IMMANUEL KANT BALTIC FEDERAL UNIVERSITY
DEPARTMENT OF FUNDAMENTAL MEDICINE

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ANATOMY: PERIPHERAL NERVOUS SYSTEM

Methodological recommendations
for students of medicine

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The manual is prepared according to requirements of the working program of the discipline “Anatomy” and contains methodical indications for the section Peripheral nervous system according to the existing curriculum. The manual is intended for the English-speaking students of medical faculty studying on specialties 31.05.01 “General medicine”.

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Topic 1

GENERAL OVERVIEW OF THE CRANIAL NERVES. I, II, III, IV, VI PAIRS OF CRANIAL NERVES

INTRODUCTION TO THE TOPIC

Among the diseases of nerves and eyes the pathology of the I, II, III, IV, VI pairs of cranial nerves are often observed.

To understand the process of the symptom development, to make a correct diagnosis and prescribe correct treatment a doctor should know the anatomy of olfactory, optic, oculomotor, trochlear and abducens nerves, should understand the olfactory and visual pathways and know how the papillary light reflex occurs.

Before the study of the topic you should know:

1. Location of the cribriform plate of the ethmoid bone, of the optic canals, of the superior orbital fissure in the skull.
2. The structure of the rhinencephalon.
3. The location of the cortical olfactory and visual areas.
4. The location of the optic tracts, optic chiasm.
5. The topography of the roots of the III, IV, VI cranial nerves on the ventral surface of the brain.
6. The location, names and types of the nuclei of the III, IV, VI cranial nerves.
7. The structure of the retina.
8. The location and function of the extraocular and intraocular muscles.

SELF-STUDY GOALS

After independently studying this topic, the student should know: the nuclei of the cranial nerves (III, IV and VI) and their locations, the zones of innervation of the oculomotor, trochlear, abducens nerves, the entry and exit points of the olfactory, visual, oculomotor, trochlear nerves on the skull and brain, abducens nerves, a diagram of the arc of the pupillary reflex, be able to show the indicated nerves and their branches on a demonstration preparation.

TOPIC CONTENT

- Topography of the bulbs and tracts of the olfactory nerves, the optic nerves, tracts, decussation at the base of the brain (examined on the preparation).
- Places of entry of I and II nerves into the cranial cavity.
- Conducting olfactory and visual pathways, subcortical and cortical centers.
- Locations of the nuclei of the oculomotor, trochlear, abducens nerves.
- Connection of the superior colliculus with the parasympathetic nuclei of the oculomotor nerve.
- Nerves of the eye muscles at the base of the brain.
- Places where nerves exit the cranial cavity.
- Branches of the nerves of the eye muscles, zones of innervation.
- Diagram of the arc of the pupillary reflex.

METHODOLOGICAL RECOMMENDATIONS FOR STUDYING THE MATERIAL

Activity	Step Description
Read the introduction to the topic	—
Study the corresponding section in literature sources	The study of the topic is accompanied by a demonstration of structural details in a table and a diagram
Draw a diagram of the corresponding cranial nerve in your notebook	Use a red color pencil for drawing the motor structures, blue one — for the sensory and green one — for the vegetative structures
Revise the openings, channels, grooves on the skull associated with the study of a given nerve	The study of the topic is accompanied by a demonstration of structural details on the skull
Describe the nerve under study	While describing the nerve, check the following: 1) English and Latin names of the nerve; 2) functional characteristics (sensory, motor, vegetative, mixed); 3) location of the nuclei (brain region), their name and functional characteristics; 4) exit of nerve roots at the base of the brain; 5) sensory ganglions; 6) hole, channel through which the nerve leaves the cranial cavity; 7) branches of the nerve, their topography and areas of innervation

The end of Table

Activity	Step Description
Write down new Latin terms	Put down new Latin terms in your notebook (see the list of Practical skills)
Check your knowledge with self-control questions	Answer the questions given in the assignment

QUESTIONS FOR SELF-CONTROL

1. What is the name of the I cranial nerve?
2. How are the olfactory nerves formed?
3. What is the type of the olfactory nerve?
4. How many olfactory nerves exist?
5. Where are olfactory receptors located?
6. Through what openings do the olfactory nerves pass into the skull?
7. How many neurons does the olfactory pathway include?
8. Where are the first-order, second-order and third-order neurons of the olfactory pathway located?
9. Where are the subcortical and cortical olfactory areas located in the brain?
10. What is the name of the II cranial nerve?
11. Axon of which neurons forms the optic nerve?
12. What parts are distinguished in the optic nerve?
13. Through what opening does the optic nerve pass into the skull?
14. How is the optic chiasma formed?
15. Where are the receptors of the visual pathway located?
16. How many neurons does the visual pathway include?
17. Where are the first-order, second-order and third-order neurons of the visual pathway located?
18. What parts of the brain are the subcortical centers of the visual analyzer?
19. Where are the subcortical and cortical visual areas located in the brain?
20. What is the name of the III cranial nerve?
21. Describe the fiber composition of the III cranial nerve.
22. How is the oculomotor nerve formed?
23. Where are the nuclei of the oculomotor nerve located? What are their names?
24. Which of the oculomotor nerve nuclei is motor, which is parasympathetic?
25. Describe the topography of the oculomotor nerve on the cerebral base.
26. Through what opening does the oculomotor nerve leave the skull?
27. Which muscles of the eye are innervated by the superior branch of the oculomotor nerve?

