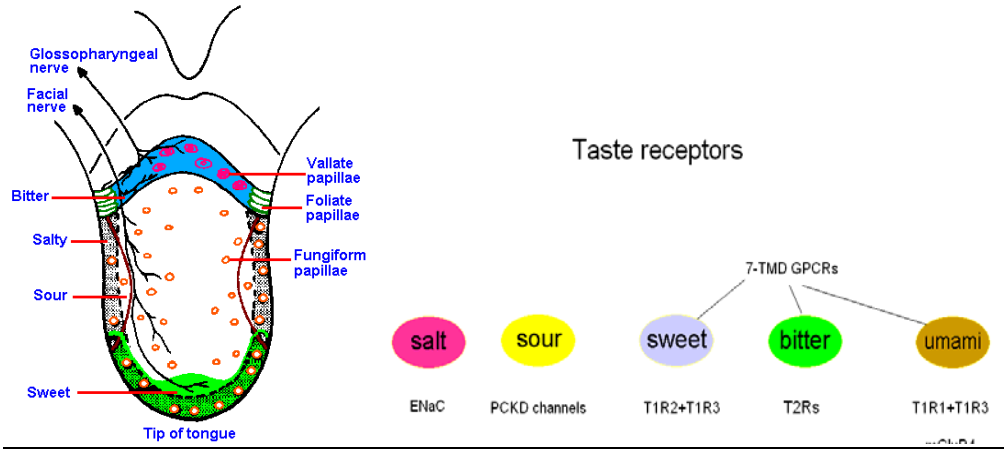
2. Ask the subject to rinse his mouth; then dry it with gauze. Moisten a swab with a few drops of sugar solution, apply it to the tip of the tongue, and ask him to indicate, without withdrawing the tongue, the taste experienced by him.

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).

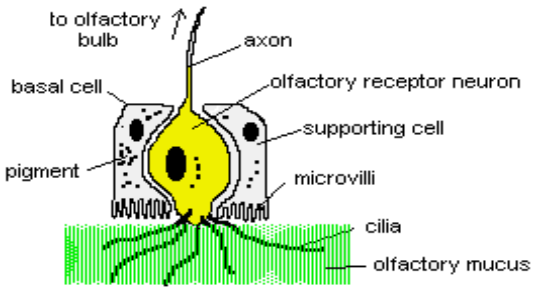
Comments Though the 7th cranial nerve is almost entirely a motor nerve, it carries taste fibers from the anterior 2/3 of the tongue. These fibers pass from the lingual nerve into the chorda tympani and then through the geniculate ganglion and the nervus intermedius of Wrisburg to enter the medulla to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

TASK9. **Explain the clinical tasks.**

What the tastes changes will be observe in a man with the traumatic damage of lingual nerve?

Haw can smell change in a man with the traumatic damage of the limbic system?

THE CONTROL OF THE LEVEL OF KNOWLEDGE

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PRACTICAL LESSON 17.

Theme: Conditioned reflexes, learning,memory

THE GOALS OF OCCUPATION:

To study the physiology of Conditioned reflexes, learning, relareted phenomena

Initial level of the knowledge

1.Anatomy of CNS

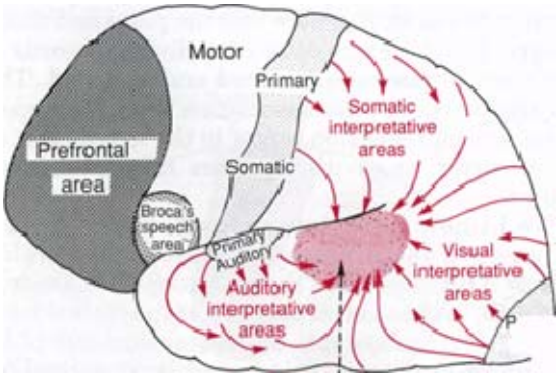
THE CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

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 morphplogical component, write an explanation of the physiological differents between the Broca's and Wernicke's areas.**



The TASK3. **Examenation 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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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

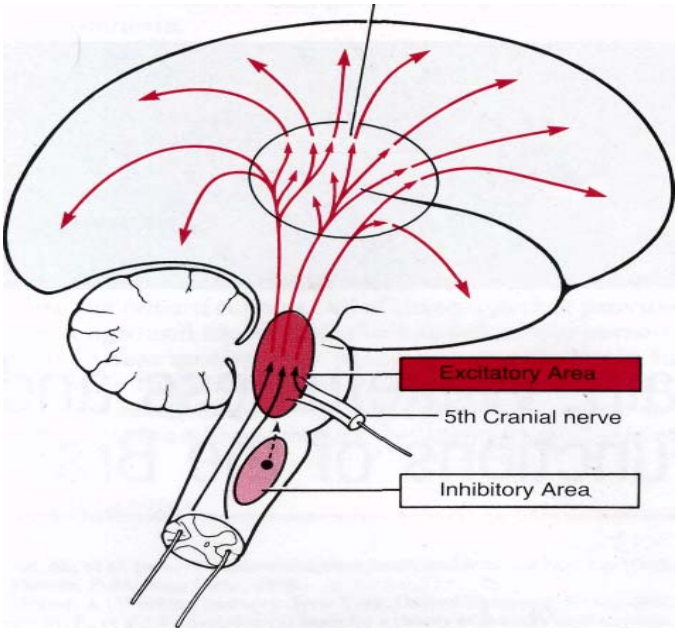
CONTROL OF THE INITIAL LEVEL OF KNOWLEDGE

CONTROL QUESTIONS:

1. Neural basis of instinctual behavior and emotions (anatomic consideratio and hystology; 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; acetycholine; opioid peptides).
7. Types of the “Higher nervous activity”.
8. Physiology of the sleep.

