Ministry of Education and Science of Ukraine
Ministry of Health of Ukraine
Sumy State University

PERIPHERAL NERVOUS SYSTEM

Study guide

Edited by Doctor of Biological Sciences,
Professor V. I. Bumeister

Recommended by Academic Council of Sumy State University

Sumy
Sumy State University
2019

УДК 611.83(075.8)
Р43

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Recommended for publication
by Academic Council of Sumy State University
as study guide
(minutes № 12 of 22.05.2019)

Р43 **Peripheral** Nervous System : study guide / O. S. Yarmolenko, L. G. Sulim, O. O. Prykhodko, S. M. Dmytruk ; edited by Doctor of Biological Sciences, Professor V. I. Bumeister. – Sumy : Sumy State University, 2019. – 183 p.
ISBN 978-966-657-766-8

This study guide is intended for the students of medical higher educational institutions of IV accreditation level who study Human Anatomy in the English language.

УДК 611.83(075.8)

ISBN 978-966-657-766-8

CONTENTS P.

INTRODUCTION

Human anatomy is a scientific study of the human body structure taking into consideration all its functions and mechanisms of its development.

Studying the structure of separate organs and systems in close connection with their functions, anatomy considers a person's organism as a unit which develops based on the regularities under the influence of internal and external factors during the whole process of evolution.

The purpose of this subject is to study the structure of organs and systems of a person, features of the body structure in comparison with animals revealing the anatomic frames of the age, sexual and individual variability, to study the adaptation of the form and structure of the organs to varying conditions of function and existence. Such functional and anatomic, evolutionary and causal treatment of the information about morphological features of a human organism has huge value for clinical manifestation in the anatomy course as it promotes comprehension of the nature of a healthy and sick person.

This educational and methodical practical work is based on the sample of educational and working programs on human anatomy according to the credit-modular system of the educational process organization. It is directed toward the assistance to the students and teachers in the organization and realization of the most effective methods of studying and teaching this subject.

GENERAL PART

MODULE 4. THE PERIPHERAL NERVOUS SYSTEM

LECTURE PLAN

1. The Cranial and Spinal Nerves.
2. The Autonomic Nervous System.

SCHEDULE OF THE PRACTICAL CLASSES

Topic 1. The peripheral part of the nervous system. The cranial nerves. The first and second branches of the trigeminal nerve.

Topic 2. The third branch of the trigeminal nerve.

Topic 3. The facial and glossopharyngeal nerves.

Topic 4. The vagus and the accessory nerves.

Topic 5. The hypoglossal nerve. The spinal nerves. The posterior branches of the spinal nerves. The cervical plexus.

Topic 6. The short and long branches of the brachial plexus.

Topic 7. The long branches of the brachial plexus.

Topic 8. The anterior branches of the thoracic nerves. The lumbar plexus.

Topic 9. The sacral plexus.

Topic 10. The autonomic part of the nervous system. The parasympathetic division of the autonomic nervous system.

Topic 11. The sympathetic division of the autonomic nervous system. The autonomic plexuses of the abdominopelvic cavity.

Topic 12. The test in PNS and autonomic division.

I. THE PERIPHERAL PART OF THE NERVOUS SYSTEM. THE CRANIAL NERVES. THE FIRST, SECOND AND THIRD BRANCHES OF THE TRIGEMINAL NERVE

The peripheral nervous system (PNS) consists of nerves that arise from the central nervous system (CNS) and connect it to other body parts.

The PNS includes:

– the cranial nerves which begin from the brain;

– the spinal nerves which arise from the spinal cord.

Also the PNS is subdivided into the somatic and autonomic nervous systems.

The somatic nervous system consists of the cranial and spinal nerve fibers that connect the CNS to the skin and skeletal muscles; it controls conscious activities. The autonomic nervous system includes fibers that connect the CNS to viscera.
It controls unconscious activities.

There are twelve pairs of cranial nerves. Their roots are found on the ventral surface of the brain:

the first pair of cranial nerves, **the olfactory nerve (I)**;
the second pair of cranial nerves, **the optic nerve (II)**;
the third pair of cranial nerves**, the oculomotor nerve (III)**;
the fourth pair of cranial nerves, **the trochlear nerve (IV)**;
the fifth pair of cranial nerves, **the trigeminal nerve (V)**;
the sixth pair of cranial nerves, **the abducens nerve (VI)**;
the seventh pair of cranial nerves**, the facial nerve (VII)**;
the eighth pair of cranial nerves, **the vestibulocochlear nerve (VIII)**;
the ninth pair of cranial nerves, **the glossopharyngeal nerve (IX)**;
the tenth pair of cranial nerves, **the vagus nerve (X)**;
the eleventh pair of cranial nerves, **the accessory nerve (XI)**;
the twelfth pair of cranial nerves, **the hypoglossal nerve (XII)**.

Table 1 – Topographycal and functional organization of cranial nerves

ORIGIN	NAME	FUNCTION
1	2	3
Telenaphalon	The olfactory nerve (I)	Special sensory for smell
Diencephalon	The optic nerve (II)	Special sensory for vision
Mesencephalon	The oculomotor nerve (III)	– Motor supply to all extraocular muscles except superior oblique and lateral rectus muscles. – Parasympathetic motor supply to ciliary and constrictor pupillae muscles
	The trochlear nerve (IV)	Motor supply to superior oblique muscle
Pons	The trigeminal nerve (V)	– General sensory from skin and mucous membranes of the face, forehead, anterior scalp, nasal and oral cavities, conjunctiva, paranasal sinuses, teeth, anterior two thirds of tongue and part of the external surface of the tympanic membrane, the dura matter of anterior and middle cranial fossae. – Motor supply to muscles of mastication, tensores tympani and veli palatini, mylohyoid and anterior belly of digastric muscles
	The abducens nerve (VI)	Motor supply to lateral rectus muscle of the eye

Continuation of the table 1

1	2	3
	The facial nerve (VII)	– General sensory from skin of auricle, behind the external ear, and external tympanic membrane. – Special sensory for taste from anterior two-thirds of the tongue. – Motor supply to muscles of facial expression. – Parasympathetic supply to lacrimal glands, oral and nasal mucosa, submandibular and sublingual glands.
	The vestibulocochlear nerve (VIII)	Special sensory for balance and hearing
Medulla oblongata	The glossopharyngeal nerve (IX)	– General sensory from posterior one-third of tongue, tonsil, tympanic cavity, and pharynx, from the carotid body and sinus. – Special sensory for taste from posterior one-third of the tongue. – Motor supply to stylopharyngeus muscle. – Parasympathetic supply to the parotid gland
	The vagus nerve (X)	– General sensory from skin behind the external ear, posterior meninges, posterior wall of external acoustic meatus, larynx, pharynx,

Continuation of the table 1

1	2	3
		and thoracic and abdominal viscera. – Motor supply to pharyngeal (except stylopharyngeal) and laryngeal muscles. – Parasympathetic supply to smooth muscles and glands of the pharynx, larynx, and thoracic, and abdominal viscera, and cardiac muscle
	The accessory nerve (XI)	Motor supply to sternocleidomas toid and trapezius muscles
	The hypoglossal nerve (XII)	Motor supply to intrinsic and extrinsic muscles of the tongue except palatoglossus

I, II, III, IV, V, VI, and VIII pairs of cranial nerves are closely connected with sense organs and their topography and responsibility areas have been described in our study guide "Central nervous system. Sense organs".

THE TRIGEMINAL (V) CRANIAL NERVE

The fifth pair of cranial nerve, the trigeminal nerve (V) is the largest cranial nerve. It is a mixed nerve.

There are four following nuclei of trigeminal nerve (Fig. 1), locating on the dorsal surface of the pons:

1) principal nucleus (nucleus pontinus nervi trigemini), it accepts tactile sensation from the face region;

2) mesencephalic nucleus (nucleus mesencephalicus nervi trigemini), it accepts proprioceptive sensation from the mimic and masticatory muscles, palatine muscles, tensor tympani and suprahyoid muscles;

3) spinal nucleus (nucleus spinalis nervi trigemini), it accepts pain and temperature sensations from the face region;

4) motor nucleus (nucleus motorius nervi trigemini).

The trigeminal nerve emerges between the pons and middle cerebellar peduncle as a large sensory root and a smaller motor root. Its sensory ganglion (the trigeminal or gasserian ganglion) is situated in the trigeminal cave (Meckel's cavity), on the apex of pyramid of the temporal bone (Fig. 2).

The Gasserian ganglion contains pseudounipolar sensory neurons. The central processes of these neurons constitute the sensory root of the trigeminal nerve, which enters the pons at its midlateral point and terminate by synapsing with second-order sensory neurons in the appropriate region of the sensory trigeminal nuclei. Their peripheral processes form three branches (Fig. 3):

1. THE OPHTHALMIC NERVE.
2. THE MAXILLARY NERVE.
3. THE MANDIBULAR NERVE.

Axons from motor trigeminal nerve nucleus travel with the mandibular nerve.