28. Which muscles of the eye are innervated by the inferior branch of the oculomotor nerve?

29. To which neurons do the parasympathetic fibers of the oculomotor nerve run?

30. Where is the ciliary ganglion located? What neurons does it contain?

31. Which muscles of the eye are innervated by the axons from the ciliary ganglion?

32. What is the name of the IV cranial nerve?

33. Describe the fiber composition of the IV cranial nerve.

34. How is the trochlear nerve formed?

35. Where is the nucleus of the trochlear nerve located? What is its name and type?

36. Describe topography of the trochlear nerve on the cerebral base.

37. Through what opening does the trochlear nerve leave the skull?

38. What eyeball muscle is innervated by the trochlear nerve?

39. What is the name of the VI cranial nerve?

40. Describe the fiber composition of the VI cranial nerve.

41. How is the abducens nerve formed?

42. Where is the nucleus of the abducens nerve located? What is its name and type?

43. Describe topography of the abducens nerve on the cerebral base.

44. Through what opening does the abducens nerve leave the skull?

45. What eyeball muscle is innervated by the abducens nerve?

46. Describe the innervation of the ocular muscles:

47. Which nerve innervates the superior oblique muscle?

48. Which nerve innervates the superior rectus muscle?

49. Which nerve innervates the inferior oblique muscle?

50. Which nerve innervates the inferior rectus muscle?

51. Which nerve innervates the medial rectus muscle?

52. Which nerve innervates the lateral rectus muscle?

53. Which nerve innervates the levator palpebrae superiores?

54. Which nerve innervates the ciliary muscle?

55. Which nerve innervates the sphincter of pupil?

PRACTICAL SKILLS

Skull

1. Optic canal, *canalis opticus*; зрительный канал.

2. Superior orbital fissure, *fissura orbitalis superior*; верхняя глазничная щель.

3. Prechiasmatic sulcus, *sulcus prechiasmaticus*; предперекрестная борозда.

4. Cribriform plate, *lamina cribrosa*; решетчатая пластинка.

Brain

1. The roots of the I cranial nerve, *nervus olfactorius*; обонятельный нерв.
2. The roots of the II cranial nerve, *nervus opticus*; зрительный нерв.
3. The roots of the III cranial nerve, *nervus oculomotorius*; глазодвигательный нерв.
4. The roots of the IV cranial nerve, *nervus trochlearis*; блоковый нерв.
5. The roots of the VI cranial nerve, *nervus abducens*; отводящий нерв.
6. Olfactory bulb, *bulbus olfactorius*; обонятельная луковица.
7. Olfactory tract, *tractus olfactorius*; обонятельный тракт.
8. Olfactory trigone, *trigonum olfactorium*; обонятельный треугольник.
9. Optic chiasm, *chiasma opticum*; зрительный перекрест.
10. Optic tract, *tractus opticus*; зрительный тракт.
11. Superior colliculus, *colliculus superior*; верхний холмик.
12. Thalamus, *thalamus*; таламус.
13. Anterior perforated substance, *substantia perforata anterior*; переднее продырявленное вещество.
14. Cerebral peduncles, *pedunculi crebri*; ножки мозга.
15. Interpeduncular fossa, *fossa interpduncularis*; межножковая ямка.
16. Pons, *pons*; мост.
17. Brain stem, *truncus cerebri*; ствол мозга.
18. Cerebral hemisphere, *hemispheria cerebri*; полушария головного мозга.
19. Medulla oblongata, *medulla oblongata*; продолговатый мозг.
20. Midbrain, *mesencephalon*; средний мозг.
21. Facial colliculus, *colliculus facialis*; холмик лицевого нерва.

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Topic 2
V, VIII PAIRS OF CRANIAL NERVES

INTRODUCTION TO THE TOPIC

The trigeminal nerve has the most complex structure among the other cranial nerves. Its branches innervate the skin of the head and face, the mucous membranes and masticatory muscles.

The pathology of the trigeminal nerve is often observed: among the lesions of the peripheral nerves, the trigeminal neuralgia is third in frequency.

Topographically and functionally the trigeminal nerve is associated with other nerves and parasympathetic ganglia of the head.

The knowledge of the trigeminal nerve anatomy is necessary in surgery to do anesthesia of teeth, surgical operations on the face.

To know topography, anatomy and functional characteristics of the trigeminal nerve is important for the study of other cranial nerves: facial, glossopharyngeal and others.

In clinical practice the diseases of the vestibulocochlear nerve, which is accompanied by disorder of hearing and balance, are often observed.

To make correct diagnosis, to understand how the symptoms appear, to treat these diseases, a doctor should know the anatomy of the vestibulocochlear nerve and vestibular and acoustic pathways.

Before the study of the trigeminal nerve you should know:

1. Location of the following skull structures:

— foramen ovale;
— superior orbital fissure;
— inferior orbital fissure;
— infraorbital canal;
— infraorbital foramen;
— supraorbital notch;
— foramen spinosum;
— zygomaticoorbital foramen;
— zygomaticotemporal foramen;
— zygomaticofacial foramen;

— foramen rotundum;
— anterior and posterior ethmoidal foramina;
— trigeminal impression;
— pterygopalatine fossa;
— sphenopalatine foramen;
— mandibular canal;
— greater and lesser palatine foramina;
— greater and lesser palatine canal.

2. Location and action of the following muscles:
— masseter;
— temporalis;
— lateral and medial pterygoid;
— mylohyoid;
— digastric;
— tensor tympani;
— tensor velli palatine.

3. Names, location and structure of the trigeminal nerve nuclei.

Before the study of the vestibulocochlear nerve you should know:

1. Name, location and types of the nuclei of vestibulocochlear nerve.
2. Location of the following skull structures:
   — meatus acousticus internus.
3. Location of vestibular and cochlear nuclei.
4. The sound conduction and the structure of Corti's organ.
5. The structure of the vestibular apparatus.

SELF-STUDY GOALS

After independently studying the topic, the student should know: the names of the nuclei and main branches of the trigeminal and vestibulocochlear nerves, the topography of their branches, their functional significance and areas of innervation, be able to draw a diagram of the nerves according to the descriptions in the textbook, be able to show the main branches of the trigeminal and vestibulocochlear nerves on anatomical preparations.

TOPIC CONTENT

Composition and function of the trigeminal nerve:

• Trigeminal nerve nuclei — their localization in the pons and medulla oblongata.

• The trigeminal ganglion, the sensory and motor roots and the three branches arising from the trigeminal ganglion.

• The ophthalmic nerve and its branches (lacrimal, nasociliary, frontal nerve), area of innervation.

• The maxillary nerve — its branches to the nasal cavity, into the orbital cavity (infraorbital and zygomatic), to the oral cavity, to the pharynx, area of innervation.

• The mandibular nerve and its branches — lingual, buccal, inferior alveolar, auriculotemporal nerves, areas of innervation. Motor branches, areas of innervation.

• Autonomic ganglions and fibers associated with the branches of the trigeminal nerve (pterygopalatine ganglion and secretory branches running as part of the zygomatic and lacrimal nerves; submandibular ganglion and branches extending to the submandibular and sublingual glands; otic ganglion and autonomic fibers running in the auriculotemporal nerve to the parotid gland), ciliary ganglion and autonomic fibers going to the smooth muscles of the eye.

Composition and function of the vestibulocochlear nerve:

• Localization of the receptor apparatus.

• Locations of the vestibular and spiral ganglions.

• Conducting paths of the statokinetic analyzer and locations of neuron bodies.

• Connection of the vestibular nuclei with the cerebellum, spinal cord, with the nuclei of the nerves of the eye muscles, with the nuclei of the vagus and glossopharyngeal nerves, with the thalamus, with the temporal lobe of the cerebral cortex.

• Conducting pathways of the auditory analyzer (receptor, conductor and central sections).

• Connection of the inferior colliculi with the spinal cord.

METHODOLOGICAL RECOMMENDATIONS FOR STUDYING THE MATERIAL

Activity	Step Description
Read the introduction to the topic	—
Study the corresponding section in literature sources	The study of the topic is accompanied by a demonstration of structural details on a table and diagram
Draw a diagram of the corresponding cranial nerve in your notebook	Use red color pencil for drawing the motor structures, blue one — for the sensory and green one — for the vegetative structures

The end of Table

Activity	Step Description
Revise the openings, channels, grooves on the skull associated with the study of a given nerve	The study of the topic is accompanied by a demonstration of structural details on the skull
Describe the nerve under study	While describing the nerve, check the following: 1) English and Latin names of the nerve; 2) functional characteristics (sensory, motor, vegetative, mixed); 3) location of the nuclei (brain region), their name and functional characteristics; 4) exit of nerve roots at the base of the brain; 5) sensory ganglions; 6) foramens, channel through which the nerve leaves the cranial cavity; 7) branches of the nerve, their topography and areas of innervation
Write down new Latin terms	Put down new Latin terms in your notebook (see the list of Practical skills)
Check your knowledge with self-control questions	Answer the questions given in the assignment

QUESTIONS FOR SELF-CONTROL

V pair of cranial nerves

1. What is the name of the V cranial nerve?
2. Describe the fiber composition of the V cranial nerve.
3. How is the trigeminal nerve formed?
4. Where are the trigeminal nerve nuclei located?
5. Name the trigeminal nerve nuclei. Which of them are motor (sensory)?
6. Describe the topography of the trigeminal nerve on the cerebral base?
7. Name the trigeminal nerve divisions.
8. Through which openings do the branches of the trigeminal nerve do leave the skull?
9. Describe the fiber composition of the trigeminal nerve divisions.
10. What area of the head is innervated by each of the trigeminal nerve divisions?

11. Describe the course of the ophthalmic nerve; what branches is it divided into?

12. Name the branches of the nasociliary nerve. Which regions do they innervate?

13. Describe the connection of the nasociliary nerve with the ciliary ganglion. Why are they connected? Describe the structure and function of the ciliary ganglion. How are the short ciliary nerves formed? What do they innervate?

