Ministry of Health of the Russian Federation
I. M. Sechenov First Moscow State Medical University
(Sechenov University)
Institute of Psychological and Social Work
Department of Pedagogy and Medical Psychology

International Institute of Teacher Professional Development

**O. M. Kolomiets, V. N. Nikolenko, N. A. Rizayeva,
M. V. Oganesyan, K. V. Bulygin,
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Methodological Manual for a Teacher

ORGANIZATION OF A STUDENT'S INDEPENDENT LEARNING ACTIVITIES

Human Anatomy
1st grade

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Recommended by the Educational Methodological Council of International Institute for Teacher Professional Development for the use in education

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The Methodological manual is developed on a new, different from the traditional methodological basis - the Psycho-pedagogical concept of achieving educational outcomes of a high level of quality by each student in the context of a Competence-activity approach (O. M. Kolomiets).

The Methodological manual reveals what should be the student's independent learning (research and practical) activities organized by the teacher in terms of structure and content, aimed at independent study of educational material and the «birth» of new knowledge for him on the topic. In the manual, a form of schematization by the student of the systematized elements of knowledge that make up the content of educational results is presented in the form of a mind map. This knowledge is complete in terms of the volume of its elements, generalized in terms of their application in the performance of practical tasks of varying degrees of complexity and typology. The mind maps act as a tool for «direct» management of the educational activities of each student, revealing to him what specific knowledge needs to be mastered within the framework of the topic being studied.

The Methodological manual reveals what the student's educational and practical activities should be organized by the teacher in terms of structure and content, aimed at independently mastering the knowledge schematized in the mind maps through solving logical problems, performing practical tasks and situational tasks. This manual acts as a means for the teacher to organize the process of transforming scientific knowledge into subjective knowledge of the student, forming his mental image («cast») of the content of the mind maps, developing different types of thinking (conceptual, logical, systemic and activity), developing mental activity as a tool for self-organization by the student different types of learning activities.

The Methodological manual is addressed to all subjects of the educational process of the medical field, as well as to those who are interested in the problems of self-organization of educational activities in the system of secondary vocational and higher education, professional retraining and advanced training.

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Topic 1: «CLASSIFICATION OF THE NERVOUS SYSTEM »

PROGRAM OF EDUCATIONAL RESEARCH ACTIVITIES (ERA)

1 SETTING OF ERA

Define the classification of the nervous system.
For this, do the work yourself with the educational literature based on exercises 1-10. Summarize and systematize new knowledge in Mind maps MM-1 (MM-1.1 and MM-1.2).

2 SELF-ORGANIZATION SCHEME OF ERA

Organize your educational research activity.

Goal: …? *To define the classification of the nervous system.*
Subject: (i.e., what needs to be analyzed in the research process): …? *Text material of the educational literature.*
Resources: …? *Educational research exercises 1-10.*
Products: …? *New information about classification of the nervous system, summarized in MM-1.*

3 EDUCATIONAL LITERATURE

Main:
– Sapin M. R., Nikityuk D. B., Nikolenko V. N., Klochkova S. V. Human anatomy. In two volumes. Textbook / Ed. M. R. Sapina. "GEOTAR-Media". – 2020. – Vol. 2. – 456 p.
– Gaivoronsky I. V., Nichiporuk G. I. Anatomy of the central nervous system. Short course. Tutorial. 4th ed. add. and correct. – St. Petersburg: ELBI-SPb. – 2010. – 108 p.

In addition:
Atlas of human anatomy: Uch. manual-atlas / F. Netter; Ed. N.O. Bartosh; Per. from English. A. P. Kiyasova – M.: GEOTAR - MED, 2003. – 600 p.

4 SYSTEM OF EDUCATIONAL RESEARCH EXERCISES

Educational research exercise 1 Define the content of the concept of «nervous system» (NS). Build a definition of the concept through generic characteristics.

Nervous system - is *a system*, that:
1) *is a complex of anatomical structures;*
2) *provides individual adaptation of the organism to the environment;*
3) *provides regulation of the activity of individual organs or tissues.*

Educational research exercise 2 Define, what a neuron is and its structure.

Neuron – is *structural and functional unit of the nervous tissue.*
A neuron has *a body and processes.*
Bodies within the CNS form *nuclei*, and on the periphery - *nodes.*
Processes within the CNS form *the basis of the pathways,*
and on the periphery, they form *the spinal and cranial nerves.*

Educational research exercise 3 Define the classification of neurons by their function and structure.

3.1. Neurons are distinguished by function on:
a) sensitive (*afferent*), which *transmit a signal from receptors to the central nervous system;*
b) associative, which are *the link between CNS neurons;*

they are divided into *intermediary* and *central;*

c) motor, which *transmit a signal from the central nervous system to target organs;* they are subdivided into: *motor, efferent, effector.*

3.2. According to the structure, neurons are distinguished on:

a) unipolar have *1 process - an axon;*

b) bipolar have *2 processes: - an axon, - a dendrite;*

c) pseudo-unipolar ones have *1 axon*, which is divided into *2 branches* during development: *peripheral and central;*

d) multipolar ones have *many processes, but the axon is always one.*

Educational research exercise 4 Determine the classification of the nervous system (NS) by its function and topography.

4.1. In the NS, by function, we distinguish:

a) *somatic (animal) NS;*

b) *vegetative (autonomous) NS,* subdivided into *sympathetic* and *parasympathetic* NS.

4.2. In the NS, according to topography, there are:

a) *the central nervous system;*

b) *peripheral nervous system.*

Educational research exercise 5 Define the content of the concept of the «somatic (animal) NS». Build a definition of the concept through generic characteristics.

The somatic (animal) NS is a part of *the nervous system*, that:

1) *is responsible for the activity of striated skeletal muscles;*

2) *is a combination of afferent and efferent nerve fibers that innervate muscles, skin, joints;*

3) *is engaged in the delivery of motor (motor) and sensory (sensory) information to the central nervous system and back.*

Educational research exercise 6 Define the content of the concept of the «vegetative (autonomous) NS».
Build a definition of the concept through generic characteristics.