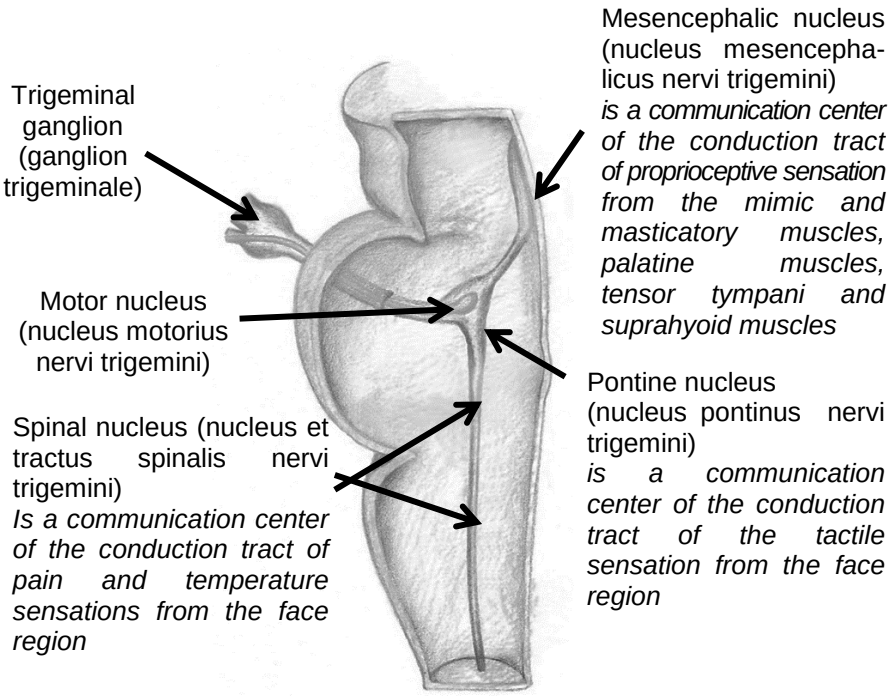

Figure 1 – Location of the trigeminal nerve nuclei

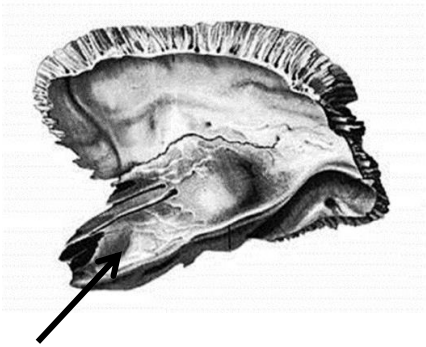

Figure 2 – The trigeminal impression

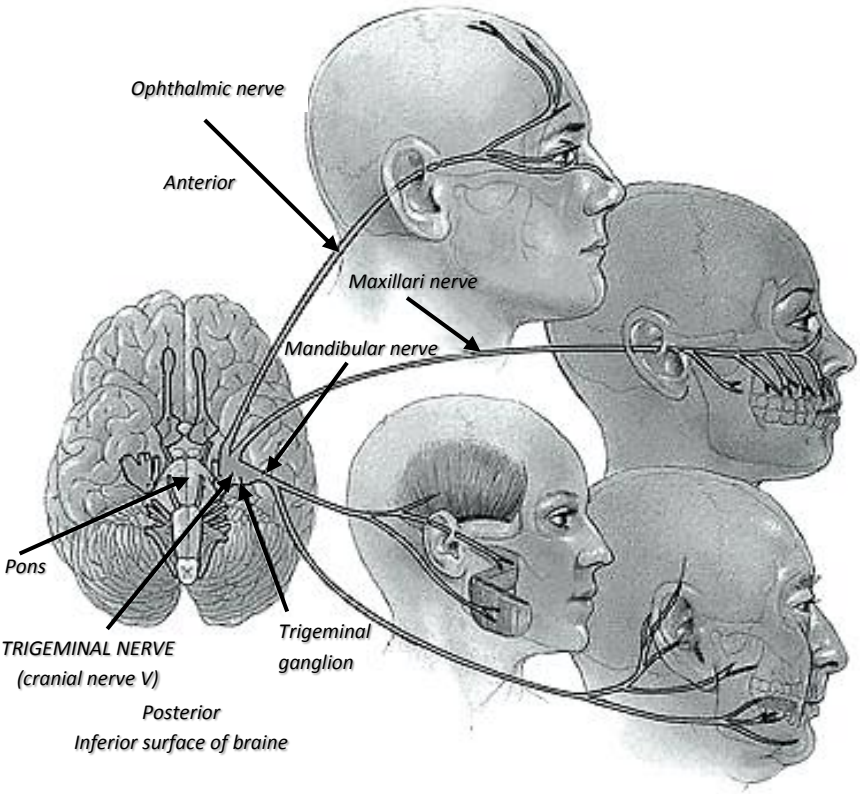

Figure 3 – Branches of trigeminal nerve

THE OPHTHALMIC NERVE

(Fig. 4) is purely sensory. From trigeminal ganglion it courses in lateral wall of cavernous sinus interior to CN IV, enters orbit through superior orbital fissure.

Before living cavernous sinus, it is divided into the following branches:

1. **Meningeal branch.** It innervates dura of cavernous sinus, sphenoid wing, anterior cranial fossa, Meckel's cavity, tentorium cerebelli, posterior falx cerebri, and dural venous

sinuses. This branch does not exit via the superior orbital fissure.

2. **Frontal nerve**. It enters orbit and divides into ***supraorbital nerve*** (innervates frontal sinuses, skin of forehead) and ***supratrochlear nerve*** (innervates medial conjunctiva, medial upper eyelid, forehead, side of nose).

3. **Lacrimal nerve**. It enters orbit and innervates lateral conjunctiva and skin near lacrimal gland. It receives postganglionic parasympathetic fibers from pterygopalatine ganglion for lacrimation from zygomatic nerve of CN V (maxillary division).

4. **Nasociliary nerve**. It enters the orbit and has several branches:

- ***infratrochlear nerve*** **–** innervates lacrimal sac, caruncle, conjunctiva, and skin of medial angle of orbital fissure;
- ***anterior and posterior ethmoidal nerves*** – innervate ethmoidal air cells, sphenoidal sinus, anterior portion of nasal mucosa;
- ***long ciliary nerves*** carry sensation from eyeball tunics;
- ***short ciliary nerves*** carry sensation from the eyeball. They also convey postganglionic parasympathetic fibers from the ciliary ganglion to the sphincter pupillae and ciliary muscles;
- ***sensory root of ciliary ganglion.***

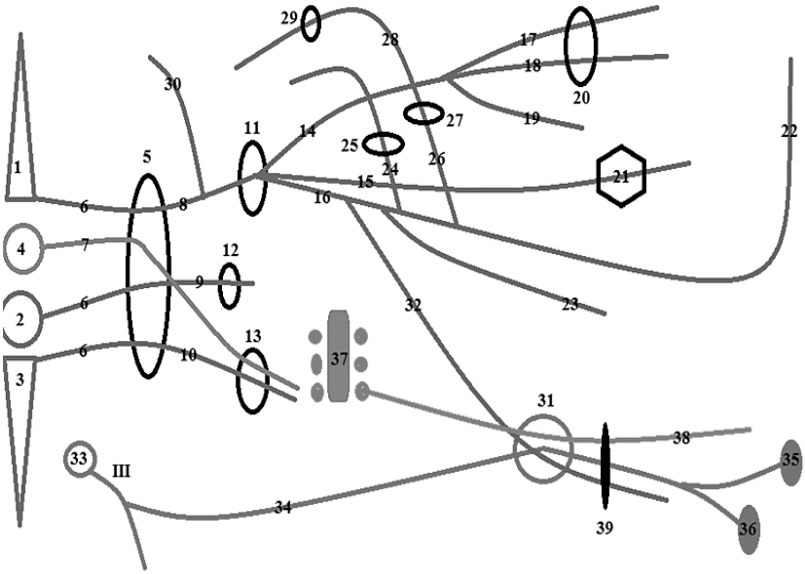

Figure 4 – The 1st branch of trigeminal nerve (ophthalmic nerve): 1 – nucl. tractus mesencephali, 2 – nucl. pontis, 3 – nucl. tractus spinalis, 4 – nucl. motorius, 5 – gangl. trigeminale, 6 – sensory root (major portion), 7 – motor root (minor portion), 8 – ophthalmic nerve, 9 – maxillary nerve, 10 – mandibular nerve (mixed), 11 – superior orbital fissure, 12 – foramen rotundum, 13 – foramen ovale, 14 – frontal nerve, 15 – lacrimal nerve, 16 – nasociliary nerve, 17 – medial ramus, 18 – supraorbital nerve, 19 – supratrochlear nerve, 20 – supraorbital notch, 21 – lacrimal gland, 22 – infratrochlear nerve, 23 – long ciliary nerve, 24 – posterior ethmoidal nerve, 25 – posterior ethmoidal foramen, 26 – anterior ethmoidal nerve, 27 – anterior ethmoidal foramen, 28 – meningeal ramus, 29 – cribriform plate, 30 – meningeal ramus, 31 – ciliary ganglion, 32 – long branch, 33 – accessory nucleus, 34 – short branch, 35 – sphincter pupillae muscle, 36 – ciliary muscle, 37 – cavernous plexus, 38 – dilator pupillae muscle, 39 – short ciliary nerve

Thus, the ophthalmic nerve provides sensory innervation to:

- lacrimal gland;
- lacrimal sac;
- eyeball;
- upper eyelid;
- mucosa of frontal, sphenoidal sinuses, ethmoidal air cells, anterior half of nasal cavity;
- skin of forehead and dorsum of nose.

MAXILLARY NERVE

It is purely sensory.

Middle meningeal nerve (Fig. 5) is given off from the maxillary nerve after its origin from the trigeminal ganglion. It innervates the dura matter of middle cranial fossa.

The maxillary nerve leaves the skull via foramen rotundum and enters the pterygopalatine fossa, where it branches into:

1. Infraorbital nerve
2. Zygomatic nerve
3. Ganglionic branches

The infraorbital nerve enters orbit via inferior orbital fissure. Then it travels under orbital periosteum; then it passes through the infraorbital canal, exits via the infraorbital foramen and innervates the midportion of the face.

Before the infraorbital canal the infraorbital nerve gives off: ***posterior superior alveolar nerves*** to maxillary sinus, molar teeth of maxilla and adjacent gums and cheek.

Inside the infraorbital canal it gives off ***middle superior alveolar nerves*** to maxillary sinus, maxillary premolar teeth and ***anterior superior alveolar nerves*** to the maxillary incisor and canine teeth. Both form the ***superior dental plexus***.

After the infraorbital canal the maxillary nerve immediately splits into three branches (**pes anserinus minor**):

- ***inferior palpebral branch*** to lower eyelid skin and conjunctiva;
- ***external nasal branches*** to the side of nose;
- ***superior labial branches*** to the upper lip.

The zygomatic nerve enters the orbit via the inferior orbital fissure, and gives off two branches:

- ***zygomaticotemporal***, it traverses a canal in zygomatic bone and passes through the zygomaticotemporal foramen in the zygomatic bone to enter the temporal fossa where it innervates the skin of the side of the forehead and the angle of the orbit;
- ***zygomaticofacial***, it runs along lateral wall of the orbit and passes through the zygomaticofacial foramen in the zygomatic bone and innervates the side and the prominence of the cheek.

Postganglionic parasympathetic fibers from the pterygopalatine ganglion join the zygomatic nerve and follow it into the inferior orbital foramen, travel with the zygomaticotemporal nerve and then connect with fibers of the lacrimal nerve, providing the lacrimal gland with secretomotor innervation.

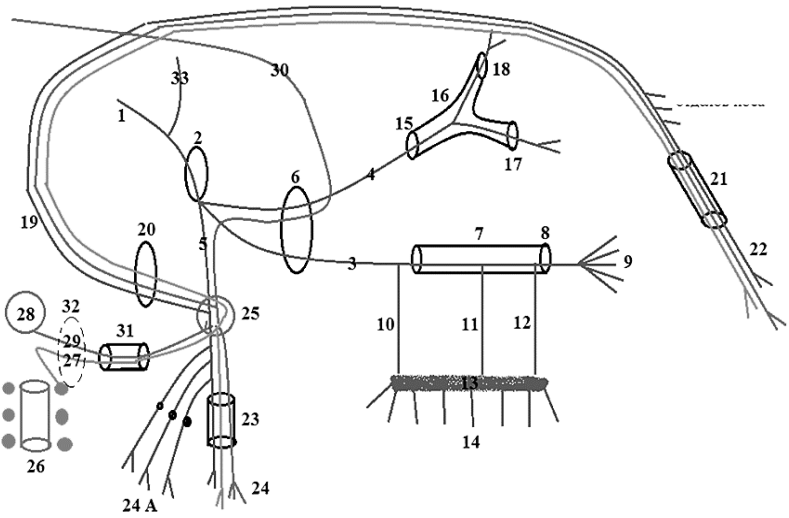

Figure 5 – The 2nd branch of trigeminal nerve (maxillary nerve): 1 – maxillary nerve, 2 – foramen rotundum, 3 – infraorbital nerve, 4 – zygomatic nerve, 5 – palatine nerves, 6 – inferior orbital fissure, 7 – infraorbital canal, 8 – infraorbital foramen, 9 – pes anserinus minor, 10 – superior posterior alveolar nerves, 11 – middle superior alveolar nerves, 12 – anterior superior alveolar nerves, 13 – superior dental plexus, 14 – superior dental and gyngival rami, 15 – zygomatico-orbital foramen, 16 – zygomatic canal, 17 – zygomatico-facial foramen, 18 – zygomatico-temporal foramen, 19 – posterior nasal nerve, 20 – sphenopalatine foramen, 21 – incisive canal, 22 – nasopalatine nerve (hard palate behind medial incisive teeth), 23 – greater palatine canal, 24 – major and minor palatine nerves, 25 – pterygopalatine ganglion, 26 – internal carotid plexus, 27 – deep petrosal nerve, 28 – superior solivatory nucleus, 29 – greater petrosal nerve, 30 – anastomosis n. zygomatici cum n. lacrimalis, 31 – pterygoid canal, 32 – nerve of pterygoid canal (Vidii nerve – 27 + 29), 33 – meningeal branch

Ganglionic branches pass through the ganglion without synapsing and include the following:

- ***the greater palatine nerve*** travels in the greater palatine foramen to the upper gingiva and hard palate;
- ***lesser palatine nerve*** travels in the lesser palatine foramen to the soft palate, uvula, and tonsills;
- ***posterior superior nasal nerves*** pass through the sphenopalatine foramen to reach the nasal cavity and innervate superior and middle nasal conchae and posterior part of the nasal septum.

Thus, the maxillary nerve provides sensory innervation to:

- a lower eyelid;
- the skin of external nose, zygomatic, buccal and temporal regions of the head;
- the skin and mucosa of the upper lip;
- upper teeth and gum;
- mucosa covering the hard and soft palate, and the maxillary sinus.

MANDIBULAR NERVE

It is the largest division of the trigeminal nerve. Mandibular nerve is a mixed branch. It features both motor and sensory fibers.