14. Describe the course and branches of the frontal nerve. Which regions does it innervate?

15. What type of innervation does the lacrimal nerve give to the lacrimal gland?

16. Describe the course of the maxillary nerve; what branches does it give off?

17. Describe the course and branches of the infraorbital nerve. Which regions does it innervate?

18. What is the pes ancerinus minor, which nerves form it?

19. Describe course and branches of the zygomatic nerve. Which regions does it innervate?

20. Explain the function of the ganglionic fibers of the maxillary nerve. Why are they connected with the pterygopalatine ganglion?

21. Name the branches of the pterygopalatine ganglion and describe their function. What glands do the branches of the trigeminal nerve, passing together with the branches of the pterygopalatine ganglion, innervate? What type of innervation do they give?

22. Describe the course and branches of the mandibular nerve.

23. Name the motor branches of the mandibular nerve. What muscles do they innervate?

24. Name the sensory branches of the trigeminal nerve and describe their course. Which regions do they innervate?

25. Which parasympathetic nerve joins the lingual nerve? Why do they pass together? To which parasympathetic ganglia do the ganglionic fibers of the lingual nerve run?

26. What type of the innervation does the lingual nerve give to the sublingual and submandibular glands?

27. Describe the course of the auriculotemporal nerve. Name its branches. What do they innervate?

28. To what parasympathetic ganglion do the connecting fibers of the auriculotemporal nerve pass?

29. Which parasympathetic nerve accompanies the aruriculotemporal nerve? Why do they pass together?

30. What type of the innervation does the auriculotemporal nerve give to the parotid gland?

Describe the innervation of the following areas:

1. Skin of forehead, zygomatic region, chin, cheek, temporal region.
2. Upper and lower lips.
3. Upper and lower eyelids.
4. Fibrous and vascular layer of eyeball.
5. Extraocular and intraocular muscles of eyeball (proprioceptive and motor innervation).
6. Lacrimal gland; submandibular, sublingual, parotid glands (sensory and secretory innervation).
7. Upper and lower teeth.
8. Mylohyoid, tensor tympani, tensor velli palatini, masseter, lateral and medial pterygoid, temporalis muscles.

VIII pair of cranial nerves

1. What is the name of VIII cranial nerve?
2. What parts does the vestibulocochlear nerve consist of, and what function do they perform?
3. Where are the vestibular and spiral ganglia located?
4. What is the functional significance of the connections of the vestibular nuclei with the nuclei of the oculomotor nerves, with the nuclei of the vagus and glossopharyngeal nerves, with the spinal cord, and the cerebellum?
5. What nuclei and pathways are involved in the start reflex to auditory stimulation?
6. Describe the fiber composition of the vestibulocochlear nerve.
7. Describe the formation of the vestibulocochlear nerve.
8. Describe the location of the cochlear ganglion.
9. Where does the cochlear root enter the brain?
10. Where are the acoustic receptors situated?
11. How many neurons does the acoustic pathway include?
12. Describe where the first, second and third-order neurons of the acoustic pathway are situated.
13. How is the trapezoid body formed?
14. Where does the acoustic pathway decussate?
15. Give the definition of the lateral lemniscus.
16. Where do the fibers of the lateral lemniscus end?
17. Which parts of the brain contain subcortical acoustic centers? Describe their connections with other parts of the central nervous system.
18. Where are the projection and association acoustic cortical areas situated?
19. Describe the formation of the vestibular root.
20. Where is the vestibular ganglion located?

21. Where does the vestibular root enter the brain?

22. Where are the vestibular receptors situated?

23. How many neurons does the vestibular pathway include?

24. Describe where the first, second and third-order neurons of the vestibular pathway are situated.

25. Where does the vestibular pathway decussate?

26. Where is the vestibular cortical area located?

PRACTICAL SKILLS

Brain

1. The roots of the V cranial nerve, *nervus trigeminus*; тройничный нерв.

2. The roots of the VIII cranial nerve, *nervus vestibulocochlearis*; пред-дверно-улитковый нерв.

3. Pons, *pons*; мост.

4. Brain stem, *truncus cerebri*; ствол головного мозга.

5. Cerebral hemisphere, *hemispheria cerebri*; полушария головного мозга.

6. Medulla oblongata, *medulla oblongata*; продолговатый мозг.

7. Midbrain, *mesencephalon*; средний мозг.

8. Thalamus, *thalamus*; таламус.

9. Cerebellum, *cerebellum*; мозжечок.

Skull

1. Internal acoustic meatus, *meatus acusticus internus*; внутренний слуховой проход.

2. Foramen rotundum, *foramen rotundum*; круглое отверстие.

3. Foramen ovale, *foramen ovale*; овальное отверстие.

4. Foramen spinosum, *foramen spinosum*; остистое отверстие.

5. Superior orbital fissure, *fissura orbitalis superior*; верхняя глазничная щель.

6. Pterygoid canal, *canalis pterygoideus*; крыловидный канал.

7. Pterygopalatine fossa, *fossa pterygopalatine*; крыловидно-небная ямка.

8. Sphenopalatine foramen, *foramen spenopalatinum*; клиновидно-небное отверстие.

9. Trigeminal impression, *impressio trigemini*; тройничное вдавление.

10. Inferior orbital fissure, *fissure orbitalis inferior*; нижняя глазничная щель.

11. Infraorbital canal, *canalis infraorbitalis*; подглазничный канал.

12. Infraorbital foramen, f*oramen infraorbitale*; подглазничное отверстие.

13. Mandibular canal, *canalis infraorbitalis*; нижнечелюстной канал.
14. Mandibular foramen, *foramen mandibulare*; нижнечелюстное отверстие.
15. Mental foramen, *foramen mentale*; подбородочное отверстие.

Literature

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5. *Lecture* material.

Topic 3
VII, IX, X, XI, XII PAIRS OF CRANIAL NERVES

INTRODUCTION TO THE TOPIC

In clinical practice the diseases of the facial nerve, which is accompanied by paralysis of mimic muscles is often observed. To make a correct diagnosis, understand the mechanism of symptoms and successfully treat these diseases, the doctor needs to know the anatomy of the facial nerve branches.

The glossopharyngeal and vagus nerves innervate the organs from the middle ear, parotid gland, tongue, pharynx to the sigmoid colon. The accessory and hypoglossal nerve innervate the cervical and lingual muscles.

These nerves can be involved in the pathological processes in the organs which they innervate, especially vagus nerve. Therefore, it is necessary to know the topography of their nuclei and their branches. This information is important for neurologists, therapists and doctors of other specialties.

Before the studying the topic you need to know:

1. Name, location and types of the nuclei of facial, glossopharyngeal, vagus, accessory, hypoglossal nerves.
2. Location of the following skull structures:

— facial canal;
— canal of greater petrosal nerve;
— petrotympanic fissure;
— foramen lacerum;
— pterygoid canal;
— pterygopalatine fossa;
— tympanic canaliculus;
— jugular foramen;
— hiatus of the lesser petrosal canal;
— petrosquamous fissure.

SELF-STUDY GOALS

After independently studying the topic, the student should know English and Latin terminology on this topic, the exit of nerves at the base of the brain and from the cranial cavity, the nuclei of these nerves and their locations, the topography

of the nerves, the location of sensory ganglions, pathway of the nerve branches, zones of their innervation; students should be able to show the nerves on preparations and models, to draw the scheme of the nerves.