The vegetative (autonomous) NS is a part of *the nervous system that:*

1) *regulates the activity of internal organs, endocrine and exocrine secretion glands, blood and lymphatic vessels;*

2) *plays a leading role in maintaining the constancy of the internal environment of the body and in adaptive reactions in all vertebrated animals.*

Educational research exercise 7 Define the concept of the «sympathetic NS».

The sympathetic NS is *a division of the autonomic NS, which speeds up the work of the body.*

Educational research exercise 8 Define the concept of the «parasympathetic NS».

Parasympathetic NS is *a division of the autonomic NS, which functionally opposed to the sympathetic NS.*

Educational research exercise 9 Define the classification of the «somatic NS» by topography.

9.1. In the somatic NS, there are: а) *the central part;* б) *peripheral part.*

9.2. The structure of the central division of the somatic nervous system includes:

a) *spinal cord;*
б) *brain:* 1) *medulla oblongata;* 2) *metencephalon;*
3) *midbrain;* 4) *diencephalon;* 5) *telencephalon.*

9.3. In the peripheral part of the somatic NS, which is associated with the *spinal cord*, there are:
a) spinal nerves (SN);
b) *spinal ganglions;*
c) *spinal* plexuses: 1) *cervical;* 2) *brachial;* 3) *lumbar;* 4) *sacral;* 5) *coccygeal;*

9.4. In the peripheral part of the somatic NS, which is associated with the brain, there are:
a) *cranial nerves (CN);*
b) *sensitive* ganglions of the head:
1) *trigeminal ganglion;* 2) *superior and inferior jugular ganglion;*
3) *geniculate ganglion;* 4) *vestibular ganglion;*
5) *spiral ganglion.*

Educational research exercise 10 Define the classification of the vegetative NS.

10.1. The vegetative NS is divided into: a) *sympathetic* part;
b) *parasympathetic* part.

10.2. The central part of the sympathetic NS includes *the spinal cord - the lateral intermediate nucleus in the lateral horns of the spinal cord segments* (C_{VIII}, Th_{I-XII}, L_{I-II}).

10.3. The peripheral division of the sympathetic NS includes:
a) *ganglions of first order (paravertebral);*
b) *ganglions of second order (prevertebral);*
c) *preganglionic fibers;*
d) *postganglionary fibers*

10.4. The central division of the parasympathetic nervous system includes:
a) *cranial centers:*
- mesencephalic center;
- pontobulbar centers;
b) *sacral centers.*

10.5. The peripheral division of the parasympathetic nervous system includes:
a) *intramural ganglions;* b) *preganglionic fibers;*
c) *postganglionary fibers;* d) *periorganic plexuses;*
e) *intramural plexuses.*

4. MM (MIND MAPS) → Your new knowledge based on educational research exercises 1-10 summarize and systemize into MM-1 «THE NERVOUS SYSTEM»

5 REFLECTION ERA → Goal: …? ⟷ Result: …?

MM (mind map) - **1** **THE NERVOUS SYSTEM (NS)**

Nervous system - is *a system*, that:
1) *is a complex of anatomical structures;*
2) *provides individual adaptation of the organism to the external environment;*
3) *provides regulation of the activity of individual organs and tissues.*

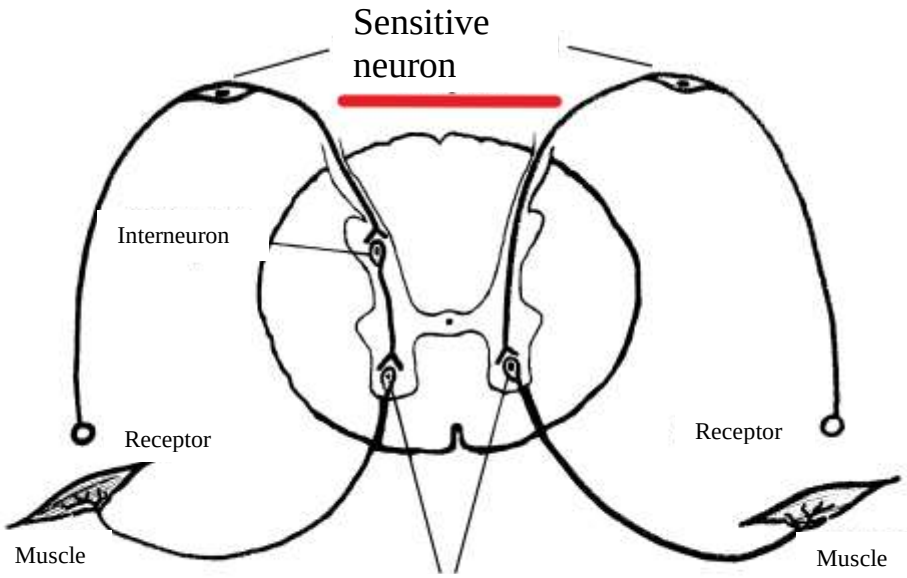
MM-1.1 **THE CLASSIFICATION OF NEURONS**

Neuron – is the functional and structural unit of *the nervous tissue.*
Neuron has *body and processes.*
In the CNS bodies of neurons form *nuclei*, but on periphery – *ganglions*.
In the CNS processes of neurons form *pathways*, but on periphery they form *cranial and spinal nerves.*

1. By function

sensitive
(afferent)