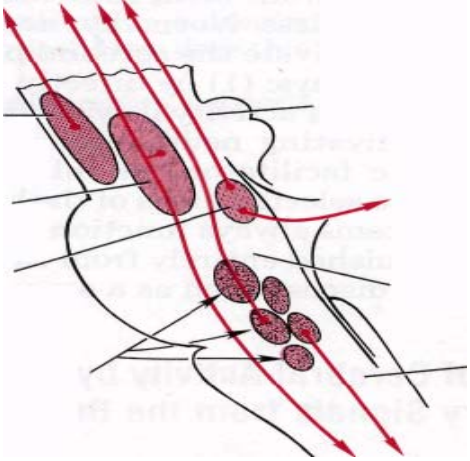
PRACTICAL WORK

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

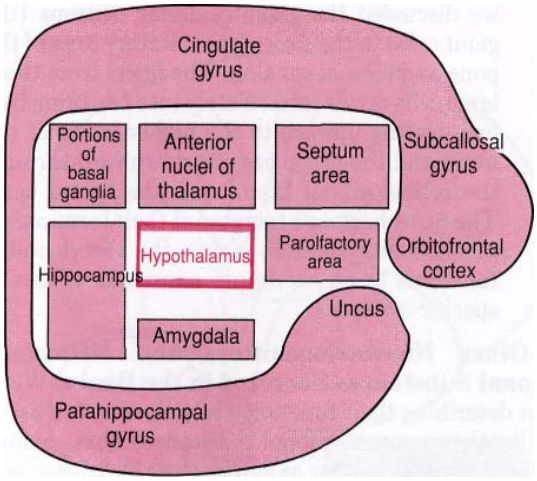


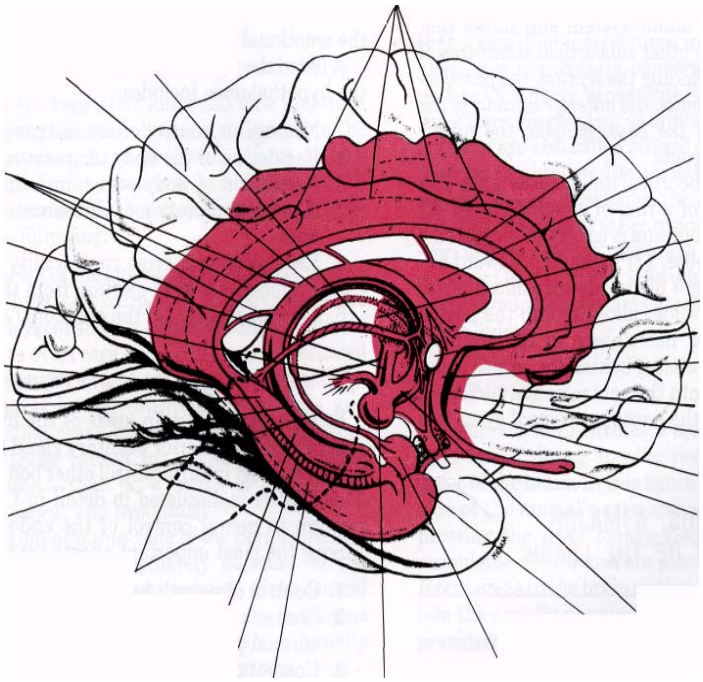
The excitatory-activating system of the brain. Also shown is an inhibitory area in the medulla that can inhibit or depress the activating system.

TASK2 **Look at this figure**. **Note all morphplogical 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 confusd 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. Immediatelly join in conversation.
56. Equally in interralation.
57. Disposed to unsociability.
58. Like accuracy and put in order.
59. Dificult adapt to new conditions.
60. Not mobile and languid.
61. Possess to self-control.
62. Diffident, shy.
63. Lose your presens of mind in new conditions.
64. Find it difficult to associate with unknown people.
65. Don't believe in your inner power.
66. Easy transfer the solitude.
67. Feel the depression and confusion under failures.
68. Disposed to shrink into yourself.
69. Quickly feel tired.
70. Quickly adjust to interlocutor's character.
71. Possess the weak and quiet speech.
72. Impressionable to crying.
73. Extraordinarily susceptible to approval and blame.
74. Make high demands to surrounding.
75. Disposed to suspiciousness, nervous.
76. Painfully sensible and easy receptive.
77. Excessively touchy.
78. Not active and shy.
79. Without any word.
80. Strive for the giving rise to the sympathy and help with surrounding.

$AT = Ch(a1/ A *100)+ S(a2/ A *100) + Ph (a3/ A *100) + M(a_4/ A *100) = 100 \%$

C – choleric person, S – sanguieperson, P - phlegmatic person,
M - melancholic person.
A – quantity of positive answers
If Ch = 40 % - dominated type
30-29 % - evedintly expressed
20-29 % - middling is expressed
10-19% - little expressed.
The tasks research

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

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

The research's tasks

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

The text control of the last knowledge's level

The 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

PRACTICAL LESSON 20

Theme : Module control 1. Tests Control.