TOPIC CONTENT

Locations and function of the nuclei of the facial and intermediate nerves:

- Topography of nuclei in the brain stem.
- Exit of nerves to the surface of the brain.
- Passage of the facial nerve in the canal of the temporal bone.
- Location of the ganglion geniculi.
- Branches of the facial and intermediate nerves in the facial canal.
- Greater petrosal nerve (intermediate nerve), areas of innervation.
- Stapedius nerve (facial nerve), areas of innervation.
- Chorda tympani (intermediate nerve), areas of innervation.
- Autonomic ganglia of the intermediate nerve.
- Muscular branches of the facial nerve after exiting the stylomastoid foramen, their topography, areas of innervation.
- The course of fibers for the innervation of the lacrimal, submandibular and sublingual salivary glands.
- The course of fibers for gustatory innervation of the anterior two-thirds of the tongue.

Anatomy of the glossopharyngeal nerve:

- Topography and name of the nuclei — ambiguus nucleus, nucleus of the solitary tract, inferior salivary nucleus.
- Its exit from the skull through the jugular foramen.
- The exit of the nerve roots from medulla oblongata is behind the olive, above the vagus nerve root.
- The formation of peripheral sensory fibers that extend from nerve cells located in the superior and inferior ganglia of the nerve (tympanic nerve, tonsil branches, pharyngeal branches, lingual branches, sinus branch).
- Formation of motor branches. Efferent fibers begin from the nucleus ambiguus, leave the brain as part of the glossopharyngeal nerve, pass through the jugular foramen, bypassing the sensory ganglia, and go to the stylopharyngeal muscle.
- The formation of secretory — parasympathetic (efferent) fibers for the parotid gland. They start from the inferior salivary nucleus, leave the brain behind the olive and, as part of the nerve, penetrate through the jugular foramen and join the sensory fibers of the tympanic nerve, then go as part of the lesser petrosal

nerve and reach the otic ganglion. In the ganglion, parasympathetic fibers end at synapses on ganglion nerve cells. The axons of the latter (postganglionic fibers) join the auriculotemporal nerve of the v pair, and, reaching the parotid gland, give it secretory fibers.

Anatomy of the vagus nerve:

- Topography and name of the nuclei — ambiguus nucleus, solitary tract, dorsal nucleus of the vagus nerve.
- The exit of the nerve roots from the medulla oblongata is behind the olive, below the glossopharyngeal nerve.
- Exit from the skull — through the jugular foramen.
- The formation of sensory branches that begin from neurons located in the superior and inferior ganglia of the nerve. Sensitive branches: in the head, neck, thoracic and abdominal parts — sensitive fibers along the vessels to the liver, spleen, pancreas, kidneys, small and large intestines to the sigmoid colon, lungs, heart.
- Formation of efferent (motor) fibers. They start from the ambiguus nucleus, emerge as part of the nerve from the posterior lateral groove of medulla oblongata, pass through the jugular foramen, bypassing the sensory ganglia, and go along with the sensory fibers, innervating the striated muscles (pharyngeal, superior and recurrent laryngeal nerves).
- Formation of efferent (secretory), parasympathetic fibers. They begin from the dorsal nucleus and emerge from the posterolateral sulcus, pass through the jugular foramen, bypassing the sensory ganglia, and go as part of the nerve trunk to the intramural ganglia. Here they form synapses on ganglion nerve cells. The axons of the latter participate in the innervation of the heart muscle (slow down the heartbeat) and the smooth muscles of blood vessels (dilate). In addition, they innervate the smooth muscles of the trachea, bronchi (narrow the bronchi), esophagus, stomach and intestines up to the sigmoid colon (increase peristalsis), liver, spleen, pancreas.

Anatomy of the accessory nerve:

- Topography and name of the nuclei — nucleus ambiguus and spinal nucleus of the accessory nerve (motor nuclei).
- Exit of the nerve roots: cerebral fibers emerge from the medulla oblongata from the posterior lateral sulcus below the vagus nerve, the spinal part is formed between the anterior and posterior roots of the spinal nerves (c2—c5) and partly from the anterior roots of the three superior cervical nerves. The latter join the cerebral part, exit the skull through the jugular foramen, innervating the trapezius and sternocleidomastoid muscles.

Anatomy of the hypoglossal nerve:

- Topography and name of the nuclei — the nucleus of the hypoglossal nerve (motor nucleus), is projected in the region of the triangonum nervi hypoglossi of the rhomboid fossa of the brainstem.
- The exit from the brain is on the border between the pyramid and the olive.
- The exit from the skull is through the canalis nervi hypoglossi.
- They are connected by the lower root of the cervical plexus, forming a cervical loop.
- Area of innervation (muscles of the tongue, muscles located below the hyoid bone, geniohyoid muscle).

METHODOLOGICAL RECOMMENDATIONS FOR STUDYING THE MATERIAL

Activity	Step Description
Read the introduction to the topic	—
Study the corresponding section in literature sources	The study of the topic is accompanied by a demonstration of structural details on a table and diagram
Draw a diagram of the corresponding cranial nerve in your notebook	Use red color pencil for drawing the motor structures, blue one — for the sensory and green one — for the vegetative structures
Revise the openings, channels, grooves on the skull associated with the study of a given nerve	The study of the topic is accompanied by a demonstration of structural details on the skull
Describe the nerve under study	While describing the nerve, check the following: 1) English and Latin names of the nerve; 2) functional characteristics (sensory, motor, vegetative, mixed); 3) location of the nuclei (brain region), their name and functional characteristics; 4) exit of nerve roots at the base of the brain; 5) sensory ganglions; 6) foramens, channel through which the nerve leaves the cranial cavity; 7) branches of the nerve, their topography and areas of innervation

The end of Table

Activity	Step Description
Write down new Latin terms	Put down new Latin terms in your notebook (see the list of Practical skills)
Check your knowledge with self-control questions	Answer the questions given in the assignment

QUESTIONS FOR SELF-CONTROL

VII cranial nerve

1. What is the name of VII cranial nerve?
2. Where are the nuclei of the facial and intermediate nerves located, and what function do they perform?
3. Where is the sensory ganglion of the intermediate nerve located?
4. Name the branches of the facial and intermediate nerves.
5. What does the greater petrosal nerve innervate?
6. What does the chorda tympani innervate?
7. What does the facial nerve innervate?
8. Describe the fiber composition of the facial nerve.
9. Describe the facial nerve formation.
10. What is the intermediate nerve? Describe its fiber composition.
11. Describe the topography of the facial nerve root on the cerebral base.
12. Describe the fiber composition of the greater petrosal nerve.
13. Describe the course of the greater petrosal nerve.
14. Through what opening of the skull does the greater petrosal nerve pass?
15. With which neurons does the greater petrosal nerve synapse?
16. Which nerve joins to the greater petrosal nerve in the pterygoid canal? What is the name of their union?
17. Name the branches of the pterygopalatine ganglion; what do they innervate?
18. Describe the course of the pterygopalatine ganglion branches.
19. What kind of innervation do the pterygopalatine ganglion branches give to the glands? How does it affect the gland`s functioning?
20. Describe the fiber composition of the chorda tympani.
21. Describe the course of the chorda tympani.
22. Through what opening of the skull does the chorda tympani pass?
23. With which neurons do the parasympathetic fibers of the chorda tympani synapse?