Transmit a signal from receptors to the CNS



Motor neuron

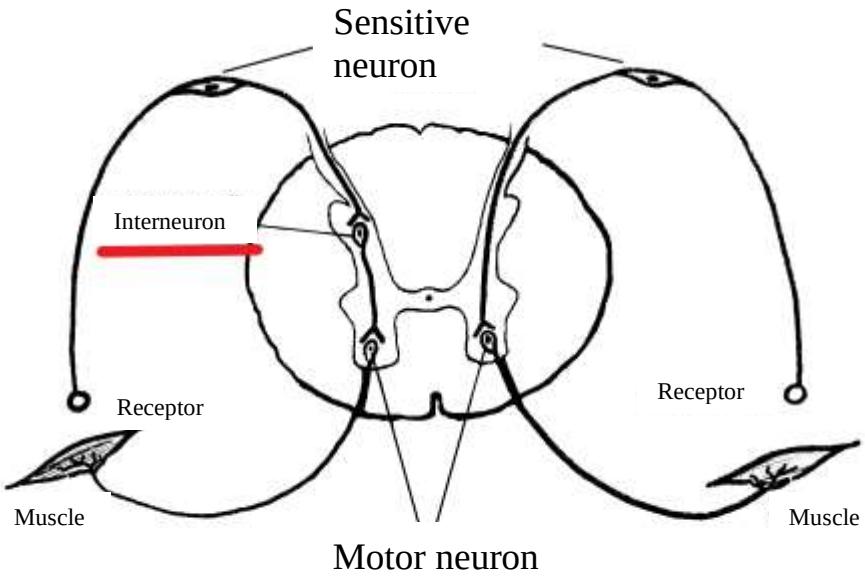
https://de.bio.msu.ru/demo/mod/page/view.php?id=255

2. By structure

Unipolar	**Bipolar**	**Pseudounipolar**
1 process – axon	*2 processes:* *- axon,* *- dendrite*	*1 axon;* *is divided in the process of development into 2 branches: peripheral and central*
		
https://reshimvse.com/	https://reshimvse.com/	https://reshimvse.com/

Associative
(insert /
interneurons)

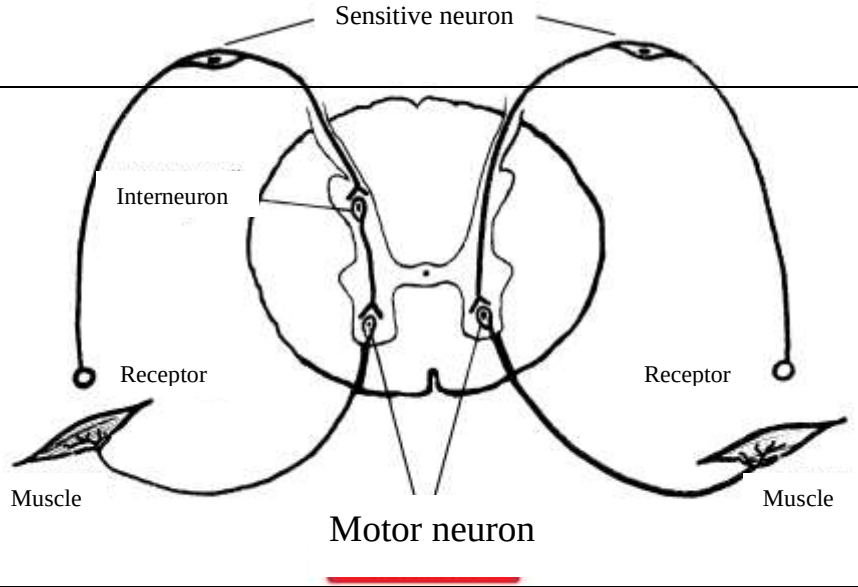
Connecting link between neurons of the CNS



https://de.bio.msu.ru/demo/mod/page/view.php?id=255

Motor
(efferent/ effector)

Transmit signals from the CNS to targeted organs.



https://de.bio.msu.ru/demo/mod/page/view.php?id=255

Multi-polar

Many processes, but axon – always 1

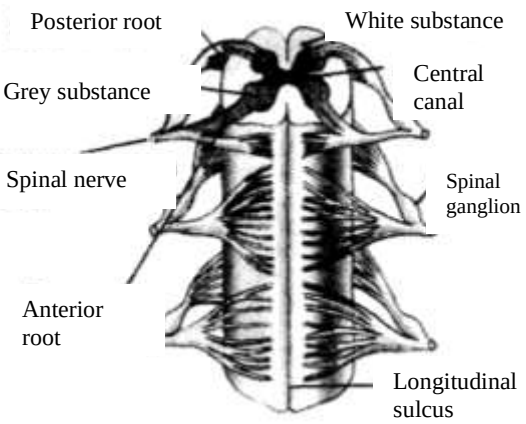
https://reshimvse.com/

<table>
<tr><td>MM-1.2</td><td colspan="6">CLASSIFICATION OF THE NERVOUS SYSTEM</td></tr>
<tr><td>By function</td><td colspan="2">Somatic (animal) NS
- is the part of the nervous system, that:
1) is responsible for the activity of striated skeletal muscles;
2) is a combination of afferent (sensory) and efferent (motor) nerve fibers that innervate muscles, skin, joints;
3) is engaged in the delivery of motor and sensory information to the central nervous system and back.</td><td colspan="4">Vegetative (autonomous) NS
- is the part of the nervous system, that:
1) regulates the activity of internal organs, endocrine and external secretion glands, blood and lymphatic vessels;
2) plays a leading role in maintaining the constancy of the internal environment of the body and in the adaptive reactions of all vertebrated animals.</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="2">Sympathetic NS
– is a department of the vegetative NS, accelerating the work of the body.</td><td colspan="2">Parasympathetic NS
– is a department of the autonomous NS, functionally opposed to the sympathetic NS.</td></tr>
<tr><td>By topography</td><td>Central part</td><td>Peripheral part</td><td>Central part</td><td>Peripheral part</td><td>Central part</td><td>Peripheral part</td></tr>
<tr><td rowspan="2"></td><td>a) spinal cord</td><td>a) spinal nerves (SN);
b) spinal ganglions;
c) spinal plexuses:
1) cervical;
2) brachial;
3) lumbar;
4) sacral;
5) coccygeal</td><td rowspan="2">spinal cord - the lateral intermediate nucleus in the lateral horns of the spinal cord segments: C_{VIII}, Th_{I-XII}, L_{I-II}</td><td rowspan="2">a) ganglions of 1st order (paravertebral;
b) ganglions of 2nd order (prevertebral);
c) preganglionic fibers;
d) postganglionary fibers</td><td rowspan="2">a) cranial centers:
- mesencephalic center;
- ponto-bulbar centers;
b) sacral centers</td><td rowspan="2">a) intramural ganglions;
b) preganglionic fibers;
c) postganglionary fibers;
d) periorgan plexuses;
e) intramural plexuses.</td></tr>
<tr><td>b) brain:
1 medulla oblongata;
2 metencephalon;
3 midbrain;
4 diencephalon;
5 telencephalon</td><td>a) cranial nerves (CN);
b) sensitive ganglions of head:
1) trigeminal ganglion;
2) superior and inferior jugular ganglion;
3) geniculate ganglion;
4) vestibular ganglion;
5) spiral ganglion</td></tr>
</table>