The mandibular nerve (Fig. 6) exits the skull via the foramen ovale. In the infratemporal fossa it is divided into:

1. **Meningeal branch** is sensory. It reenters foramen spinosum along with the middle meningeal artery to innervate the dura matter of the middle cranial fossa.

2. **Motor branches** to masticatory muscles (***medial and lateral pterygoid nerves*** to corresponding muscles, ***masseteric***

nerve to masseter muscle, ***deep temporal nerve*** to the temporalis muscle), tensor tympani and tensor veli palatini muscles.

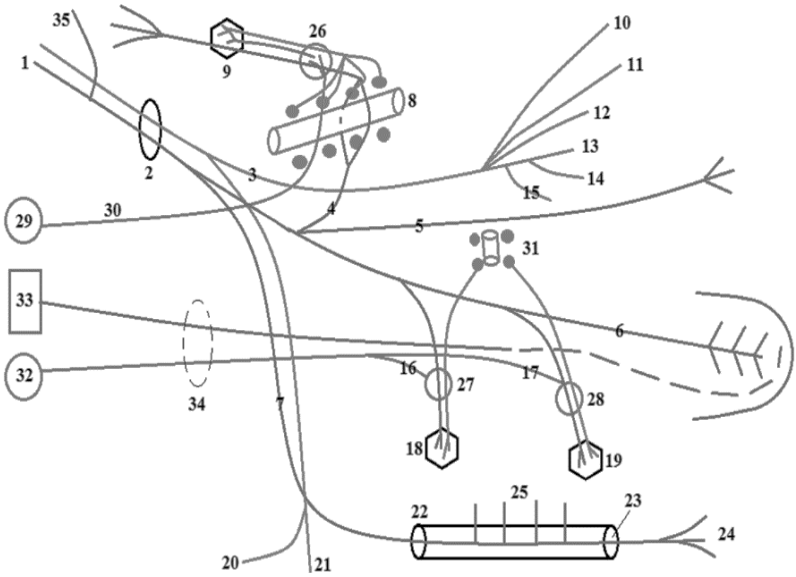

Figure 6 – The 3rd branch of trigeminal nerve (mandibular nerve): 1 **–** mandibular nerve, 2 – foramen ovale, 3 – masticatory nerve, 4 – auriculotemporal nerve, 5 – buccal nerve, 6 – lingual nerve, 7 – inferior alveolar nerve, 8 – meningeal plexus and middle meningeal artery, 9 – parotid gland, 10 – masseteric nerve, 11 – temporal nerve, 12 – lateral pterigoid nerve, 13 – medial pterigoid nerve, 14 – ramus m. tensor veli palatini, 15 – ramus m. tensoris tympani, 16 – submandibular branch, 17 – sublingual branch, 18 – submandibular gland, 19 – sublingual gland, 20 – mylohyoid muscle, 21 – anterior belly of digastric muscle, 22 – mandibular canal, 23 – mental foramen, 24 – mental nerve, 25 – inferior dental and gingival rami, 26 – otic ganglion, 27 – submandibular ganglion, 28 – sublingual ganglion, 29 – inferior salivatory nucleus (IX), 30 – lesser petrosal nerve, 31 – facial plexus, 32 – superior salivatory nucleus (VII), 33 – nucl. of solitary tract, 34 – chorda tympani, 35 – meningeal ramus

Buccall nerve is sensory. It innervates the skin over the buccinator muscle and mucosa, which covers buccinator opposite second molar teeth (note: motor innervation to the buccinator is not provided by buccal nerve, the buccinator is innervated by buccal branches of CN VII).

3. **Auriculotemporal nerve** is sensory**.** It runs posterior to the neck of the mandible, then turns upward with the superficial temporal artery under the parotid gland, then, ascends over the zygomatic arch. It supplies skin of the auricle, external acoustic meatus and tympanic membrane, the temporomandibular joint and skin of temporal region.

Also, the auriculotemporal nerve conveys postganglionic parasympathetic fibers (from CN IX and the otic ganglion) to the parotid gland.

4. **Lingual nerve** is sensory. It innervates the mucous membrane of the mouth and gums and anterior two thirds of the tongue (but not taste, which is supplied by CN VII). It is joined by the chorda tympani nerve (branch of CN VII), which transmits taste from anterior two thirds of the tongue and provides parasympathetic secretomotor innervation to the submandibular and sublingual ganglia.

5. **Inferior alveolar nerve** is mixed. It descends adjacent to the ramus of the mandible to the mandibular foramen, passes through the mandibular canal, giving sensory branches to lower teeth and gums.

Mental nerve is terminal branch of inferior alveolar nerve. It leaves mandidular canal via the mental foramen and innervates skin of the chin and lower lip.

Moreover, inferior alveolar nerve before entering the mandibular canal gives off motor **mylohyoid nerve** to supply mylohyoid muscle and anterior belly of digastric muscle.

Thus, the mandibular nerve provides:

- ✓ **sensory** innervation to:
  - lower teeth and gums;
  - lower lip;
  - tongue and cheek;
  - mental region;
  - submandibular and sublingual glands;
  - temporomandibular joint;
- ✓ **motor** innervation to:
  - masticatory muscles;
  - tensor tympani and tensor veli palatini;
  - mylohyoid and anterior belly of the digastric.

II. THE FACIAL, GLOSSOPHARYNGEAL, THE VAGUS AND ACCESSORY CRANIAL NERVES

THE FACIAL (VII) CRANIAL NERVE

The facial nerve is a mixed nerve. It arises from the pontocerebellar angle with two roots.

The greater root is **the facial nerve itself**. As a nerve of the second visceral arch it innervates the muscles developing from it, namely, all the facial expression and part of the neck muscles. The lesser root is called the intermediate nerve. It emerges from the brain as a thin trunk between the facial nerve and the vestibulocochlear nerve. After passing for a certain distance between both these nerves, it joins the facial nerve and becomes its component.

The intermediate nerve includes gustatory (sensory) and secretory (parasympathetic) fibers.

Its sensory fibers arise from the central processes of the pseudounipolar sensory cells of the *geniculate ganglion* which pass to the brain and terminate in the nucleus of the solitary tract. The peripheral processes of the cells pass into the **chorda tympani** conducting gustatory sensitivity from the anterior two thirds of the tongue. The secretory parasympathetic fibers from the intermediate nerve begin in the superior salivatory nucleus and run along the chorda tympani to the submandibular and sublingual salivary glands (by means of the submandibular and sublingual ganglia) and along the greater petrosal nerve through the sphenopalatine ganglion to the mucosal glands of the nasal and oral cavities, and to the lacrimal gland. Thus, the secretory fibers of the intermediate nerve innervate all the glands in the cavities of the face, with the exception of the parotid gland, which receives its secretory fibers from the glossopharyngeal nerve (Fig. 7).

The nuclei of the facial nerve:

1) ***the motor nucleus*** of the facial nerve resides within the tegmentum of pons (pons of Varolii) ventrally from the nucleus of abducent nerve somewhat below the facial colliculus;

2) ***the superior salivatory nucleus*** gives rise to the parasympathetic preganglionic fibers to the corresponding parasympathetic ganglia (submandibular, sublingual and sphenopalatine) which run along the chorda tympani and the greater petrosal nerves to the facial glands;

3) ***the nucleus of the solitary tract*** (gustatory) accepts the central processes of the sensory pseudounipolar cells of the geniculate ganglion.

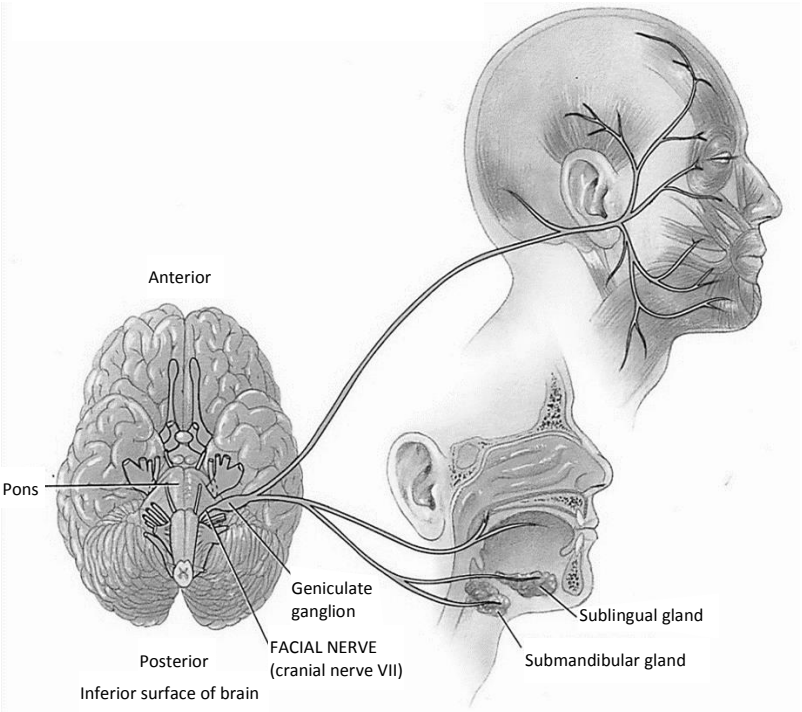

Figure 7 – Branches of the facial nerve

The greater and lesser roots of the facial nerve emerge to the surface of the brain laterally along the posterior edge of the pons on the trigeminofacial line, next to the vestibulocochlear nerve. Then, together with the latter nerve, the roots of the facial nerve penetrate the internal acustic porus and enter the canal for the facial nerve (Fig. 8). The two roots

join in the facial canal. In the canal the nerve first runs horizontally to the outside; then, in the region of the hiatus of the greater petrosal nerve it turns at the right angle to the back and passes along the mastoid (posterior) wall of the tympanic cavity (here the facial canal becomes evident as the prominens of the facial canal). Outside of the tympanic cavity the facial nerve curves again and descends vertically, emerging from the skull through the stylomastoid foramen. In the place where the nerve turns back to form a genu, its sensory (gustatory) segment forms a small nervous ganglion (the geniculate ganglion). The ganglion is made up of the sensory pseudounipolar cells. Their central processes enter the brainstem and synapse with the cells of the nucleus of the solitary tract, while the peripheral processes run to their responsibility areas. On emerging from the stylomastoid foramen the facial nerve enters the thickness of the parotid gland and forms the plexus from which its terminal branches arise.

The facial nerve gives rise to the following branches in the canal of the temporal bone:

- **the nerve to the stapedius muscle** (motor) innervates the stapedius muscle;
- **the greater petrosal nerve** (secretory parasympathetic) originates in the region of the genu and emerges through the hiatus for the greater petrosal nerve and runs along the groove of the same name on the anterior surface of the pyramid of the temporal bone. The nerve pierces the cartilaginous sealing of the foramen lacerum and proceeds to the pterygoid canal where joins *the deep petrosal nerve* (sympathetic nerve that arises from the internal carotid plexus). Both nerves form *the nerve of*

pterygoid canal (the Vidian nerve) that reaches the pterygopalatine fossa. The parasympathetic preganglionic fibers (the greater petrosal nerve) synapse with the pterygopalatine ganglion cells. The postganglionic fibers together with sympathetic fibers (from the deep petrosal nerve) and sensory fibers (from the maxillary nerve) give off the following branches:

****the posterior superior nasal nerves*** reach the mucosal glands of the nasal cavity via the sphenopalatine foramen;

****the greater and lesser palatine nerves*** pass to small salivary glands of the palatine mucosa through the canals of the same names;

****the communicating branch with zygomatic nerve*** joins the zygomatic nerve (the branch of the maxillary nerve) to pass through the inferior orbital fissure into the orbit. On the lateral wall of the orbit the communicating branch detaches from the zygomatic nerve and ascends to join the lacrimal nerve (from the ophthalmic nerve). It innervates the lacrimal gland;

- **the chorda tympani** (mixed branch) separates from the facial nerve in the lower part of the facial canal, enters the canaliculus for chorda tympani to return to the tympanic cavity, fits there onto the medial surface of the tympanic membrane and then leaves the tympanic cavity through the petrotympanic fissure. The chorda tympani supplies nothing within the tympanic cavity. On emerging from the fissure it descends forward and joins the lingual nerve (from the mandibular nerve). The sensory (gustatory) part of the chorda tympani (peripheral processes of the pseudounipolar sensory cells contained in the geniculate ganglion) as a component of the

lingual nerve runs to the mucosa of the tongue supplying its anterior two thirds with gustatory fibers. The secretory part (preganglionic parasympathetic fibers) approaches the submandibular and sublingual ganglia and after the interruption it supplies the corresponding salivary glands with secretory (postganglionic) fibers. Sympathetic fibers (from the periarterial facial plexus) and sensory fibers (from the lingual nerve) traverse the parasympathetic ganglia to supply the submandibular and sublingual salivary glands.