24. What organs are innervated by the vegetative fibers of the chorda tympani?

25. What kind of innervation does the chorda tympani give to the glands? How does it affect the gland`s functioning?

26. What organs are innervated by the sensory fibers of the chorda tympani?

27. Describe the fiber composition of the stapedius nerve.

28. Describe the course of the stapedius nerve.

29. What does the stapedius nerve innervate?

30. With which nerves is the facial nerve connected via its communicating branches?

31. Through what opening does the facial nerve leave the skull?

32. Name the branches of the third part of the facial nerve before it enters the parotid gland; what do they innervate?

33. Name the branches of the facial nerve after it exits the parotid gland; what do they innervate?

IX cranial nerve

1. What is the name of the IX cranial nerve?

2. Describe the fiber composition of the IX cranial nerve.

3. Describe the formation of the IX cranial nerve.

4. Name the nuclei of the IX pair of cranial nerves.

5. In what part of the brain are the nuclei of cranial nerves IX located?

6. Where do the fibers of the IX pair of cranial nerves leave the brain?

7. Through which opening does the glossopharyngeal nerve leave the skull?

8. Describe the location of the glossopharyngeal nerve ganglia.

9. Which vessels are located near the glossopharyngeal nerve at the jugular foramen?

10. Name the motor, sensory and mixed branches of the glossopharyngeal nerve.

11. Describe the fiber composition of the lingual branches of the glossopharyngeal nerve? What do they innervate?

12. What is the composition of the tympanic nerve?

13. Describe the course of the tympanic nerve.

14. What nerves form the tympanic plexus?

15. What does the tympanic nerve innervate?

16. Where does the lesser petrosal nerve originate? Describe its fiber composition and course.

17. Through which opening does the lesser petrosal nerve leave the skull?

18. With which neurons does the lesser petrosal nerve synapse?

19. What is the fiber composition of the pharyngeal branches of the glossopharyngeal nerve?

20. What do the pharyngeal branches innervate?

21. What is the fiber composition of the tonsillar branches of the glossopharyngeal nerve?

22. What do the tonsillar branches innervate?

23. With which nerves do the communicating branches of the glossopharyngeal nerve connect?

24. What is the fiber composition of the carotid branch of the glossopharyngeal nerve?

25. What does the carotid branch innervate?

X cranial nerve

1. What is the name of the X cranial nerve?
2. Describe the fiber composition of the X cranial nerve.
3. Describe the formation of the vagus nerve.
4. Where are the nuclei of the vagus nerve located? Name them.
5. Which of the nuclei of the vagus nerve motor (sensory, parasympathetic)?
6. Describe the topography of the vagus nerve root at the cerebral base.
7. Through which opening does the vagus nerve leave the skull?
8. What parts does the vagus nerve have?
9. Name the branches of the head part of the vagus nerve.
10. Name the branches of the cervical part of the vagus nerve.
11. Name the branches of the thoracic part of the vagus nerve.
12. What organs are innervated by the branches of the vagus nerve?
13. Describe the fiber composition of branches of the vagus nerve.

XI cranial nerve

1. What is the name of the XI cranial nerve?
2. Describe the fiber composition of the XI cranial nerve.
3. Describe the formation of the accessory nerve.
4. Where are the nuclei of the accessory nerve located? What are their names and types?
5. Describe the topography of the accessory nerve root at the cerebral base.
6. Through which opening does the accessory nerve leave the skull?
7. What muscles are innervated by the 11^{th} pair of cranial nerves?
8. Is the XI pair of cranial nerves involved in the innervation of the laryngeal muscles?
9. With which nerve does the accessory nerve connect?

XII cranial nerve

1. What is the name of the XII cranial nerve?
2. Describe the fiber composition of the XII cranial nerve.
3. Describe the formation of the hypoglossal nerve.
4. Name the nucleus of the XII pair of cranial nerves. What is its type?
5. What muscles does the hypoglossal nerve innervate?
6. With which nerve does the hypoglossal nerve connect?
7. In what part of the brain is the nucleus of the 12^{th} pair of cranial nerves located?
8. Where do the fibers of the 12^{th} pair of cranial nerves leave the brain?
9. Where do the fibers of the 12^{th} pair of cranial nerves exit the skull?
10. What will be the result of cutting the hypoglossal nerve above the cervical loop?

PRACTICAL SKILLS

Skull

1. Facial canal, *canalis facialis*; лицевой канал.
2. Hiatus of greater petrosal nerve canal, *hiatus canalis nervi petrosi majoris*; расщелина большого каменистого нерва.
3. Hiatus of lesser petrosal nerve canal, *hiatus canalis nervi petrosi minoris*; расщелина малого каменистого нерва.
4. Groove for greater petrosal nerve, *sulcus canalis nervi petrosi majoris*; борозда большого каменистого нерва.
5. Petrotympanic fissura, *fissura petrotympanica*; каменисто-барабанная щель.
6. Lacerum foramen, *foramen lacerum*; рваное отверстие.
7. Pterygoid canal, *canalis pterygoideus*; крыловидный канал.
8. Tympanic canaliculus, *canaliculus tympanicus*; барабанный каналец.
9. Jugular foramen, *foramen jugulare*; яремное отверстие.
10. Groove for lesser petrosal nerve, *sulcus canalis nervi petrosi minoris*; борозда малого каменистого нерва.
11. Petrosquamous fissura, *fissura petrosquamosa*; каменисто-чешуйчатая щель.
12. Pterygopalatine fossa, *fossa pterygopalatina*; крыловидно-небная ямка.

Brain

1. The roots of the VII cranial nerve, *nervus facialis*; лицевой нерв.
2. The roots of the IX cranial nerve, *nervus glossopharyngeus*; языкоглоточный нерв.

3. The roots of the X cranial nerve, *nervus vagus*; блуждающий нерв.

4. The roots of the XI cranial nerve, *nervus accessorius*; добавочный нерв.

5. The roots of the XII cranial nerve, *nervus hypoglossus*; подъязычный нерв.

6. Pons, *pons*; мост.

7. Brain stem, *truncus cerebri*; ствол головного мозга.

8. Medulla oblongata, *medulla oblongata*; продолговатый мозг.

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5. *Lecture* material.

Topic 4
ANATOMY OF THE SPINAL NERVES. CERVICAL AND BRACHIAL PLEXUSES.

INTRODUCTION TO THE TOPIC

Knowledge of the anatomy of the cervical plexus is necessary in the clinic of nervous, surgical and therapeutic diseases. Without it, correct typical diagnosis of spinal cord injuries and diagnosis of cervical plexitis of various etiologies is impossible. Such knowledge also helps to diagnose diseases of the liver ("Phrenicus symptom") and diaphragm.

The diagnostics of the spinal injuries and the damages to the upper limb nerves is based on the anatomy of the brachial plexus. The traumas and neurites of the long branches of the brachial plexus often occur. To know their anatomy is especially important for operations on the bones and soft tissues of the arm. The doctors must know the interrelation between the nerves and surrounding tissues to choose the correct methods of the treatment in case of damages to the upper limb.

Before the study of the topic you should know:

1. Muscles of the neck: classification, origination, attachment, functions.
2. Topography of the neck: regions, triangles, fossae.
3. Muscles of the upper limb: classification, origination, attachment, functions.
4. Topography of the upper limb: fossae, grooves, canals.

SELF-STUDY GOALS

After independently studying the topic, the student should know the structure of the spinal nerve, the principle of formation of its branches, the principle of formation of plexuses, know the formation and areas of innervation of the branches of the cervical nerve plexus. Be able to show the branches on the preparation (pay special attention to the anatomy of the phrenic nerve. After independently studying the material on this topic, the student must know the formation of the nerves of the brachial plexus; student should find, name and be

able to show on a preparation the location, course of the brachial plexus and its branches, relationship with surrounding tissues and vessels, accurately localize the areas of cutaneous innervation by individual nerves, know what nerves innervate individual muscles of the upper limb.

TOPIC CONTENT

- The structure of the spinal nerve, the principle of formation of its branches, the principle of formation of plexuses.
- Anatomy of the branches of the cervical nerve plexus and the area of their innervation:
  - lesser occipital;
  - great auricular;
  - supraclavicular branches;
  - muscle branches;
  - phrenic nerve.
- Anatomy of the brachial plexus (supraclavicular and subclavian parts, lateral, medial and posterior bundles).
- Anatomy of the short branches of the brachial plexus (dorsal scapular nerve, long thoracic nerve, subclavian nerve, suprascapular nerve, subscapular nerve, axillary, medial and lateral pectoral nerves), areas of their innervation.
- Anatomy of the long branches of the brachial plexus, their relationship with vessels, bones and muscles (musculocutaneous, median, ulnar, radial, medial cutaneous nerve of the upper arm, medial cutaneous nerve of the forearm).
- Areas of innervation of the skin and muscles by individual nerves.