Spinal cord

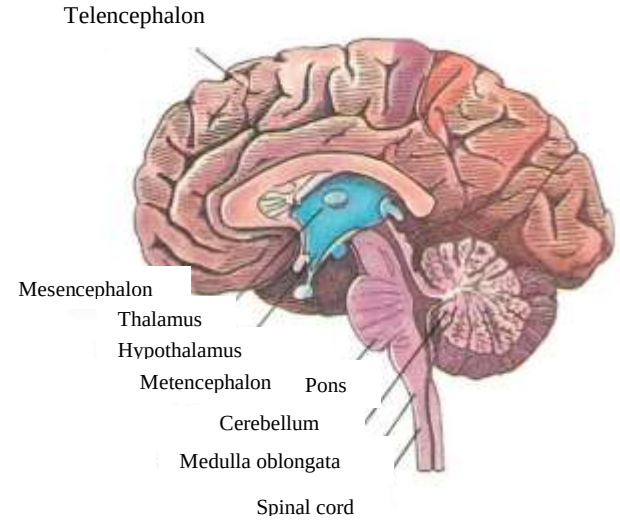
https://shopdon.ru/blog/simpaticheskaya-nervnaya-sistema/

Spinal cord



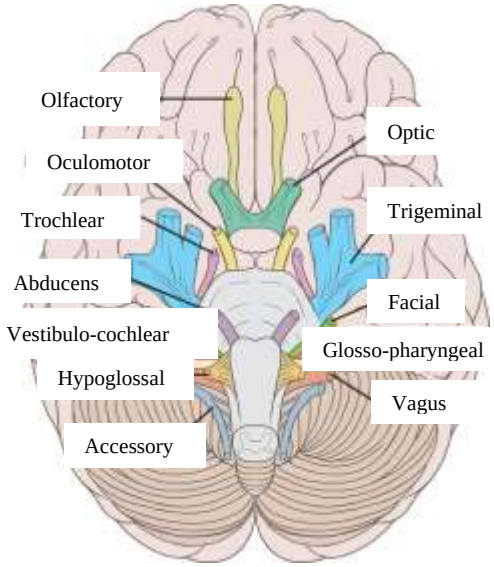
https://ppt-online.org/236704

Brain



https://wsd.events/2016/11/26/pres/heads-up/

Cranial nerves



https://commons.wikimedia.org/wiki/File:Brain_human_normal_inferior_view_with_labels_ru.svg

EDUCATIONAL PRACTICAL ACTIVITIES

Logical task 1 **Build up a definition of the concept** «nervous system».

Logical technique **« building a definition of a concept»** **(**based on genus and species characteristics)	
Structure and content	1. Select all the signs of the concept.
	2. Determine which one is genus.
	3. Determine which of them are species.
	4. Arrange genus and species signs in a logical order.

A nervous system is a *system* that:

1) *is a complex of anatomical structures;*
2) *provides individual adaptation of the organism to the external environment;*
3) *provides regulation of the activity of individual organs and tissues.*

Logical task 2 **Classify** neurons / nerve cells by the basis - function.

Logical technique **«classification»**	
Structure and content	1. The concept, that is going to be classified, take for a generic concept.
	2. Choose an essential sign of the generic concept as the basis for classification.
	3. Divide the entire set of objects included in the scope of the generic concept into classes so that they differ from each other according to the chosen basis.
	4. Build a hierarchical classification system.

basis: *function*

Neurons
- *sensitive (afferent)*
- *associative insert / Interneurons*
- *motor (efferent)*

Logical task 3 **Classify** neurons / nerve cells by the basis - structure.

basis: *structure*

Neurons
- *unipolar*
- *bipolar*
- *pseudounipolar*
- *multipolar*

Logical task 4 **Classify** the definition «nervous system (NS)» by the basis - function.

basis: *function*

The nervous system (NS)
- *somatic (animal) NS*
- *vegetative NS*
  - *sympathetic NS*
  - *parasympathetic NS*

Logical task 5 **Classify** the definition «nervous system (NS)» by the basis - topography.

basis: *topography*

Nervous system (NS)
- *central NS*
- *peripheral NS*

Logical task 6 **Build up a definition of the concept** «somatic nervous system».

Logical technique **«building a definition of a concept»** **(**based on genus and species characteristics)	
Structure and content	1. Select all the signs of the concept.
	2. Determine which one is genus.
	3. Determine which of them are species.
	4. Arrange genus and species signs in a logical order.

Somatic nervous system - is the part of *the nervous system,* that:

1) *is responsible for the activity of striated skeletal muscles;*

2) *is a combination of afferent (sensitive) and efferent (motor) nerve fibers innervating muscles, skin, joints;*

3) *is engaged in the delivery of motor (motor) and sensory (sensory) information to the central nervous system and back.*

Logical task 7 **Build up a definition of the concept** «vegetative nervous system».

Vegetative nervous system - is the *division of the nervous system*, that:

1) *regulates the activity if internal organs, glands of internal and external secretion, blood and lymphatic vessels;*

2) *plays a leading role in maintaining the constancy of the body and in the adaptive reactions of all vertebrates.*

Logical task 8 Determine, which structural elements belong to the central section of the somatic nervous system, and which to the peripheral (based on the logical technique «**bringing under the concept**»).