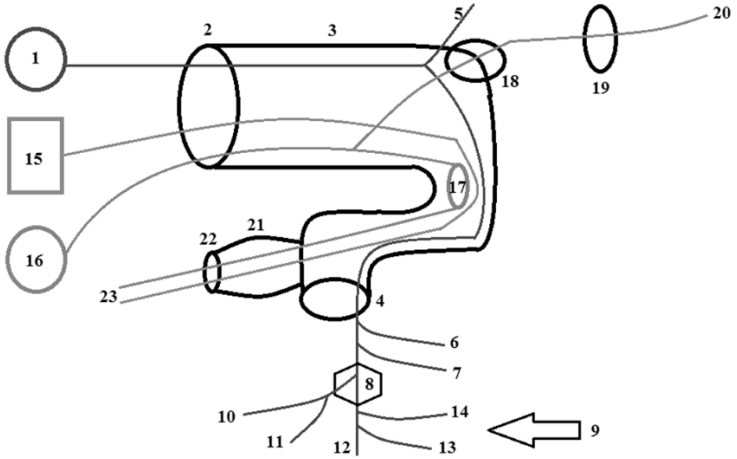

Figure 8 – The facial nerve: 1 – motor nucleus of facial, 2 – internal acoustic opening, 3 – canal of facial nerve, 4 – stylomastoid foramen, 5 – stapedius muscle, 6 – stylogioid muscle, 7 – posterior belly of digastric muscle, 8 – parotid gland, 9 – pes anserinus major, 10 – temporal branch, 11 – zygomatic branch, 12 – buccal branch, 13 – marginal mandibular branch, 14 – cervical branch, 15 – nucleus of the solitary tract, 16 – superior salivatory nucleus, 17 – geniculate ganglion, 18 – hiatus for the greater petrosal nerve, 19 – foramen lacerum, 20 – the greater petrosal nerve, 21 – tympanic cavity, 22 – petrotympanic fissure, 23 – chorda tympani

After leaving the facial canal through the stylomastoid foramen the facial nerve penetrates the parotid gland where forms the parotid plexus. The following muscle branches separate from the parotid plexus forming ***pes anserinus major*** ("greater goose's foot"):

- ✓ ***the temporal branches*** supply the anterior and superior auricular muscles, the frontal belly of the epicranius muscle and the orbicularis oculi;
- ✓ ***the zygomatic branches*** pass to the orbicularis oculi and both zygomatic muscles;
- ✓ ***the buccal branches*** supply the muscles in the region of the mouth and nose;
- ✓ ***the marginal mandibular branch*** is the branch passing along the base of the mandible to the muscles of the chin and oral muscles;
- ✓ ***the cervical branch*** descends to the neck and innervates the platysma.

The latter branch anastomoses with transversus coli nerve from the cervical plexus.

Apart from the branches listed above, the facial nerve gives off:

- ✓ ***the posterior auricular nerve*** supplies the posterior auricularis muscle, and the occipital belly of the epicranius muscle;
- ✓ ***the digastric branch*** supplies the posterior belly of the digastric muscle and the stylohyoid muscle.

THE GLOSSOPHARYNGEAL (IX) NERVE

The glossopharyngeal nerve (Fig. 9) is a nerve of the third visceral arch which separates from the vagus nerve during the development. It consists of three types of fibers:

1) afferent (sensory) fibers running from the receptors of the pharynx, the tympanic cavity, mucosa of the tongue (the posterior third), tonsils and palatal arches;

2) efferent (motor) fibers innervating one of the muscles of the pharynx (the stylopharyngeal muscle);

3) efferent (secretory parasympathetic) fibers to the parotid gland.

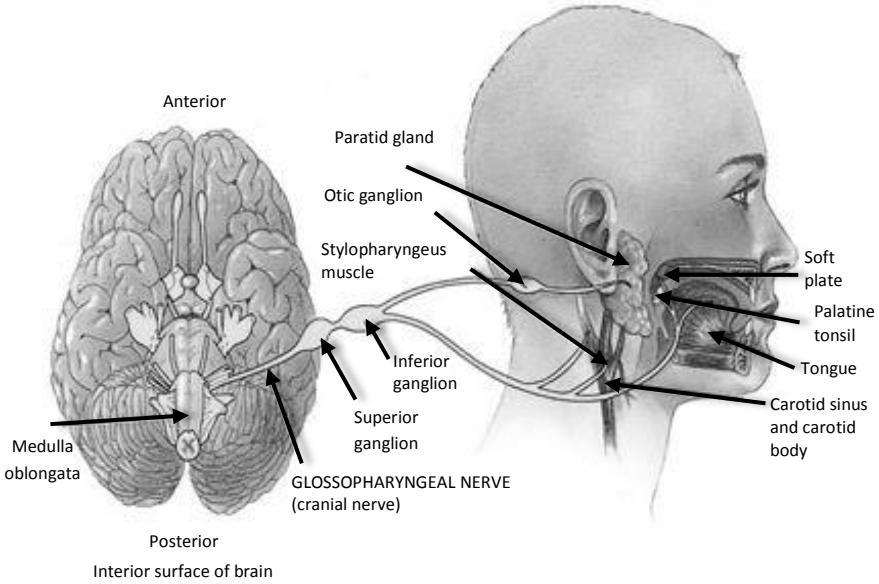

Figure 9 – Distribution of glossopharyngeal nerve branches

Nuclei of the glossopharyngeal nerve

Corresponding to its components the glossopharyngeal nerve has three nuclei situated within the medulla oblongata:

1) ***the nucleus ambiguus*** (motor) which is common withthe vagus nerve and accessory nerves;

2) ***the nucleus of the solitary tract*** (sensory) to which come the central processes of the cells of two afferent ganglia: the superior and inferior;

3) ***the inferior salivatory nucleus*** (secretory parasympathetic).

The glossopharyngeal nerve with its roots originates from the medulla oblongata behind the olive, above the vagus and leaves the skull through the jugular foramen together with the vagus and the accessory nerves. Within the limits of the latter the sensory part of the nerve forms a ganglion, ***the superior ganglion***, and, on emerging from the jugular foramen, it forms another ganglion, ***the inferior ganglion***, which lies on the inferior surface of the pyramid of the temporal bone. Both ganglia comprise the sensory pseudounipolar cells. Their central processes run to the nucleus of the solitary tract and the peripheral processes join the branches of the nerve and proceed to the pharyngeal and tympanic mucosa, the posterior third of the tongue and the carotid sinus. The nerve descends first between the internal jugular vein and the internal carotid artery. Then it bends around and behind the stylopharyngeus muscle and approaches the root of the tongue along the lateral side of this muscle in a slanting arch where it divides into its terminal branches (Fig. 10).

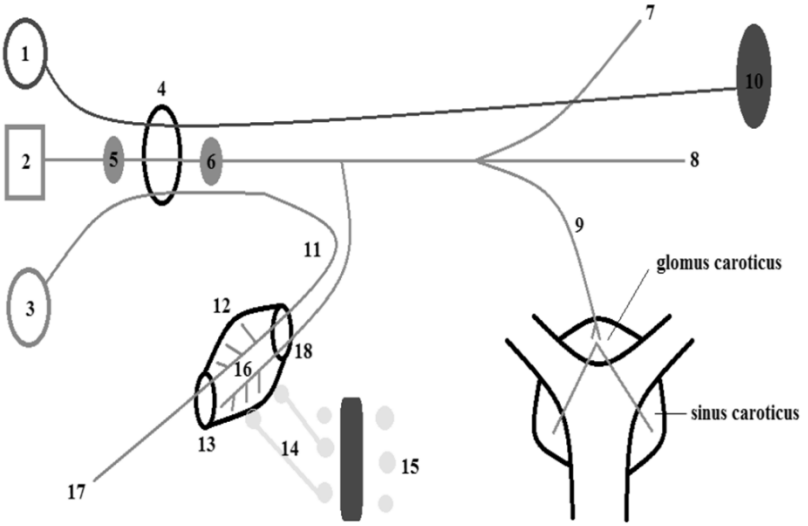

Figure 10 – The glossopharyngeal nerve: 1 – nucleus ambiguus (motor), 2 – nucleus of the solitary tract (sensory), 3 – inferior salivatory nucleus (autonomic), 4 – jugular foramen, 5 – inferior ganglion, 6 – superior ganglion, 7 – lingual branches, 8 – pharyngeal branches, 9 – carotid branch, 10 – stylopharyngeal branch, 11 – tympanic nerve (Jakobsoni), 12 – tympanic cavity, 13 – hiatus for the lesser petrosal nerve, 14 – carotico-tympanic nerves, 15 – carotid plexus, 16 – tympanic (Jakobsoni) plexus, 17 – the lesser petrosal nerve, 18 – sphenopetrosal fissure

The branches of the glossopharyngeal nerve:

The mixed branch:

• **the tympanic nerve** comprises the sensory and the parasympathetic fibers. It branches away from the inferior ganglion and penetrates the tympanic cavity via the tympanic canaliculus where it leaves all sensory fibers to form the tympanic plexus. The plexus receives branches from the

periarterial sympathetic plexus of the internal carotid artery. This plexus innervates the mucosa of the tympanic cavity, the mastoid air cells. mucosa and the auditory tube.

The secretory parasympathetic preganglionic fibers (runing from the inferior salivatory nucleus) proceed to the hiatus for the lesser petrosal nerve where they form ***the lesser petrosal nerve***. The nerve passes in a groove for the lesser petrosal nerve over the anterior surface of the pyramid and escapes from the skull cavity through the sphenopetrosal fissure. Upon reaching the inferior cranial base, the lesser petrosal nerve enters the otic ganglion. After it synapses with ganglionic cells, the postganglionic fibers join the auriculotemporal nerve (from the maxillary nerve) and sympathetic fibers (from the periarterial sympathetic plexus around the internal carotid artery) and proceeds to the parotid gland.

The sensory branches:

- **the pharyngeal branches** take part in formation of the pharyngeal plexus. They provide sensory nerve supply to the pharyngeal mucosa;
- **the lingual branches** are the terminal branches of the glossopharyngeal nerve to the mucosa of the posterior third of the tongue supplying it with sensory fibers (general sensitivity), among which the gustatory fibers also pass to the taste buds of the vallate papillae;
- **the tonsillar branches** supply the mucosa of the palatine tonsils and arches;
- **the carotid branch** runs to the carotid sinus and the carotid body. It conducts the impulses from the carotid sinus to

the medulla oblongata participating in regulation of the blood pressure and heart rate.

The muscle branch:

- **the stylopharyngeal branch** to the corresponding muscle.

THE VAGUS (X) NERVE

The vagus nerve was given such name because it is the longest cranial nerve. It is developed from the fourth and subsequent visceral arches. The vagus nerve supplies the respiratory organs, a considerable part of the digestive tract (up to the sigmoid colon) and also gives off branches to the heart which receives fibers that slow down the heartbeat (Fig. 11). The vagus nerve consists of three types of fibers.

Nuclei of the vagus nerve:

1) the autonomic – ***dorsal nucleus of the vagus nerve***, located in the vagal triangle;

2) the sensory – ***nucleus of the solitary tract;***

3) the motor nucleus – ***nucleus ambiguus***.

Afferent (sensory) fibers emerging from the receptors of internal organs and vessels described above, as well as from a certain part of the dura mater and the external acoustic meatus to the sensory nucleus, the nucleus of solitary tract.

Efferent (motor) fibers for striated muscles of the pharynx, soft palate, larynx and upper part of oesophagus arise from the motor nucleus (the ambiguus nucleus).