METHODOLOGICAL RECOMMENDATIONS FOR STUDYING THE MATERIAL

Activity	Step Description
Read the introduction to the topic	—
Study the corresponding section in literature sources	The study of the topic is accompanied by a demonstration of structural details on a table and diagram
Revise the grooves and canals in which the studied neurovascular formations pass	Open the appropriate section of the textbook and check the topography of the area being studied

The end of Table

Activity	Step Description
Describe the nerve under study	While describing the nerve, check the following: 1) English and Latin names of the nerve; 2) functional characteristics (sensory, motor, vegetative, mixed); 3) the segment of the spinal cord from which the nerve originates; 4) topography of neurovascular formations; (location in muscle canals, grooves, openings, relation to internal organs); 5) main branches of nerves; 6) areas of innervation
If possible, determine the location of the nerve on yourself	—
Write down new Latin terms	Put down new Latin terms in your notebook (see the list of Practical skills)
Check your knowledge with self-control questions	Answer the questions given in the assignment

QUESTIONS FOR SELF-CONTROL

1. Explain the main spinal nerve branches.
2. Describe the zones of innervation of the spinal nerve branches.
3. Describe the composition of spinal nerve branches.
4. From which segments of the spinal cord are the branches of the cervical plexus formed?
5. What is the anatomy and topography of the nerves of the cervical plexus?
6. What is the topography and the area of innervation of the phrenic nerve?
7. Describe the areas of innervation of individual branches of the cervical plexus.
8. What are the sources of the formation of the brachial plexus as a whole and its individual bundles?
9. What is the anatomy and topography of the brachial plexus to the neck and clavicle area?
10. Name and show the short branches of the brachial plexus and indicate the areas of their innervation.
11. Name and show the sources of formation of the long branches of the brachial plexus.

12. What is the anatomy of the median nerve, its branches and area of innervation?

13. What is the anatomy of the ulnar nerve, its branches and area of innervation?

14. What is the anatomy of the radial nerve, its branches and area of innervation?

15. What is the anatomy of the musculocutaneous nerve?

16. Describe the zones of innervation of the cutaneous brachial and antebrachial nerves.

17. What nerves innervate individual areas of the skin and the area of the shoulder girdle and the free part of the upper limb?

18. What nerves innervate individual groups of muscles of the shoulder girdle and free upper limb: forearm flexors, forearm extensors, pronators, supinator, flexors of the hand and fingers, extensors of the hand and fingers?

19. How are the joints of the shoulder girdle and free upper limb innervated?

20. What is the skin of the palmar surface of the hand innervated by?

21. What is the skin of the dorsum of the hand innervated by?

22. What is the flexor muscle of the upper limb innervated by?

23. What are the extensors of the upper limb innervated by?

24. How are the muscles and skin of the shoulder girdle innervated?

25. Fill in the tables:

Table 1

Name of the region	The nerve innervating this area
Skin	
Lateral surface of the upper arm	
Medial surface of the upper arm	
Posterior surface of the upper arm	
Lateral surface of the forearm	
Medial surface of the forearm	
Posterior surface of the forearm	
Dorsum of the hand	
Palm of the hand	
Muscle group	
Anterior group of shoulder girdle muscles	
The posterior group of the shoulder girdle muscles	
Posterior group of upper arm muscles	

The end of Table 1

Name of the region	The nerve innervating this area
Anterior group of upper arm muscles	
Posterior group of forearm muscles	
Anterior group of forearm muscles	
The muscles of the thenar	
The muscles of the hypothenar	
The middle group of the hand muscles	

Table 2

Topographic formations of the upper limb	Anatomical structures that form them	Neurovascular structures located or passing through them
Axillary cavity		
Foramen trilaterum		
Framen quadrelaterum		
Humeromuscular canal		
Medial bicipital groove		
Lateral bicipital groove		
Cubital fossa		
Median groove of the forearm		
Ulnar groove of the forearm		
Radial groove of the forearm		
Carpal tunnel		

PRACTICAL SKILLS

1. Spinal nerve, *nervus spinalis*; спинномозговой нерв.
2. Cervical plexus, *plexus cervicalis*; шейное сплетение.
3. Phrenic nerve, *nervus phrenicus*; диафрагмальный нерв.
4. Lesser occipital nerve, *nervus occipitalis minor*; малый затылочный нерв.
5. Great auricular nerve, *nervus auricularis magnus*; большой ушной нерв.
6. Transverse cervical nerve, *nervus transversus colli*; поперечный нерв шеи.
7. Supraclavicular nerves, *nervi supraclaviculares*; надключичные нервы.
8. Brachial plexus, *plexus brachialis*; плечевое сплетение.
9. Long thoracic nerve, *nervus thoracicus longus*; длинный грудной нерв.

10. Lateral and medial pectoral nerves, *nervi pectorales lateralis et medialis*; латеральный и медиальный грудные нервы.

11. Subscapular nerve, *nervus subscapularis*; подлопаточный нерв.

12. Medial brachial cutaneous nerve, *nervus cutaneus brachii medialis*; медиальный кожный нерв плеча.

13. Medial antebrachial cutaneous nerve, *nervus cutaneus antebrachii medialis*; медиальный кожный нерв предплечья.

14. Ulnar nerve, *nervus ulnaris*; локтевой нерв.

15. Median nerve, *nervus medianus*; срединный нерв.

16. Musculocutaneous nerve, *nervus musculocutaneus*; мышечно-кожный нерв.

17. Axillary nerve, *nervus axillaris*; подмышечный нерв.

18. Radial nerve, *nervus radialis*; лучевой нерв.

19. Dorsal scapular nerve, *nervus dorsalis scapulae*; дорсальный нерв лопатки.

20. Suprascapular nerve, *nervus suprascapularis*; надлопаточный нерв.

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4. *Atlas* of Human Anatomy / Frank H. Netter. — 6th ed. — Philadelphia : Elsevier, 2014. — 531 p., ill.

5. *Lecture* material.

Topic 5
INTERCOSTAL NERVES. LUMBOSACRAL PLEXUS

INTRODUCTION TO THE TOPIC

The anterior branches of the spinal nerves innervate the walls of the chest and abdominal cavity. Knowledge of this section is necessary for surgeons, therapists, and neurologists in connection with damage to the organs of the thoracic cavity.

Knowledge of the educational material of this topic allows to correctly make a topical diagnosis in the traumatology departments of hospitals and in the clinic of nervous diseases with frequent injuries and diseases of the branches of the lumbosacral plexus. In addition, the study of this topic allows to better understand the general patterns of development and distribution of peripheral nerves.

For the correct diagnosis of wounds, injuries, diseases, knowledge of the topographic and anatomical relationships of nerves, muscles of the lower limb, the principles of innervation is necessary.

Before the study of the topic you should know:

1. Skeleton of the chest, pelvic girdle, free lower limbs.
2. Muscles of the chest: classification, origination, attachment, functions.
3. Muscles of the lower limb: classification, origination, attachment, functions.
4. Topography of the lower limb: fossae, grooves, canals.
5. The formation of spinal nerves.

SELF-STUDY GOALS

After self-study of the material of this topic, the student should: name the branches of the lumbosacral plexus in English and Latin, show the lumbosacral plexus and its nerves on the cadavedr, know the topography and the areas of innervation of the lumbosacral plexus branches, be able to identify the branches of the lumbosacral plexus.