Logical technique **«bringing under the concept»**	
Structure and content	1. Highlight the **concept**, under which you want to bring a ***given subject***.
	2. Identify the signs in the concept.
	3. Highlight signs in a ***given subject***.
	4. Consistently compare all the signs of a ***given subject*** with all the signs of the **concept.**
	5. Make a conclusion about the belonging or non-belonging of a ***given object to the concept.***

The concept	Structural elements
A Central department of the somatic nervous system	**1** sensitive nodes of the head
	2 telencephalon
	3 spinal nerves
	4 spinal cord throughout
	5 spinal plexuses
B Peripheral department of the somatic nervous system	**6** brain
	7 diencephalon
	8 spinal ganglion
	9 medulla oblongata
	10 cranial nerves

Answer: **A** - *2*, **A** - *4*, **A** - *6*, **A** - *7*, **A** - *9*, **B** - *1*, **B** - *3*, **B** - *5*, **B** - *8*, **B** - *10*

Logical task 9 **Group** the structural elements of the somatic nervous system, by choosing the basis for this. Name these groups.

Logical technique **«grouping»**	
Structure and content	1. Select the basis.
	2. Combine single-order concepts in separate groups.
	3. Give a generic name to the group.

Metencephalon, midbrain, cervical plexus, trigeminal ganglion, brachial plexus, superior and inferior jugular nodes, diencephalon, lumbar plexus, geniculate ganglion, telencephalon, spiral ganglion, sacral plexus, medulla oblongata, vestibular ganglion.

Groups / Basis	1 group *Parts of the brain*	2 group *Spinal plexuses*	3 group *Sensitive nodes of the head*
topography	*medulla oblongata*	*cervical*	*trigeminal ganglion*
	metencephalon	*brachial*	*superior and inferior jugular nodes*
	midbrain	*lumbar*	*geniculate ganglion*
	diencephalon	*sacral*	*vestibular ganglion*
	cerebrum	*coccygeal*	*spiral ganglion*

Logical task 10 **Establish system links** between types of neurons by function and structure.

Logical technique **«establishing system links between elements»**	
Structure and content	1. Highlight the grounds for differentiation of elements.
	2. Determine, which elements are of the same order, and which are of different order.
	3. Establish system links between single-order elements.
	4. Establish system links between elements of different order.
	5. Arrange them in the system hierarchy.

Multipolar, efferent, intercalary, bipolar, motor, sensitive, interneuron, afferent, associative, pseudounipolar, motor, unipolar, effector.

By function	By structure
sensitive (afferent)	*unipolar bipolar pseudounipolar*
associative (intermediary/ interneuronal)	*multipolar*
motor (motor / efferent / effector)	

Logical task 11 Systematize the structural elements of the somatic nervous system.

Logical technique **«systematization»**	
Structure and content	1. Group single-order concepts by highlighting the basis.
	2. Define a generic concept.
	3. Define species concepts.
	4. Arrange them in a logical hierarchy.
	5. Indicate system genus and species relationships.

Midbrain, spinal nerves, coccygeal plexus, metencephalon, cervical plexus, cranial nerves, trigeminal ganglion, brachial plexus, superior and inferior jugular nodes, diencephalon, peripheral department, lumbar plexus, geniculate ganglion, vestibular ganglion, telencephalon, spiral ganglion, sacral plexus, spinal nodes, spinal cord throughout, medulla oblongata.

CONCEPT SYSTEM			
Generic ↔ ***Species*** concept -	**Generic** ↔ ***Species*** concept	**Generic** concept ↔ ***Species*** concept	
Somatic nervous system	*central part*	*spinal cord throughout*	
		brain	*medulla oblongata*
			metencephalon
			midbrain, mesencephalon
			diencephalon
			telencephalon
	peripheral part	*spinal nerves (SN)*	
		spinal ganglion	
		spinal plexuses	*cervical plexus*
			brachial plexus
			lumbar plexus
			sacral plexus
			coccygeal plexus
		cranial nerves (CN)	
		sensitive nodes of the head	*trigeminal ganglion*
			superior and inferior jugular ganglion
			geniculate ganglion
			vestibular ganglion
			spiral ganglion

Logical task 12 **Classify** concept «vegetative nervous system» based on its function.

Logical technique **«classification»**	
Structure and content	1. The concept, that is going to be classified, take for a generic concept.
	2. Choose an essential characteristic of the generic concept as the basis for classification.
	3. Divide the entire set of objects included in the scope of the generic concept into classes so that they differ from each other according to the chosen basis.
	4. Build a hierarchical classification system.

basis:

function

Vegetative nervous system

sympathetic NS *parasympathetic NS*

Logical task 13 Determine, which structural elements belong to the central section of the sympathetic nervous system, and which to the peripheral section (on the basis of a logical technique «**bringing under the concept**»).

Logical technique **«bringing under the concept»**	
Structure and content	1. Highlight the **concept**, under which you want to bring a ***given subject***.
	2. Identify the signs in the concept.
	3. Highlight signs in a ***given subject***.
	4. Consistently compare all the signs of a ***given subject*** with all the signs of the **concept.**
	5. Make a conclusion about the belonging or non-belonging of a ***given object to the concept.***

Concept	Structural elements
А central part of the sympathetic nervous system	**1** spinal ganglion
	2 telencephalon
	3 ganglion of second order (prevertebral)
Б peripheral part of the sympathetic nervous system	**4** postganglionary fibers
	5 spinal cord
	6 ganglion of first order (paravertebral)
	7 cranial nerves
	8 preganglionic fibers

Answer: **А** - *5*, **А** - *...*, **А** - …, **А** - …, **А** - …, **Б** - *3*, **Б** - *4*, **Б** - *6*, **Б** - *8*, **Б** - …

Logical task 14 Determine, which structural elements belong to the central part of the parasympathetic nervous system, and which to the peripheral department (based on the logical method of «**bringing under the concept**»).

Logical technique **«bringing under the concept»**	
Structure and content	1. Highlight the **concept**, under which you want to bring a ***given subject***.
	2. Identify the signs in the concept.
	3. Highlight signs in a ***given subject***.
	4. Consistently compare all the signs of a ***given subject*** with all the signs of the **concept.**
	5. Make a conclusion about the belonging or non-belonging of a ***given object to the concept.***

Concept	Structural elements
А central part of the parasympathetic nervous system	**1** sensitive nodes of the head
	2 pontobulbar centers
	3 preganglionic fibers
	4 intramural ganglia
	5 sacral centers
В peripheral part of the parasympathetic nervous system	**6** mesencephalic center
	7 spinal ganglion
	8 periorganic plexuses
	9 cranial center
	10 intramural plexuses
	11 postganglionary fibers

Answer: **А** - *2*, **А** - *5*, **А** - *6*, **А** - *9*, **А** - ..., **В** - *3*, **В** - *4*, **В** - *8*, **В** - *10*, **В** – *11,* **В** - ...