Efferent (parasympathetic) fibers originate in the autonomic nucleus, the dorsal nucleus of the vagus nerve. They run to the striated cardiac muscles (slowing down the heart beat) and to the smooth muscles of the vessels (dilating vessels). The parasympathetic fibers also innervate the trachea and lungs (they constrict the bronchi), esophagus, stomach, and intestines up to the descending colon (intensify peristalsis), glands situated in the wall of these organs and big glands of the abdominal cavity: the liver, pancreas (secretory fibers), and kidneys.

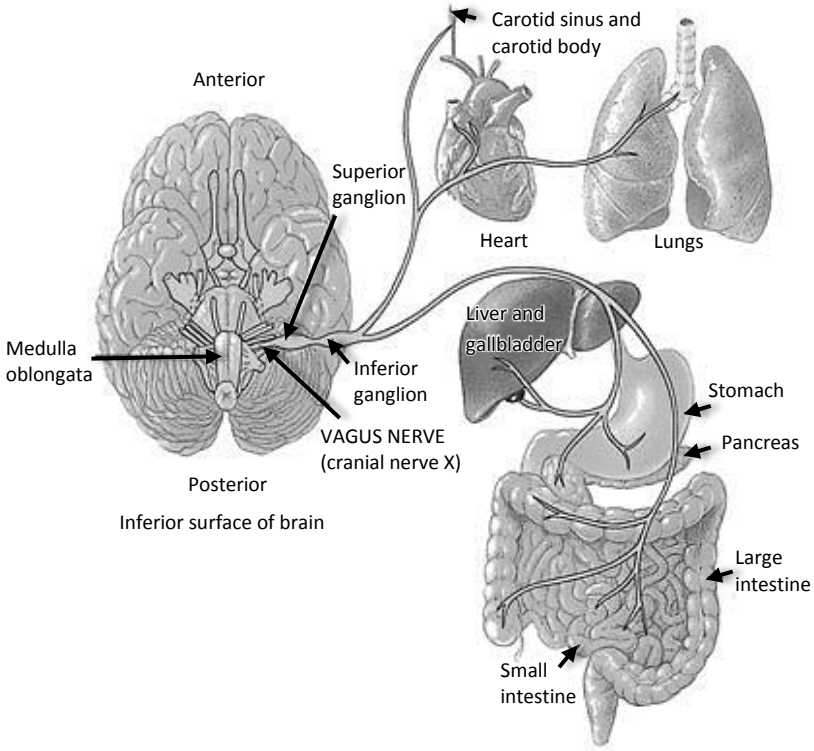

Figure 11 – Vagus nerve

The parasympathetic portion of the vagus nerve is huge and as a consequence it is predominantly an autonomic nerve, very important for the organisms's vital functions.

The cranial part of the vagus nerve (between the origination point and the superior ganglion)

Fibers of all kinds are connected with three main nuclei of the vagus nerve arise from the medulla oblongata. They pass into posterolateral sulcus posterior to the inferior olive below the glossopharyngeal nerve in 10 to 15 roots which form the thick trunk of the nerve. This trunk leaves the cranium through the jugular foramen together with the glossopharyngeal and accessory nerves. In the jugular foramen the sensory part of the nerve forms a small ganglion (the superior ganglion) and on leaving this orifice it forms the inferior ganglion. Both ganglia contain pseudounipolar sensory cells whose peripheral processes are components of the sensory branches running to these ganglia from interoceptors of the internal organs and vessels (the inferior ganglion) and from the skin exteroceptors of the external acoustic meatus and the auricle (the superior ganglion). The central processes group together in a singular bundle which ends in the sensory nucleus (the nucleus of the solitary tract).

The cranial part gives the branches as follows:

- **the meningeal branch** supplies the dura mater of the posterior cranial fossa;
- **the auricular branch** enters the mastoid canaliculus that gives escape to the nerve through the tympanomastoid fissure. The branch supplies the skin of the auricle and the skin of the posterior wall of the external acoustic meatus.

The cervical part of the vagus nerve (between the inferior ganglion and the recurrent laryngeal nerve)

On leaving the cranial cavity, the vagus nerve descends to the neck and passes between the internal jugular vein and internal carotid artery, and then between the same vein and the common carotid artery. It lies in the same sheath as the vessels mentioned above. Further the vagus nerve enters the thoracic cavity via the superior thoracic aperture where the right one lies between the subclavian artery and the subclavian vein, while the left trunk passes between the common carotid artery and the subclavian vein and extends on the anterior surface of the aortic arch.

The cervical part gives the branches as follows:

- **the pharyngeal branch** forms the pharyngeal plexus together with branches of the glossopharyngeal nerve and sympathetic branches from the sympathetic trunk. The plexus supplies the pharyngeal muscles (with exception of the stylopharyngeus muscle), the muscles of the soft palate (except for the tensor velli palatini), and the pharyngeal mucosa;
- **the superior laryngeal nerve** descends to the hyoid bone and splits into two branches: the external and internal branches. The external branch (motor) supplies the cricothyroid muscle only. The internal branch (it comprises the sensory and the parasympathetic preganglionic fibers) supplies the laryngeal mucosa above the rima glottidis, part of the root of the tongue and epiglottic mucosa. The superior laryngeal nerve also comprises the gustatory fibers that run from the epiglottis and taste buds of the root of the tongue. Parasympathetic preganglionic fibers are axons of the dorsal nucleus of the vagus nerve which synapse with cells of the intramural ganglia

located into the mucosa of the viscera. Postganglionic parasympathetic fibers innervate small glands of the pharynx and upper part of the larynx mucosa (above the rima glottidis);

- **the superior cervical cardiac branches** descend along each common carotid artery and join the cardiac plexus. They carry the parasympathetic preganglionic fibers from the dorsal nucleus of vagus nerve that synapse within the ganglia of the cardiac plexus. Postganglionic fibers together with the sympathetic fibers innervate the cardiac muscles. The superior cervical cardiac branches also contain the interoceptive sensory fibers from the inferior ganglion of the vagus nerve that participate in regulation of blood pressure;
- **the recurrent laryngeal nerve** comprises all types of fibers. It branches off where the left vagus nerve lies in front of the aortic arch and the right vagus nerve lies in front of the subclavian artery. On the right side this nerve curves around the subclavian artery from below and from the back, and on the left side it curves around the aortic arch also from the back and from below. After this it ascends in the groove between the esophagus and the trachea supplying them with numerous branches (esophageal and tracheal branches). The end of the nerve known as inferior laryngeal branches innervates all laryngeal muscle (except for the cricothyroid) and the laryngeal mucosa below the rima glottidis, an area of the mucous membrane of the root of the tongue near the epiglottis. The laryngeal branches also supply the thyroid gland, the parathyroid, and thymus with the sensory and the secretory nerve fibers;
- **the inferior cervical cardiac branches** may arise either from the recurrent laryngeal nerve or directly from the

vagus nerve on each side. They carry the sensory and the preganglionic parasympathetic fibers to the cardiac plexus.

The thoracic part of the vagus nerve (between the recurrent laryngeal nerve and the esophageal hiatus of the diaphragm)

Within the thoracic cavity, both vagus nerves bypass the roots of the lungs on both sides dorsally, and then accompany the esophagus, forming plexus on its walls (the esophageal plexus). The left nerve runs along the anterior surface and the right nerve along the posterior surface of the esophagus. The lower portion of the plexus gives rise to the anterior and the posterior vagal trunks, that enter the abdominal cavity via the esophageal hiatus. Each vagal trunk contains the nerve fibers from both right and left vagus nerves.

The thoracic part of the vagus nerve gives the branches as follows:

- **the thoracic cardiac branches** pass to the cardiac plexus. They comprise the sensory and parasympathetic preganglionic fibers that join the cardiac plexus;
- **the tracheal branches** together with the sympathetic fibers form the tracheal plexus;
- **the bronchial branches** together with the sympathetic fibers form the pulmonary plexus on the walls of the bronchi;
- **the esophageal plexus** arises from the branches of both vagus nerves.

The smooth muscles and glands of the trachea, the bronchi and esophagus are innervated with the branches of the plexuses. It also contains sensory fibers for the trachea, bronchi and lungs.

The abdominal part of the vagus nerve (between the esophageal hiatus of diaphragm and the descending colon)

The vagal trunks are derived from the oesophageal plexus. The anterior vagal trunk is mostly derived from the left vagus and the posterior trunk – from the right vagus.

On reaching the abdominal cavity, the anterior vagal trunk splits within the anterior wall of the stomach. The posterior vagal trunk branches within the posterior wall of the stomach and joins the sympathetic coeliac plexus. The parasympathetic preganglionic fibers of the vagus nerve reach the viscera along the related arteries and form the autonomic plexuses together with the sympathetic fibers. The parasympathetic intramural ganglia reside within the walls of the viscera. The postganglionic parasympathetic fibers supply the glands of the mucosa and the big digestive glands (the liver, pancreas, kidneys, spleen). The branches of the vagus nerve contain numerous visceral sensory fibers that supply the abdominal viscera.

Within the abdominal cavity, the vagus nerve gives the branches as follows:

- **the anterior gastric branches** arise from the anterior trunk and run along the lesser curvature of the stomach to supply its anterior wall (the muscles, glands and mucous membrane);
- **the hepatic branches** arise from the anterior trunk and pass to the liver along the common hepatic artery between the layers of the lesser omentum;
- **the posterior gastric branches** arise from the posterior trunk and run along the lesser curvature of the

stomach to supply its posterior wall (the muscles, glands and mucous membrane);

• **the renal branches** run along the renal arteries to reach the kidneys;

• **the coeliac branches** pass through the sympathetic coeliac plexus but never synapse within its ganglia. The preganglionic parasympathetic fibers of the vagus nerve spread along the arteries and reach the pancreas, spleen, small and large intestines (up to the descending colon). This fibers synapse within the intramural parasympathetic ganglia of the respective viscera.

THE ACCESSORY (XI) NERVE

The accessory nerve (Fig. 12) develops in association with the last visceral arches. It is a muscle nerve containing the efferent (motor) fibers.

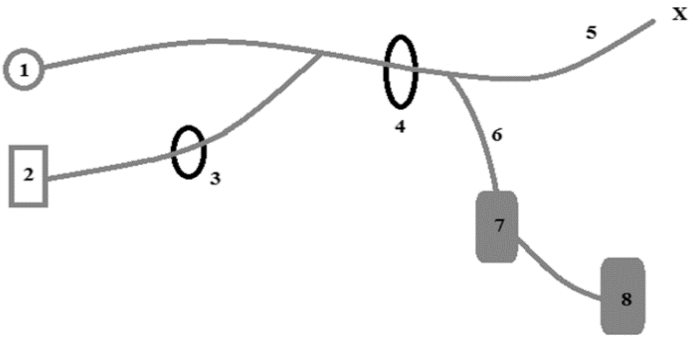

Figure 12 – The accessory nerve: 1 – nucl. ambiguous, 2 – spinal nucleus of accessory nerve, 3 – foramen magnum, 4 – jugular foramen, 5 – internal branch, 6 – external branch, 7 – trapezius muscle, 8 – sternocleidomastoid muscle

The accessory nerve has two motor nuclei lodged in the medulla oblongata and the spinal cord:

1) ***the nucleus ambiguus*** is the common nucleus for the IX, the X and the XI cranial nerves. The fibers of the accessory nerve arise from the caudal portion of the nucleus ambiguus;

2) ***the nucleus of accessory nerve*** resides within the posterolateral portion of the anterior grey column of the spinal cord at the level of C1–C6 segments.

According to these nuclei, the cerebral and spinal portions are distinguished.

The fibers of the cerebral portion arise from the dorsolateral surface of medulla oblongata immediately below the vagus nerve. The spinal portion of the accessory nerve is formed between the anterior and posterior roots of the spinal nerves (C1–C6). It ascends as a small nerves trunk and joins the cerebral portion.

Sinse the accessory nerve is a part that separated from the vagus nerve, it emerges together with the vagus from the cranial cavity through the jugular foramen.