Know the topographic and anatomical relationships of the nerves, group innervation of muscles, be able to show main nerve branches, muscles on the cadaver. Students should determine the place of projection of the nerves on the lower limb of a living person.

TOPIC CONTENT

- Topography and areas of innervation of the intercostal nerves.
- Topography and areas of innervation of the lumbar plexus branches: muscular branches; iliohypogasrtic nerve; ilioinguinal nerve; genitofemoral nerve and its branches; lateral cutaneous nerve of the thigh; femoral nerve and its branches; obturator nerve.
- Topography and areas of innervation of short branches of the sacral plexus: muscle branches; superior gluteal nerve; inferior gluteal nerve; pudendal nerve and its branches.
- Topography and areas of innervation of the long branches of the sacral plexus: posterior cutaneous nerve of the thigh; sciatic nerve and its terminal branches — tibial and common peroneal nerves.
- Topography and areas of innervation of the tibial nerve: nervus cutaneous surae medialis; medial plantar nerve and its terminal branches; lateral plantar nerve and its terminal branches, topography and zones of innervation of the common peroneal nerve branches, sural nerve.
- Revise the skeleton, bone connections, muscles, topography of the pelvic area and the free lower limb.
- Innervation of the pelvic girdle and the free lower limb muscles and skin.

METHODOLOGICAL RECOMMENDATIONS FOR STUDYING THE MATERIAL

Activity	Step Description
Read the introduction to the topic	—
Study the corresponding section in literature sources	The study of the topic is accompanied by a demonstration of structural details on a table and diagram
Revise the grooves and canals in which the studied neurovascular formations pass	Open the appropriate section of the textbook and check the topography of the area being studied
Describe the nerve under study	While describing the nerve, check the following: 1) English and Latin names of the nerve; 2) functional characteristics (sensory, motor, vegetative, mixed); 3) the segment of the spinal cord from which the nerve originates; 4) topography of neurovascular formations. (location in muscle canals, grooves, openings, relation to internal organs); 5) main branches of nerves; 6) areas of innervation

The end of Table

Activity	Step Description
If possible, determine the location of the nerve on yourself	—
Write down new Latin terms	Put down new Latin terms in your notebook (see the list of Practical skills)
Check your knowledge with self-control questions	Answer the questions given in the assignment

QUESTIONS FOR SELF-CONTROL

1. Which spinal nerves form the intercostal nerves?
2. Describe the topography of the intercostal nerves.
3. Describe the intercostal nerves zones of innervation.
4. Which spinal nerves form the lumbar plexus?
5. Describe the iliohypogastric nerve: topography, branches and zones of innervation.
6. Describe the ilioinguinal nerve: topography, branches and zones of innervation.
7. Describe the genitofemoral nerve: topography, branches and zones of innervation.
8. Describe the obturator nerve: topography, branches and zones of innervation.
9. Describe the lateral cutaneous nerve of the thigh: topography, branches and zones of innervation.
10. Which nerve of the lumbar plexus participates in the innervation of the abdominal wall muscles?
11. Which nerves of the lumbar plexus innervate the skin of the anterior surface of the thigh?
12. What nerves pass through the inguinal canal?
13. Describe the femoral nerve: topography, branches and zones of innervation.
14. Describe the saphenus nerve: origin, topography and composition. What region does it supply?
15. Which spinal nerves form the sacral plexus?
16. Describe the short branches of sacral plexus: topography, branches and zones of innervation.
17. Describe the ischiadicus nerve: topography, branches and zones of innervation.

18. Which nerve innervates the skin of the lateral surface of the thigh?
19. Which nerve innervates the back of the thigh?
20. Which nerves innervate the anterior thigh surface?
21. Which nerve innervates the medial thigh surface?
22. Which nerves innervate the skin of the leg?
23. Which cutaneous nerves innervate the dorsum of the foot?
24. Which cutaneous nerves innervate the sole of the foot?
25. Through what formation does the obturator nerve pass?
26. Through what formation does the femoral nerve exit to the thigh?
27. What nerves innervate the pelvic muscles?
28. What nerves innervate: the anterior group of the thigh muscles? The posterior group of the thigh muscles? Medial thigh muscle group? The posterior group of the leg muscles? The anterior group of the leg muscles? The lateral group of the leg muscles? The dorsal muscles of the foot? The muscles of the sole?
29. Through what formation does the upper gluteal nerve pass? The inferior gluteal nerve? The pudendal nerve?
30. In which channel does the tibial nerve pass? Superficial fibular nerve?
31. Describe the borderlines of the channels, groves, fossae of the lower limbs.
32. In which grooves does the medial plantar nerve pass?
33. In which grooves does the lateral plantar nerve pass?
34. In which of the lacunae does the femoral nerve pass?
35. Describe the sources of innervation of the muscles of the thigh, leg, foot in groups.
36. Fill in the tables:

Table 1

Topographic formations of the lower limb	Anatomical structures that form them	Neurovascular structures located or passing through them
Suprapiriform foramen		
Infrapiriform canal		
Obturator channel		
Lacuna musculorum		
Femoral triangle		
Adductor channel		
Popliteal fossa		
Cruropopliteal canal		
Upper musculoperoneal canal		

The end of Table 1

Topographic formations of the lower limb	Anatomical structures that form them	Neurovascular structures located or passing through them
Lower musculoperoneal canal		
Medial plantar groove		
Lateral plantar groove		

Table 2

Name of the region	The nerve innervating this area
Skin	
Buttocks	
The front surface of the thigh	
The posterior surface of the thigh	
The lateral surface of the thigh	
The medial surface of the thigh	
The medial surface of the leg	
The lateral surface of the leg	
The plantar and dorsal foot surfaces	
Muscles	
Anterior thigh muscle group	
Posterior thigh muscle group	
Medial thigh muscle group	
Lateral led muscle group	
Posterior leg muscle group	
Anterior leg muscle group	
Dorsal foot muscles	
Plantar foot muscles	

Practical Skills

1. Intercostal nerve, *nervus intercostalis*; межреберный нерв.
2. Lumbar plexus, *plexus lumbalis*; поясничное сплетение.
3. Sacral plexus, *pexus sacralis*; крестцовое сплетение.
4. Iliohypogastric nerve, *nervus iliohypogastricus*; позвздошно-пояснич-ный нерв.
5. Ilioinguinal nerve, *nervus ilioinguinalis*; подвздошно-паховый нерв.

6. Genitofemoral nerve, *nervus genitofemoralis*; бедренно-половой нерв.

7. Lateral cutaneous nerve of thigh, *nervus cutaneous femoris lateralis*; латеральный кожный нерв бедра.

8. Obturator nerve, *nervus obturatorius*; запирательный нерв.

9. Femoral nerve, *nervus femoralis*; бедренный нерв.

10. Saphenus nerve, *nervus saphenus*; подкожный нерв.

11. Sciatic nerve, *nervus ischiadicus*; седалищный нерв.

12. Superior gluteal nerve, *nervus gluteus superior*; верхний ягодичный нерв.

13. Inferior gluteal nerve, *nervus gluteus inferius*; нижний ягодичный нерв.

14. Pudendal nerve, *nervus pudendus*; половой нерв.

15. Posterior cutaneous nerve of the thigh, *nervus cutaneous femoris superior*; задний кожный нерв бедра.

16. Tibial nerve, *nervus tibialis*; большеберцовый нерв.

17. Medial plantar nerve, *nervus plantaris medialis*; медиальный подошвенный нерв.

18. Lateral plantar nerve, *nervus plantaris lateralis*; латеральный подошвенный нерв.

19. Superficial fibular (peroneal) nerve, *nervus fibularis (peroneus) superficialis*; поверхностный малоберцовый нерв.

20. Deep fibular (peroneal) nerve, *nervus fibularis (peroneus) profundus)*; глубокий малоберцовый нерв.

21. Common fibular (peroneal) nerve, *nervus fibularis (peroneus) communis*; общий малоберцовый нерв.

Literature

1. *Human* anatomy: 2 vol. / M. Prives, N. Lysenkov, V. Bushkovich. — Moscow : Mir Publishers, 1985. — Vol. 2. — 439 p., ill.