Logical task 15 **Group** the structural elements of the vegetative nervous system, by choosing the basis for this. Give these groups a name.

Logical technique **«grouping»**	
Structure and content	1. Select the basis.
	2. Combine single-order concepts in separate groups.
	3. Give a generic name to the group.

Cranial center, postganglionic fibers, second order ganglion (prevertebral), pontobulbar centers, intramural plexuses, spinal cord - lateral intermediate nucleus in the lateral horns of spinal cord segments (C_{VIII}, Th_{I-XII}, L_{I-II}), intramural nodes, mesencephalic centers, ganglion of 1st order (paravertebral), periorganic plexuses, sacral center, preganglionic fibers.

Groups / Basis	1 group *central part of the sympathetic NS*	2 group *peripheral part of the sympathetic NS*	3 group *central part of the parasympathetic NS*	4 group *peripheral part t of the parasympathetic NS*
Topography	*spinal cord - lateral intermediate nucleus in the lateral horns of spinal cord segments (C_{VIII}, Th_{I-XII}, L_{I-II}).*	*ganglion of first order (paravertebral)*	*cranial center*	*intramural plexuses*
		second order ganglion (prevertebral)	*mesencephalic center*	*preganglionic fibers*
		preganglionic fibers	*pontobulbar centers*	*postganglionary fibers*
		postganglionary fibers	*sacral centers*	*paraorganic plexuses*
				intramural plexuses

Logical task 16 **Systematize** the structural elements of the vegetative nervous system.

Logical technique **«systematization»**	
Structure and content	1. Group single-order concepts by highlighting the basis.
	2. Define a generic concept.
	3. Define species concepts.
	4. Arrange them in a logical hierarchy.
	5. Indicate system genus and species relationships.

Cranial center, ganglion of first order (paravertebral), preganglionic fibers, peripheral department, periorganic plexuses, mesencephalic center, intramural ganglion, preganglionic fibers, second order ganglion (prevertebral), parasympathetic nervous system, preganglionic fibers, sacral center, peripheral department, postganglionary fibers, spinal cord, intramural plexuses, pontobulbar centers.

CONCEPT SYSTEM				
Generic ↔ ***Species*** **Generic**		↔ ***Species*** **Generic**	↔ ***Species*** **Generic**	↔ ***Species***
Vegetative nervous system	sympathetic NS	*central part*	*spinal cord*	
		peripheral	*ganglion of first order (paravertebral)*	
			second order ganglion (prevertebral)	
			preganglionic fibers	
			postganglion fibers	
	parasympathetic NS	*central part*	*cranial center*	*mesencephalic center*
				pontobulbar centers
			sacral centers	
		peripheral part	*intramural ganglion*	
			preganlionic fibers	
			postganglionary fibers	
			periorganic plexuses	
			intramural plexuses	

Practical task 1 Indicate, into which parts the unified nervous system of a person is divided by function.

Answer: *By function, the unified human nervous system is divided into somatic or animal NS and vegetative or autonomous NS.*

Practical task 2 Specify the structural element of the somatic nervous system, which is its central department.

Answer: *The central part of the somatic nervous system is the spinal cord throughout.*

Practical task 3 Highlight the locations of the spinal cord and brain.

Answer: *The spinal cord and brain are located in the central part of the somatic (animal) NS.*

Practical task 4 Specify the structural elements of the peripheral part of the somatic nervous system, which are associated with the spinal cord.

Answer:

а) spinal nerves (SN);

б) spinal ganglion;

в) spinal plexuses: cervical, brachial, lumbar, sacral, coccygeal.

Practical task 5 Select the parts, into which the vegetative nervous system is divided by function.

Answer: *By function, the autonomic nervous system is divided into sympathetic and parasympathetic nervous system.*

Practical task 6 Specify the locations of the central and peripheral parts of the sympathetic nervous system.

Answer:

- The central part of the sympathetic nervous system includes the lateral intermediate nucleus of the lateral horn of the spinal cord segments throughout C_{VIII}, Th_I-Th_{XII}, L_I-L_{II};

- the peripheral part of the symphathetic nervous system includes first-order ganglion (paravertebral) and second-order ganglion (prevertebral).

Practical task 7 Specify the central and peripheral parts of the parasympathetic nervous system.

Answer:

- The central part of the parasympathetic nervous system includes the cranial centers and the sacral centers;

- the peripheral part of the parasympathetic nervous system includes third-order ganglion (periorganic ganglion and intramural ganglion).

Practical task 8 Highlight the difference in the structure of the reflex arc of the somatic and autonomic nervous system.

Answer: *The efferent part of the reflex arc of the autonomic nervous system is two-neuronal in contrast to the efferent part of the reflex arc of the somatic nervous system.*

Practical task 9 Specify the number of neurons in the efferent part of the reflex arc of the symphathetic nervous system.

Answer: *2 neurons.*

A first-order neuron (lateral intermediate nucleus) resides in the lateral horn of a segment of the spinal cord throughout C_{VIII}, Th_I-Th_{XII}, L_I-L_{II}.

The second-order neuron is found in the paravertebral and prevertebral.

Practical task 10 Specify the parts of the vegetative (autonomic) nervous system, based on the function they perform.

Answer: *The Vegetative (autonomic) nervous system is divided into symphathetic and parasympathetic nervous system.*

Practical task 11 Draw the neurons.

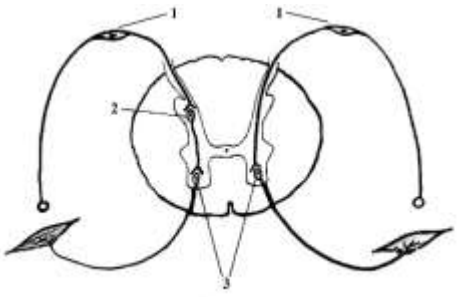
Unipolar neuron	Bipolar neuron	Pseudounipolar neuron	Multipolar neuron
			

Practical task 12

Sign the structural elements of the reflex arc.