The branches of the accessory nerve (Fig. 13):

- **the internal branch** is formed with the cerebral portion of the nerve that joins the vagus nerve. The internal branch of the accessory nerve as a component of the recurrent laryngeal nerve innervates the muscles of the larynx;
- **the external branch** is formed with the spinal portion of the nerve. It innervates the trapezius and sternocleidomastoid muscles.

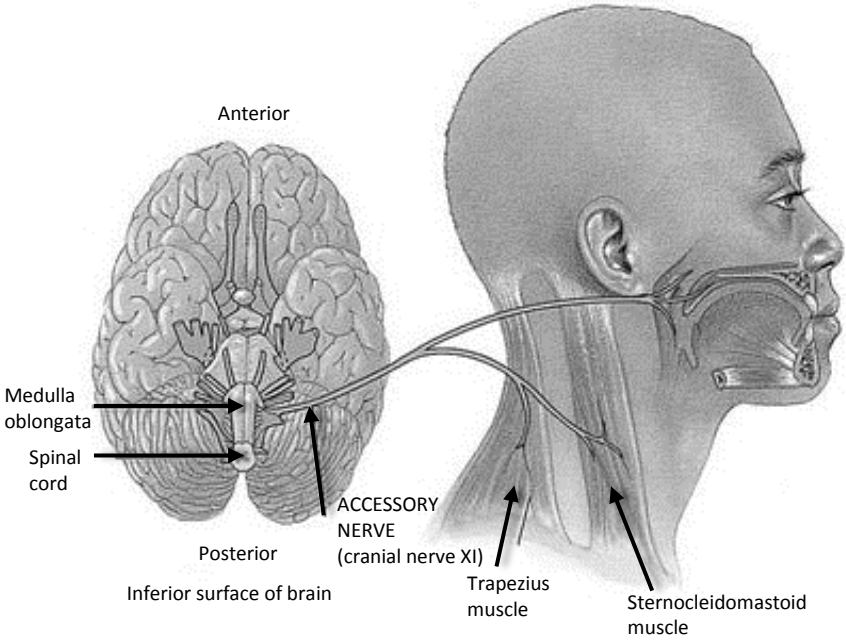

Figure 13 – Distribution of accessory nerve branches

III. THE HYPOGLOSSAL NERVE. THE SPINAL NERVES. THE POSTERIOR BRANCHES OF SPINAL NERVES. THE CERVICAL PLEXUS

THE HYPOGLOSSAL (XII) NERVE

The hypoglossal nerve (Fig. 14) is a motor nerve containing the efferent (motor) fibers to the muscles of the tongue. It has connections with the lingual nerve, with the inferior ganglion of the vagus nerve, and with the upper three cervical nerves.

The nucleus of the hypoglossal nerve (motor) is located in the medulla oblongata, in the region of the hypoglossal

triangle of the rhomboid fossa, descends through the medulla oblongata to the first-second cervical segments. Appearing on the base of the brain between the pyramid and olive (the ventrolateral sulcus) by several roots, the nerve then passes via the hypoglossal canal of the occipital bone, descends along the lateral side of the internal carotid artery, runs under the posterior belly of the digastric muscle and proceeds in the form of an arch, with convexity down, along the lateral surface of the hyoglossus muscle. Here the arch of the hypoglossal nerve is limited by a lingual triangle (the Pirogov triangle) at the top. At the anterior edge of the hyoglossus muscle the hypoglossal nerve separates into its terminal branches (the lingual branches) which enter the muscles of the tongue to supply all its muscles.

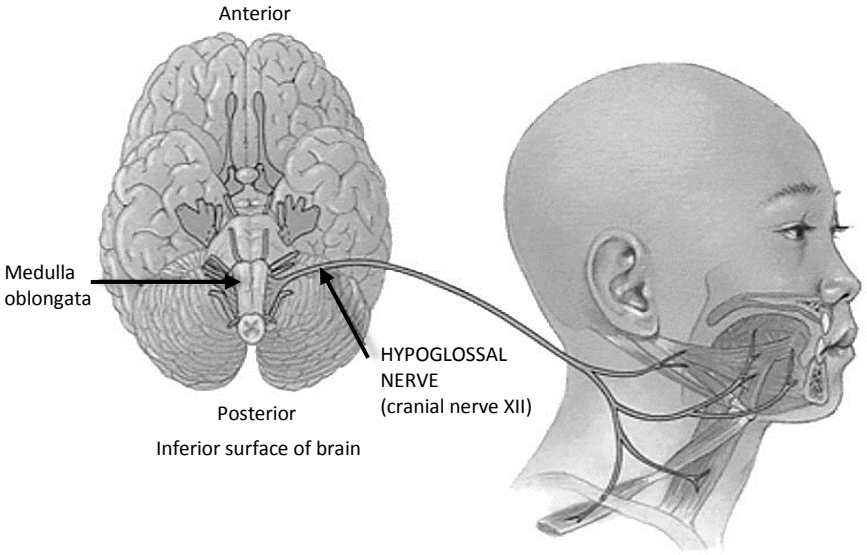

Figure 14 – Distribution of the hypoglossal nerve branches

The motor fibers from the first-second spinal nerves enter the skull cavity through the foramen magnum and together with the hypoglossal nerve they leave the cranial cavity via the hypoglossal canal forming the descending branch. It descends to join the ascending branch forming by the same motor fibers from the first-second spinal nerves so that they both form the ***ansa cervicalis***. The ansa supplies the infrahyoid muscles of the neck and the geniohyoid muscle (Fig. 15).

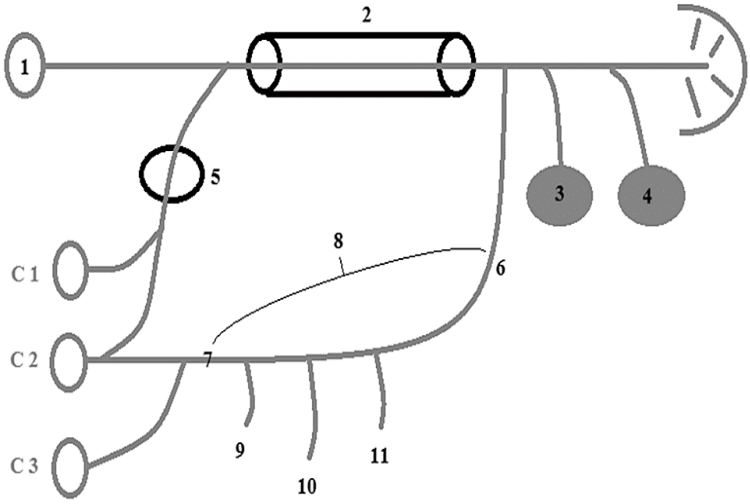

Figure 15 – The hypoglossal nerve: 1 – nucleus of hypoglossal nerve, 2 – hypoglossal canal, 3 – geniohyoid muscle, 4 – thyrohyoid muscle, 5 – foramen magnum, 6 – descending branch, 7 – ascending branch, 8 – 6+7 – ansa cervicalis, 8 – sternohyoid muscle, 9 – sternohyoid muscle, 10 – sternothyroid muscle, 11 – omohyoid muscle

SPINAL NERVES

Spinal nerves are associated with the spinal cord and, like all nerves of the peripheral nervous system (PNS), are parallel bundles of axons and their associated neuroglial cells wrapped in several layers of connective tissue. Spinal nerves connect the CNS to sensory receptors, muscles, and glands in all parts of the body. There are 31 pairs of spinal nerves. Spinal nerves arise from the spinal cord and supply all parts of the body except the head and some areas of the neck. All nerves are mixed.

Spinal nerves are not named individually, but are grouped according to the level from which they arise. Each nerve is numbered in sequence. On each vertebra the vertebral notches, the major parts of the intervertebral foramina, are associated with the inferior part of their respective vertebrae. For this reason, each spinal nerve, as it passes through the intervertebral foramen, is associated with the vertebra above it. The cervical spinal nerves are an exception, because spinal nerve C1 passes superior to the vertebra C1. Thus, although there are seven cervical vertebrae, there are eight pairs of cervical nerves (numbered C1 to C8).

The spinal nerves include:

- 8 pairs of cervical spinal nerves (C1–C8);
- 12 pairs of thoracic nerves (T1–T12);
- 5 pairs of lumbar nerves (L1–L5);
- 5 pairs of sacral nerves (S1–S5);
- 1 pair of tiny coccygeal nerves (Co1).

The spinal nerves are formed with two roots – anterior (ventral) root and posterior (dorsal) root. The anterior roots

predominantly contain axons of somatic motor neurons arising from cell bodies in the anterior horns of the spinal cord gray matter. These axons transmit action potentials to the muscles and glands of the body. In thoracic and upper lumbar segments these are supplemented with thin autonomic preganglionic motor fibers derived from the intermediolateral nucleus of the lateral column. The posterior roots, which contain the central processes of the sensory unipolar neurons project from the posterolateral sulcus of the spinal cord. These neurons transmit action potentials from peripheral receptors to the central nervous system. The anterior and posterior roots on each side of the spinal cord correspond to one developmental segment of the spinal cord. As the sensory posterior root and motor anterior root project laterally from the spinal cord, they converge to form a mixed spinal nerve. The spinal nerve trunk runs for a short distance before branching (Fig. 16).

Each large spinal nerve branch, named a ramus, follows a specific course to different peripheral regions. The two largest branches, the anterior (ventral) ramus and posterior (dorsal) ramus, are somatic branches that run in the musculoskeletal wall of the body.

The posterior (dorsal) ramus serves the deep muscles and skin of the posterior surface of the trunk.

The anterior (ventral) ramus serves the muscles and structures of the upper and lower limbs and the muscles and skin of the lateral and anterior regions of the trunk.

The meningeal branch reenters the vertebral canal through the intervertebral foramen and supplies the vertebrae, vertebral ligaments and meninges of the spinal cord.

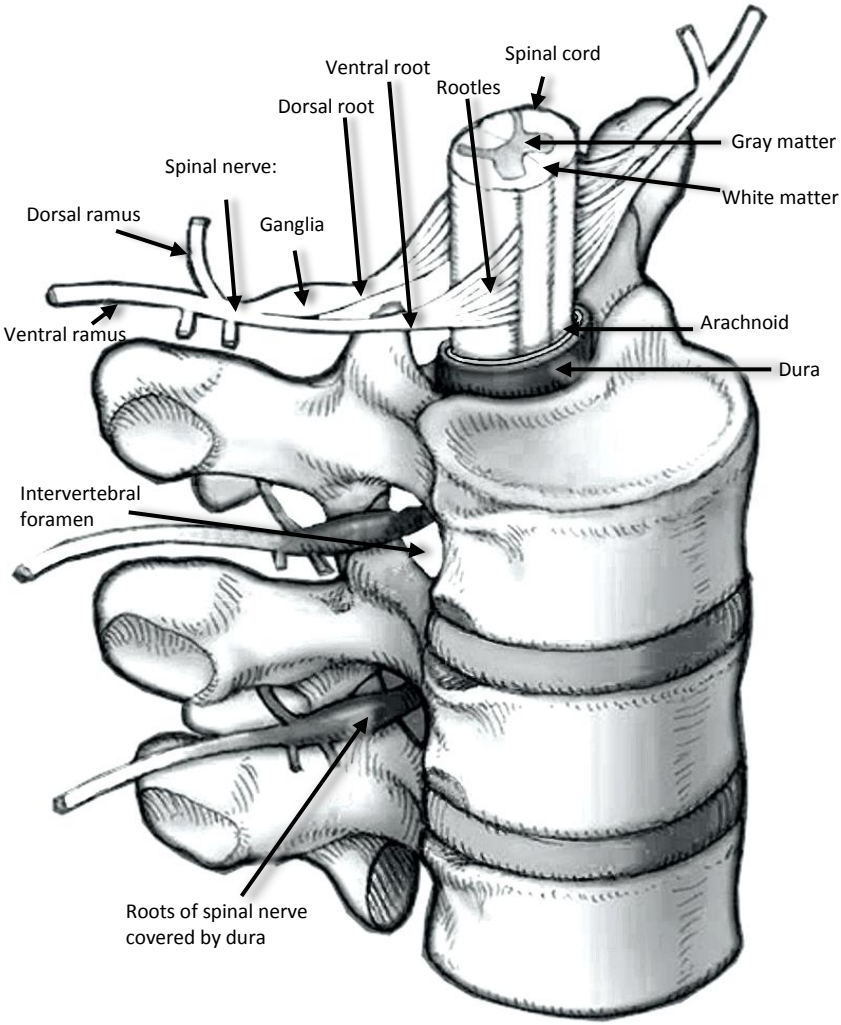

Figure 16 – Spinal nerve formation

The rami communicantes are two branches from each spinal nerve that connect to a sympathetic trunk ganglion, which is part of the autonomic nervous system.