2. *Textbook* of Human Anatomy. In 3 vol. Vol. 3. Nervous system. Esthesiology / L. L. Kolesnikov, D. B. Nikitiuk, S. V. Klochkova, I. G. Stelnikova. — Moscow : GEOTAR-Media, 2018. — 216 p.

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5. *Lecture* material.

Topic 6
MAJOR CONTROL: PERIPHERAL NERVOUS SYSTEM

INTRODUCTION TO THE TOPIC

This lesson provides a summary and review of the studied material in peripheral nervous system, helping students to reinforce their understanding of key concepts.

SELF-STUDY GOALS

After revising the topic material, the student should be able to complete a major computer test on LMS, know the features of the topography, the areas of innervation of the cranial and spinal nerves; be able to identify all the anatomical structures on the models and preparations. The student should know the theoretical aspects of this topic (development, anomalies, patterns of structures, etc.).

TOPIC CONTENT

REVISE:

- Classification of cranial nerves (lecture material).
- Topography of cranial nerve nuclei.
- Features of the course of cranial nerves and their branches.
- Areas of innervation of cranial nerves.
- Features of the topography of the upper and lower extremities.
- Features of the course of the upper limb nerves and their branches.
- Features of the course of the lower limb nerves and their branches.
- Features of the course of the cervical plexus nerves and their branches.
- Features of the course of the intercostal nerves and their branches.
- Areas of innervation of spinal nerves.
- Latin terms (see the list of practical skills: Topic 1—5).

METHODOLOGICAL RECOMMENDATIONS FOR STUDYING THE MATERIAL

Activity	Step Description
Read the introduction to the topic	—
Study the corresponding section in literature sources	The study of the topic is accompanied by a demonstration of structural details on a table and diagram
Draw a diagram of the corresponding cranial nerve in your notebook	Use red color pencil for drawing the motor structures, blue one — for the sensory and green one — for the vegetative structures
Revise the openings, channels, grooves on the skull associated with the study of a given nerve	The study of the topic is accompanied by a demonstration of structural details on the skull
Describe the nerve under study	While describing the nerve, check the following: 1) English and Latin names of the nerve; 2) functional characteristics (sensory, motor, vegetative, mixed); 3) location of the nuclei (brain region), their name and functional characteristics; 4) exit of nerve roots at the base of the brain; 5) sensory ganglions; 6) foramens, channel through which the nerve leaves the cranial cavity; 7) branches of the nerve, their topography and areas of innervation
Write down new Latin terms	Put down new Latin terms in your notebook (see the list of Practical skills)
Check your knowledge with self-control questions	Answer the questions given in the assignment

QUESTIONS FOR MAJOR PERIPHERAL NERVOUS SYSTEM

1. Describe the pathway of the olfactory analyzer.
2. Describe the pathway of the stato-kinetic analyzer.
3. Describe the pathway of the visual analyzer.
4. Describe the pathway of the auditory analyzer.
5. Where are the neurons of the visual analyzer located?

6. Where are the nuclei of the oculomotor, trochlear, abducens nerves located? Through which opening do these nerves enter the orbit?

7. What muscles of the eyeball are innervated by the oculomotor, trochlear, abducens nerves?

8. What nuclei does the trigeminal nerve have? Where are they located?

9. What is the functional significance of the trigeminal nerve?

10. What branches does the trigeminal nerve have? Through what openings do they leave the cranial cavity?

11. What is the area of innervation of the ophthalmic nerve? Maxillary nerve? Mandibular nerve? What vegetative ganglions connected with trigeminal nerve branches do you know and where are they located?

12. What muscles does the motor part of the trigeminal nerve innervate?

13. Where are the nuclei of the facial and intermediate nerves located, and what function do they perform?

14. Where is the sensory ganglion of the intermediate nerve located?

15. Name the branches of the facial and intermediate nerves.

16. What does the greater petrosal nerve innervate?

17. What does the chorda tympani innervate?

18. What does the facial nerve innervate?

19. What parts does the vestibulocochlear nerve consist of, and what function do they perform?

20. Where are the vestibular and spiral ganglia located?

21. What nuclei and pathways are involved in the auditory start reflex?

22. Name the nuclei of the IX pair of cranial nerves. In what part of the brain are the nuclei of cranial nerves IX located? Where do the fibers of the IX pair of cranial nerves leave the brain? Where do the fibers of the IX pair of cranial nerves leave the skull?

23. What does the glossopharyngeal nerve innervate?

24. What does the vagus nerve innervate? Explain its nuclei, branches, functions.

25. Name the nuclei, branches of the XI pair of cranial nerves. What muscles are innervated by the 11^{th} pair of cranial nerves?

26. Is the XI pair of cranial nerves involved in the innervation of the laryngeal muscles?

27. Name the nuclei, branches of the XII pair of cranial nerves.

28. What does the hypoglossal nerve innervate?

29. Describe the main spinal nerve branches: formation, composition, zones of innervation.

30. Name and show the branches of the cervical plexus and indicate the areas of their innervation.

31. Name and show the branches of the intercostal nerves and indicate the areas of their innervation.

32. What are the sources of the formation of the brachial plexus as a whole and its individual bundles?

33. What is the anatomy and topography of the brachial plexus?

34. Name and show the short branches of the brachial plexus and indicate the areas of their innervation.

35. Name and show the sources of the formation of long branches of the brachial plexus.

36. What is the anatomy of the median nerve, its branches and the area of innervation?

37. What is the anatomy of the ulnar nerve, its branches and the area of innervation?

38. What is the anatomy of the radial nerve, its branches and the area of innervation?

39. What is the anatomy of the musculocutaneous nerve and the area of innervation?

40. What nerves innervate individual areas of the skin of the shoulder girdle and free upper limb?

41. Describe the innervation of individual muscle groups of the shoulder girdle and free upper limb.

42. What is the innervation of the joints of the shoulder girdle and the free upper limb?

43. From which spinal nerves is the lumbar plexus formed? Sacral plexus?

44. Name the branches of the lumbar plexus. Which spinal segments give rise to the nerves of the lumbar plexus? Describe the topography of the plexus.

45. What muscles are innervated by the branches of the lumbar plexus?

46. Name the branches of the sacral plexus (short and long). Which spinal segments give rise to the nerves of the sacral plexus? Describe the topography of the plexus.

47. What muscles are innervated by the short branches of the sacral plexus?

48. Describe the areas innervated by the long branches of the sacral plexus.

49. Describe the innervation of the all muscle groups of the thigh.

50. Describe the innervation of the all muscle groups of the leg.

51. Describe the innervation of the all muscle groups of the foot.

52. Describe the skin innervation of the thigh.

53. Describe the cutaneous innervation of the leg.

54. Describe the cutaneous innervation of the foot.

55. What nerves innervate individual areas of the skin of the pelvic girdle.

56. Describe the innervation of individual muscle groups of the pelvic girdle.

Literature

1. *Human* anatomy: 2 vol. / M. Prives, N. Lysenkov, V. Bushkovich. — Moscow : Mir Publishers, 1985. — Vol. 2. — 439 p., ill.

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4. *Atlas* of Human Anatomy / Frank H. Netter. — 6th ed. — Philadelphia : Elsevier, 2014. — 531 p., ill.

5. *Lecture* material.

6. *List* of practical skills: Topic 1—4.

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Methodological recommendations for students of medicine

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