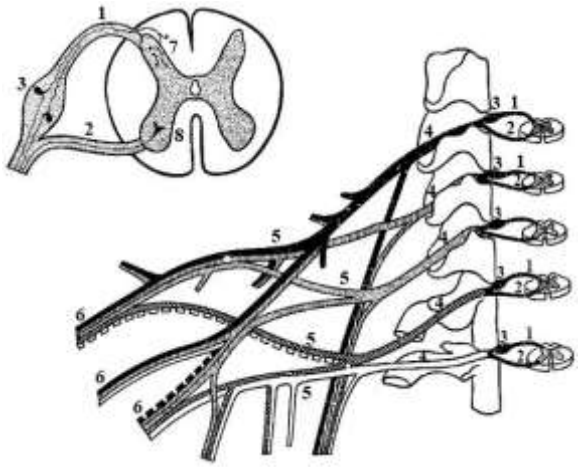
Answer:

1. *Spinal ganglion;*
2. *nucleus (body) sensory neuron;*
3. *motor neurons of the anterior horn.*



Practical task 13

Sign the structural elements of the somatic nervous system.



Answer:

1 *posterior (sensitive) root;*

2 *anterior (motor) root;*

3 *spinal ganglion;*

4 *spinal nerve;*

5 *branches of the spinal nerve;*

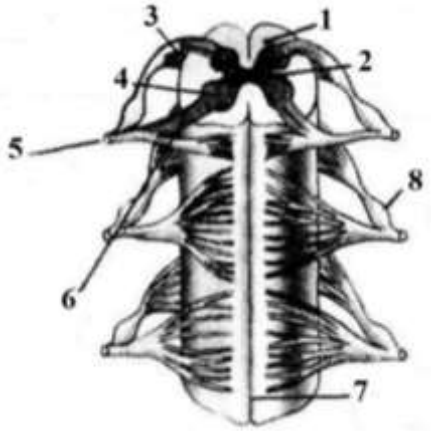
6 *trunks of spinal (brachial) plexuses;*

7 *sensitive nuclei of the posterior horn;*

8 *motor nuclei of the anterior horn.*

Practical task 14

Sign the structural elements of the spinal cord.



Answer:

1 *white matter;*

2 *central canal;*

3 *posterior roots;*

4 *gray matter;*

5 *spinal nerve;*

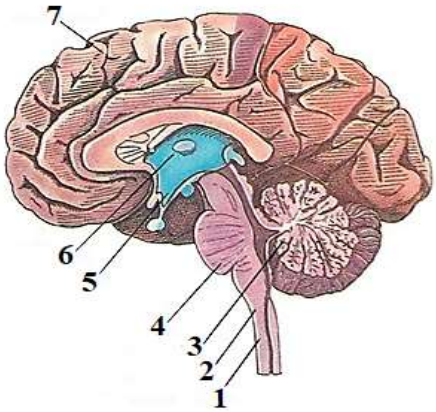
6 *anterior roots;*

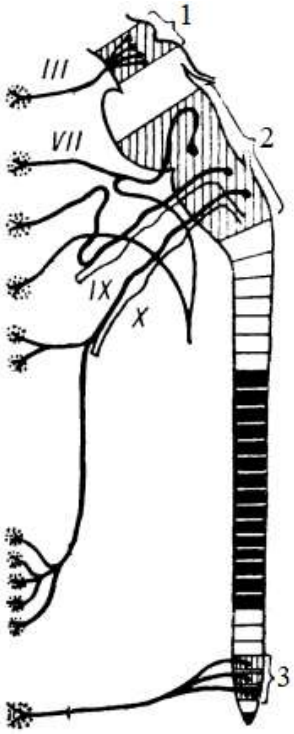
7 *anterior median fissure;*

8 *spinal ganglion.*

Practical task 15

Label parts of the brain.





Answer:

1 *spinal cord;*

2 *medulla oblongata;*

3 *cerebellum;*

4 *pons;*

5 *hypothalamus;*

6 *thalamus;*

7 *telencephalon.*

Practical task 16

Sign the structural elements of the central division of the parasymphatetic nervous system.

Answer:

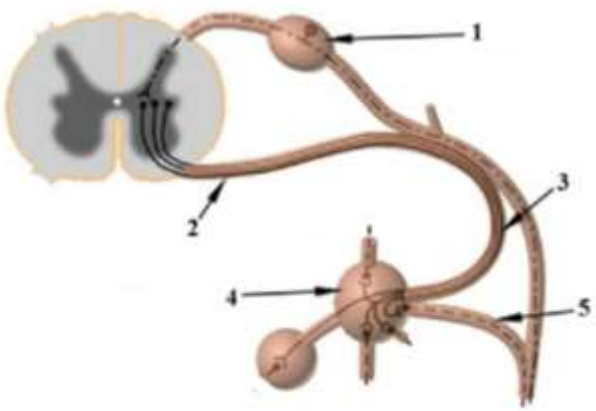
1 *cranial center: midbrain (nucleus of the III pair of the cranial Nerves);*

2 *cranial center: medulla oblongata (nucleus VII, IX u X pairs cranial nerves);*

3 *sacral center (parasympathetic nuclei of the pelvic viscera In the sacral spinal cord).*

Practical task 17

Sign the structural elements of the peripheral part of the symphathetic nervous system.