Thus, they are present in the nerves C8–L2. The *rami communicantes* are composed of a gray ramus, containing unmyelinated fibers, and a white ramus, containing myelinated fibers. ***The white rami communicantes*** comprise the

sympathetic preganglionic fibers. They arise from the intermediolateral nucleus of the spinal cord and synapse with neurons of sympathetic trunk ganglia. ***The grey rami communicantes*** are postganglionic fibers, arising from the sympathetic trunk. They join anterior, posterior and meningeal branches of spinal nerves (Fig. 17).

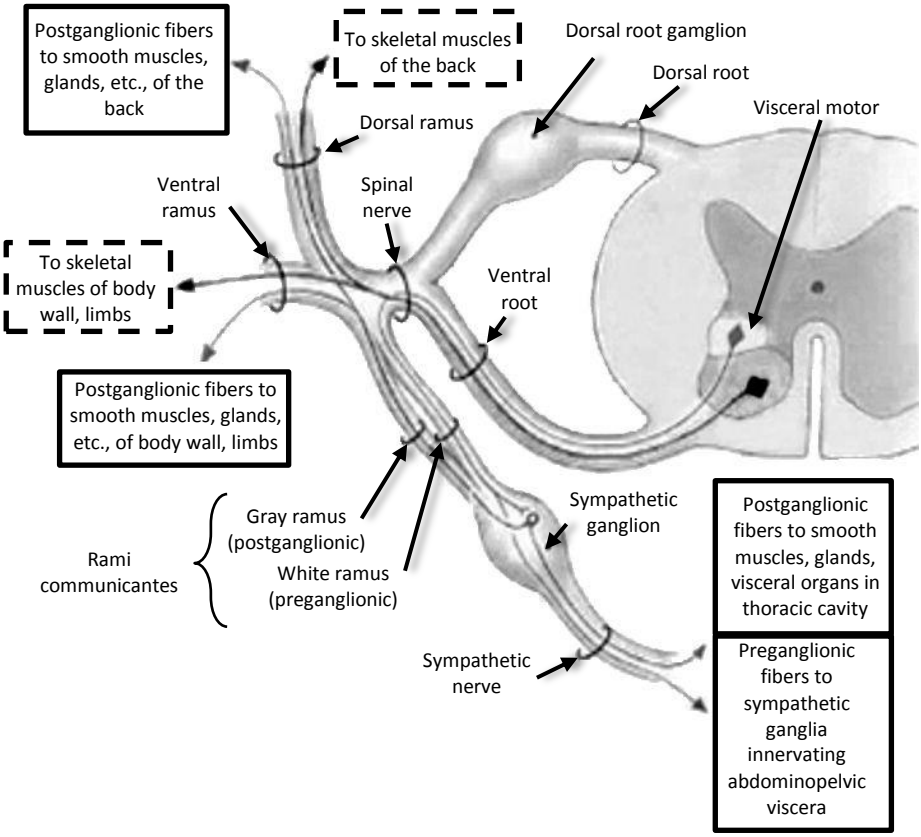

Figure 17 – Peripheral distribution of thoracic or upper lumber spinal nerve

Anterior (ventral) and posterior (dorsal) rami, like the spinal nerve itself, are mixed. The spinal nerve rami and their

main branches supply the entire somatic region of the body (skeletal muscles and skin) from the neck down. The dorsal rami supply the posterior body trunk. The thicker ventral rami supply the rest of the trunk and the limbs.

Notice difference between roots and rami!

• Roots form the spinal nerves. Each root is strictly sensory or motor.

• Rami are branches of the spinal nerves. Like spinal nerves, rami carry both sensory and motor fibers.

Except for T2–T12, all ventral rami branch and join one another lateral to the vertebral column, forming complicated interlacing nerve networks called nerve plexuses. Nerve plexuses occur in the cervical, brachial, lumbar, and sacral regions and primarily serve the limbs. Notice that only ventral rami form plexuses.

POSTERIOR BRANCHES OF SPINAL NERVES

The dorsal rami innervate the muscles, joints, and skin of the back along the vertebral column. With the exception of the first cervical, fourth and fifth sacral and coccygeal branches, they all divide into the medial branch (ramus medialis) and lateral branch (ramus lateralis) which supply the skin of the back of the head, the posterior surface of the neck and back and the deep dorsal muscles.

Only few dorsal rami have proper names:

• ***the suboccipital nerve*** is the dorsal branch of the first cervical nerve, it is purely motor and supplies suboccipital muscles and semispinalis capitis;

• ***the greater occipital nerve*** is the dorsal branch of the second cervical nerve, it is mixed and supplies skin of the occipital region and posterior cervical muscles (the splenius capitis and cervicis, the semispinalis capitis and the longissimus capitis);

• ***the superior cluneal*** nerves are dorsal branches of the lumbar and sacral nerves, they are purely sensory and supply skin of the gluteal region.

Other dorsal branches of spinal nerves are mixed.

Plexuses

Axons from the anterior rami of spinal nerves, except for thoracic nerves T2–T12, do not go directly to the body structures they supply. Instead, they form networks on both the left and right sides of the body by joining with various numbers of axons from anterior rami of adjacent nerves. Such a network of axons is called a plexus. Within a plexus, fibers from the various ventral rami crisscross one another and become redistributed so that each resulting branch of the plexus contains fibers from several spinal nerves. The principal spinal nerve plexuses are ***the cervical plexus, brachial plexus, lumbar plexus,*** and ***sacral plexus.*** A smaller coccygeal plexus is also present.

THE CERVICAL PLEXUS

The cervical plexus is formed by the ventral (anterior) rami of the first four cervical nerves (C1–C4), with contributions from C5 (Fig. 18). There is one on each side of the neck alongside the first four cervical vertebrae. It lies on the deep cervical muscles anterior to the transverse processes of cervical vertebrae below the sternocleidomastoid muscle. Most of its

branches are cutaneous nerves that supply only the skin. They transmit sensory impulses from the skin of the neck, the ear area, the back of the head, and the shoulder. Other branches innervate muscles of the neck.

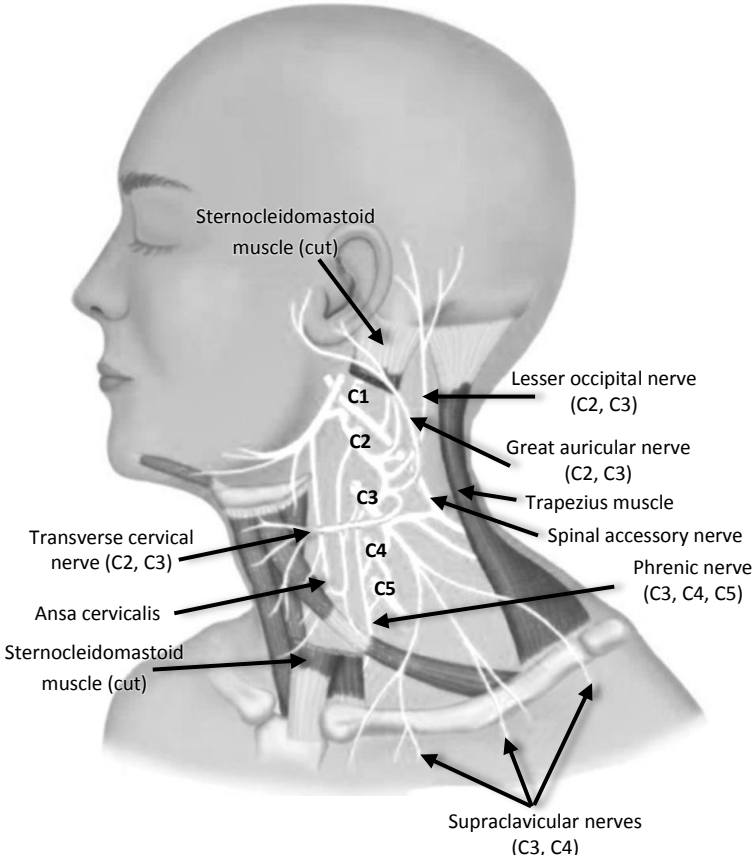

Figure 18 – Cervical plexus

Some fibers of the cervical plexus also combine with the hypoglossal cranial nerve to supply muscles of the neck. ***Ansa cervicalis*** is located anterior to the internal jugular vein below sternocleidomastoid muscle. It is formed by two roots: superior and inferior. The superior root consists of motor fibers from C1 and hypoglossal nerve. The inferior root arises from the cervical plexus (C2–C3). The ansa cervicalis innervates infrahyoid muscles.

The single mixed nerve from this plexus is ***the phrenic nerve***, which receives fibers from C3, C4, and C5. The phrenic nerve runs inferiorly through the thorax and supplies both motor and sensory fibers to the diaphragm. It descends obliquely with the internal jugular vein across the anterior scalene muscle. On both sides, the phrenic nerve runs posterior to the subclavian vein. On the left, it passes along subclavian artery, crossing the aortic arch. On the right, phrenic nerve crosses the subclavian artery. In the thorax both phrenic nerves run anterior to the root of the lung and between the fibrous pericardium and mediastinal pleura. The right phrenic nerve leaves the thorax by passing through the vena cava hiatus opening in the diaphragm at the level of T8. The left phrenic nerve pierces the diaphragm separately. Both of these nerves supply motor fibers to the diaphragm and sensory fibers to the fibrous pericardium, mediastinal pleura, and diaphragmatic peritoneum. The sensory branches of the right phrenic nerve also supply the peritoneal investiment of the liver and gallbladder, and the fibrous capsule of the liver.

The nerves of the cervical plexus are summarized in the table 2.

Table 2 – Branches of cervical plexus

NERVE	DISTRIBUTION
SUPERFICIAL (SENSORY) BRANCHES	
Lesser occipital	Skin of scalp posterior and superior to ear
Great auricular	Skin over the ear and over parotid gland
Transverse cervical	Skin over anterior aspect of neck
Supraclavicular	Skin over superior portion of chest and shoulder
DEEP (MOTOR) BRANCHES	
Ansa cervicalis	Infrahyoid muscles of neck
Muscular branches	Prevertebral and scalene muscles
MIXED BRANCH	
Phrenic	Diaphragm, parietal pleura and peritoneum covering diaphragm. Right nerve also supplies the peritoneum covering the liver and the liver capsule

IV. THE BRACHIAL PLEXUS. THE SHORT AND LONG BRANCHES OF THE BRACHIAL PLEXUS. THE ANTERIOR BRANCHES OF THE THORACIC NERVES

The anterior rami of spinal nerves C5–C8 and T1 form the brachial plexus, which extends inferiorly and laterally on either side of the last four cervical and first thoracic vertebrae. It passes above the first rib posterior to the clavicle and then enters the axillary cavity. It can be palpated (felt) in a living person just superior to the clavicle at the lateral border of the sternocleidomastoid muscle. Topographycally, the brachial plexus is divided into supraclavicular and infraclavicular parts. The supraclavicular part is located in the interscaleni space. It is represented by truncks. The anterior rami of C5 and C6

converge to become the superior trunk, the C7 ramus becomes the middle trunk, and the ventral rami of C8 and T1 converge to become the inferior trunk (Fig. 19).