Answer:

1 *spinal ganglion;*

2 *anterior root;*

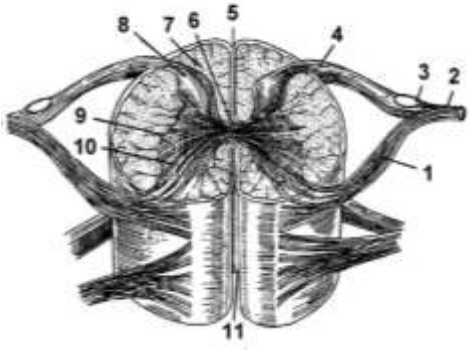
3 *white connecting branch;*

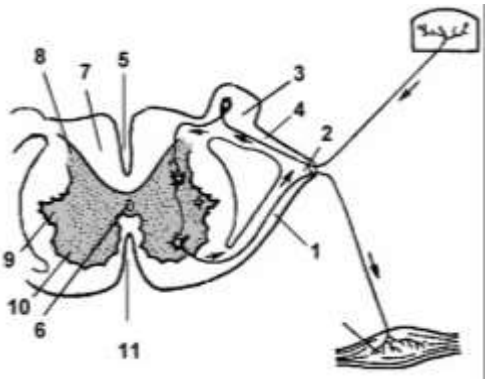
4 *symphathetic trunk ganglion;*

5 *grey connecting branch.*

Practical task 18

Sign structural elements of the spinal cord.





Answer:

1 *anterior (motor root);*

2 *spinal nerve;*

3 *spinal node;*

4 *posterior (sensitive) root ;*

5 *posterior median sulcus;*

6 *central canal;*

7 *funiculus posterior;*

8 *posterior horn;*

9 *lateral horn;*

10 *anterior horn;*

11 *anterior median fissure.*

Situational task 1 The photo shows the synapse. Small bubbles are visible in its right side, but they are absent in the left side. Where is the presynaptic section located in this synapse (right or left). In which direction does this synapse conduct excitation (left or vice versa).

Answer. *The presynaptic department is located on the right. Conduction of excitation is carried out from the presynaptic department to the postsynaptic (that is from right to left).*

Situational task 2 The patient developed paralysis, that is, it became impossible to move the paralyzed part of the body. Damage to what structures (levels) in the three-membered reflex arc could cause paralysis?

Answer. *The effector link of the reflex arc is damaged (that is, the motor neuron or its axon).*

Situational task 3 When studying the anatomical preparation, the student discovered an unknown formation: a thickening of the posterior root of the IV thoracis segment of the spinal cord. What is the name of this structure? The body of which neuron (by structure) is located in it?

Answer. *A student discovered the spinal node. It contains the body of pseudounipolar neuron.*

Situational task 4 After a head injury, a patient has a violation of maintaining body balance, coordination of movement, and a decrease in muscle tone. Name the part of the brain and, if damaged, the above symptoms are recorded.

Answer. *Damage to the cerebellum which is part of the hindbrain (includes the pons and cerebellum).*

Situational task 5 When answering an exam, the student is excited, some of the signs of which are rapid breathing and heartbeat. How is the nervous system classified by function? What part of the nervous system is activated in a student? Where are the centers of coordination of this department in the CNS?

Answer. *According to the functions, the nervous system is classified into somatic and autonomic, which in turn is divided into sympathetic and parasympathetic. At the moment of excitement, the sympathetic nervous system is activated. Its centers are located in the sympathetic nuclei of the lateral horns of the spinal cord at the level of its segments CVIII-LII.*

Test control

For each test task, choose one correct answer.

Task 1 – *C*, task 2 – *C*, task 3 – *D*, task 4 – *B*, task 5 – *B*, task 6 – *B*, task 7 – *A*, task 8 – *D*, task 9 – *C*, task 10 – *D*, task 11 – *A*, task 12 – *B.*

Test task 1		THE SOMATIC NERVOUS SYSTEM IS RESPONSIBLE FOR
	A	condition of the glands in the body
	B	condition of internal organs
	C	condition of striated skeletal muscles
	D	innervation of the walls of blood vessels
Test task 2		BELONGS TO THE CENTRAL PART OF THE SOMATIC NERVOUS SYSTEM
	A	spinal ganglia
	B	sensitive ganglia of the head
	C	spinal cord
	D	hypoglossal nerve
Test task 3		THE SPINAL GANGLIA ARE LOCATED
	A	at the foramen magnum
	B	on the anterior surface of the vertebral bodies
	C	at the spinous processes
	D	in the intervertebral foramen
Test task 4		BELONGS TO THE PERIPHERAL PART OF THE SOMATIC NERVOUS SYSTEM
	A	diencephalon
	B	spinal ganglions
	C	medulla oblongata
	D	cerebellum
Test task 5		THE CENTERS OF THE SYMPATHETIC NERVOUS SYSTEM ARE
	A	cervical segments of the spinal cord
	B	segments of the spinal cord along C_8; $Th_{1\text{-}12}$; $L_{1\text{-}2}$
	C	cranial centers
	D	sacral centers
Test task 6		MOTOR NEURONS ARE LOCATED IN
	A	dorsal horns of spinal cord segments
	B	anterior horns of spinal cord segments
	C	central intermediate substance
	D	lateral horns of spinal cord segments

Test task 7		BELONGS TO THE PERIPHERAL PART OF THE SYMPATHETIC NERVOUS SYSTEM
	A	paravertebral ganglions
	B	spinal ganglions
	C	intramural ganglions
	D	flocculus of cerebellum
Test task 8		BELONGS TO THE CENTRAL PART OF THE SYMPATHETIC NERVOUS SYSTEM
	A	thoracolumbar center
	B	spinal ganglions
	C	vagus nerve
	D	cranial center
Test task 9		THE PERIPHERAL PART OF THE SYMPATHETIC NERVOUS SYSTEM CONSISTS OF SUCH GANGLIONS AS
	A	paravertebral
	B	prevertebral
	C	intramural
	D	spinal
Test task 10		THE AUTONOMOUS SYSTEM IS RESPONSIBLE FOR ACTIVITY OF
	A	striated mucles of trunk
	B	striated muscles of limbs
	C	chewing muscles
	D	glandular structures of the body
Test task 11		THE PARASYMPATHETIC GANGLIONS OF THE HEAD ARE
	A	pterygopalatine ganglion
	B	ganglion of trigeminal nerve
	C	spinal ganglions
	D	geniculate ganglion
Test task 12		TO THE SYMPATHETIC TRUNK (PARAVERTEBRAL GANGLIONS) APPROACH
	A	gray connecting branches (postganglionary fibers)
	B	white connecting branches (preganglionic fibers)
	C	interganglionar branches
	D	dorsal roots of spinal nerves

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1st grade

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