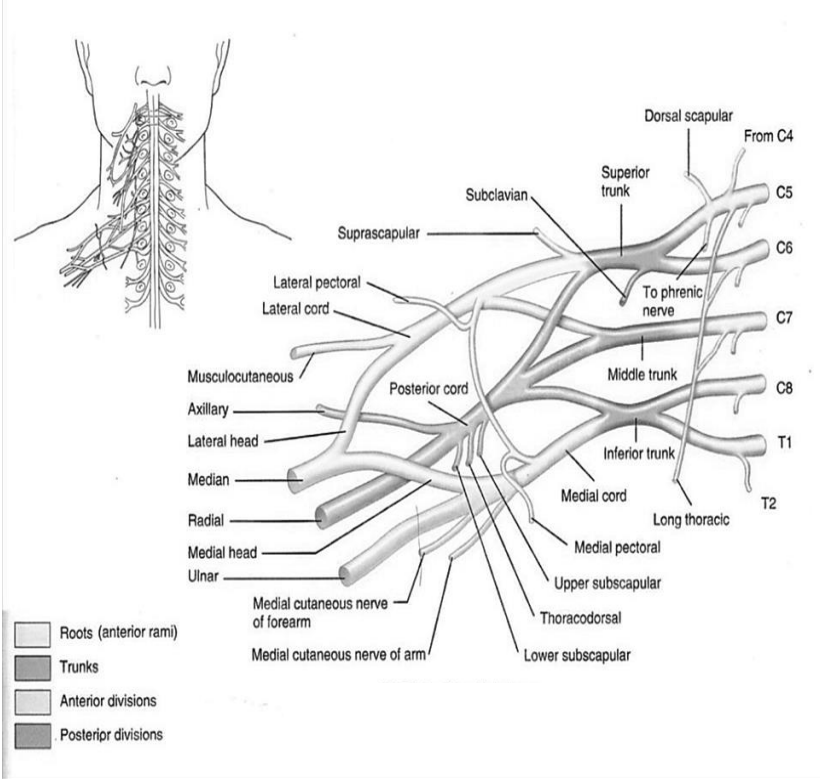

Figure 19 – Origin of brachial plexus

The infraclavicular part of brachial plexus is in the axillary cavity. It is represented by the lateral, medial, and posterior cords. The cords are named for their relationship to the axillary artery.

The supraclavicular part gives off ***short motor branches*** to muscles of the shoulder girdle and to the superficial muscles of the thorax:

- ***the dorsal scapular nerve*** – supplies the levator scapulae muscle and the rhomboideus major and minor muscles;
- ***the suprascapular nerve*** supplies supraspinatous muscle and infraspinatous muscle;
- ***the subscapular nerve*** supplies the subscapular and teres major muscle;
- ***the subclavius nerve*** runs to the subclavius muscle;
- ***lateral and medial pectoral nerves*** supply the pectoralis major and pectoralis minor muscles;
- ***the long thoracic nerve*** supplies the serratus anterior muscle;
- ***the thoracodorsal nerve*** supplies the latissimus dorsi muscle;
- ***the axillary nerve*** branches off from posterior cord of the infraclavicular part. It passes deep in the axillary fossa through the quadrilaterum foramen to the back surface of the scapula. It supplies the capsule of the shoulder joint and gives off motor branches for deltoid and teres minor muscles, and lateral brachial cutaneous nerve, which supplies the skin in the deltoid region.

The infraclavicular part gives off ***long branches*** (Fig. 20):

- ***The musculocutaneous nerve*** is a branch of the lateral cord. It courses inferiorly in the anterior arm, supplying motor fibers to the biceps brachii, brachialis, and coracobrachialis muscles. Distal to the elbow, it provides cutaneous sensation in

the lateral forearm, giving the lateral cutaneous nerve of the forearm (*n. cutaneus antebrachii lateralis*).

• ***The median nerve*** arises from the medial and lateral cords in two roots which embrace the axillary artery in front. It then passes medial bicipital groove together with the brachial artery. In the cubital fossa the nerve runs under the pronator teres muscle and the superficial flexor of the fingers. Then it passes between the superficial and deep flexors of the fingers and into the median groove of the forearm, running to the palm.

In the upper arm, the median nerve gives off no branches.

In the forearm, it gives off muscular branches to both pronators and to all the muscles of the anterior flexor group, with the exception of the flexor carpi ulnaris muscle and the medial part of the deep flexor of the fingers. One of the branches, the anterior interosseous nerve, innervates the deep flexor muscles (*m. flexor pollicis longus* and lateral part of the *flexor digitorum profundus*), pronator quadratus muscle and the radiocarpal joint.

The median nerve passes onto the palm through the carpal canal together with the tendons of the flexors and divides into three branches, the common palmar digital nerves which run along the first, second and third metacarpal spaces under the palmar aponeurosis toward the fingers. The common palmar digital nerves, in turn, divide into seven proper palmar digital nerves which pass to both sides of the thumb, to the index and middle fingers and to the radial side of the ring finger. Apart from this, median nerve supplies skin over distal phalanges on the dorsal surface of the same fingers (Fig. 21, 22).

In the palmar area, the motor branches innervate two lateral lumbricalis muscles, the muscles of the thenar with the exception of the adductor pollicis muscle and the deep head of the *m. flexor pollicis brevis* which are innervated by the ulnar nerve.

Median nerve injury makes it difficult to use the pincer grasp (opposed thumb and index finger) to pick up small objects.

• ***The ulnar nerve*** (Fig. 20) branches off the medial cord of the plexus. It descends along the medial aspect of the arm toward the elbow, swings behind the medial epicondyle, and then follows the ulna along the medial forearm.

The ulnar nerve passes in the ulnar sulcus on the forearm through the flexor carpi ulnaris muscle and then runs below this muscle to the wrist joint. It does not traverse the carpal tunnel but passes over the flexor retinaculum to the palmar surface of the hand where it divides into superficial and deep branches.

In the upper arm, the ulnar nerve gives off no branches.

In the forearm, it gives off branches to the flexor carpi ulnaris muscle and to the ulnar half of the flexor digitorum profundus muscle.

In the middle of the forearm a sensory branch is given off, the dorsal branch of the ulnar nerve, which passes to the ulnar side of the back of the hand where it supplies the skin of the medial aspect of the hand and the skin of the dorsal surface of the 4^{th}, 5^{th} and ulnar half of the 3^{rd} fingers.

Another sensory branch, the palmar branch of the ulnar nerve, is given off in the distal third of the forearm. It passes to the palm of the hand and supplies the skin of the hypothenar eminence.

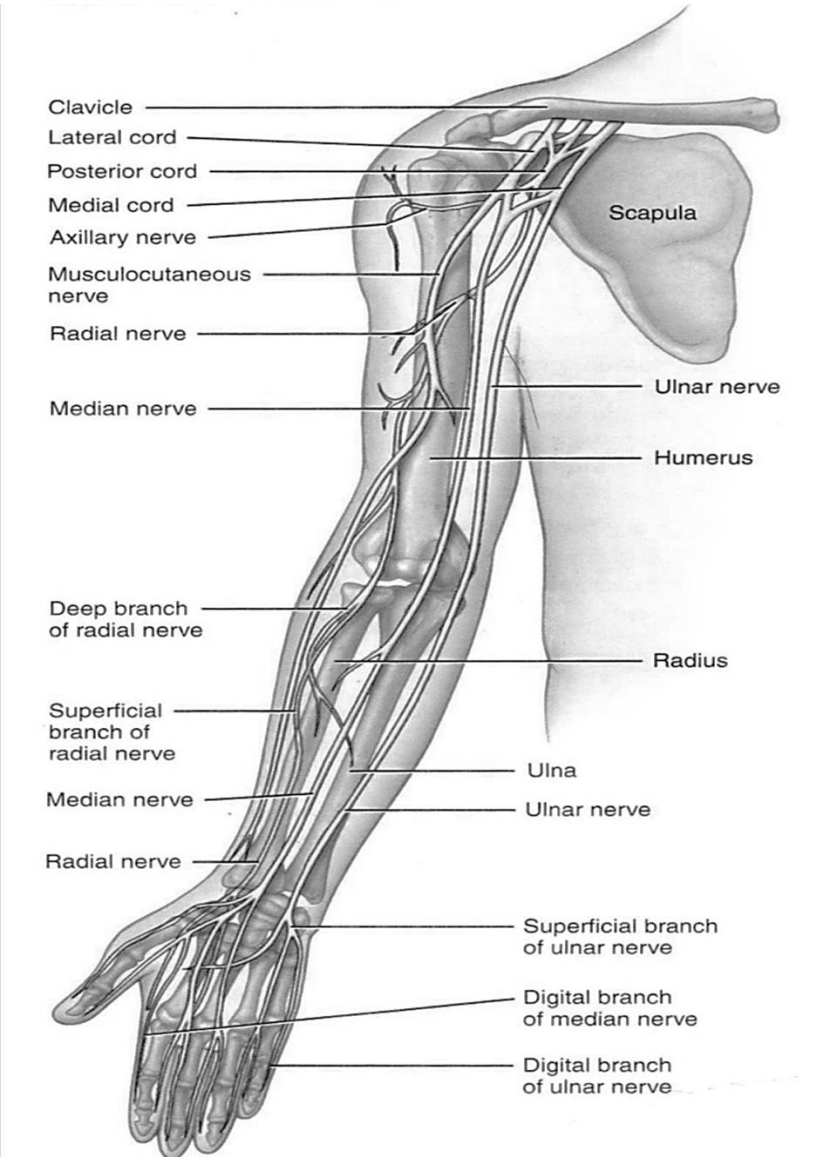

Figure 20 – Distribution of branches of the brachial plexus

The superficial branch, as the fourth common palmar digital nerve, passes to the interosseous space between the ring and little fingers and divides into the proper palmar digital nerves, which supply the sensory innervation of the dorsal surface of the little finger and the ulnar side of the 4^{th} finger (Fig. 21, 22).

The deep branch gives off branches to all the muscles of the hypothenar eminence and all the dorsal and palmar interosseous muscles, the third and fourth lumbrical muscles, the adductor pollicis muscle, and the deep head of the flexor pollicis brevis muscle.

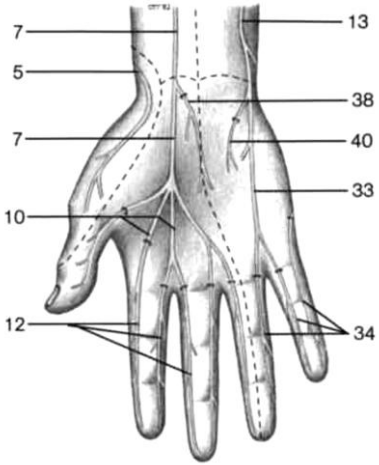

Figure 21 – Innervation pattern of palmar surfaces of a hand: 5 – superficial branch of radial nerve, 7 – median nerve, 10 – common palmar digital branches of median nerve, 12 – proper palmar digital nerves (median nerve), 33 – common palmar digital branch of ulnar nerve, 34 – proper palmar digital branches of ulnar nerve, 38 – palmar branch of median nerve, 40 – palmar branch of ulnar nerve

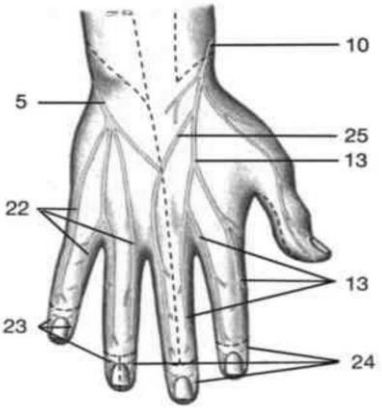

Figure 22 – Innervation pattern of posterior surfaces of a hand: 5 – ulnar nerve, 10 – radial nerve, superficial branch, 13 – dorsal digital branches of radial nerve, 22 – proper dorsal digital branches of ulnar nerve, 23 – regions supplied by palmar digital nerves (ulnar nerve), 24 – regions supplied by palmar digital nerves (median nerve), 25 – communicating branch with ulnar nerve

Severe or chronic damage can lead to the sensory loss, paralysis, and muscle atrophy. Affected individuals have trouble making a fist and gripping objects. As the little and ring fingers become hyperextended at the knuckles and flexed at the distal interphalangeal joints, the hand contorts into a "clawhand" or "bird's foot".

- ***The medial cutaneous nerve of the arm*** arises from the medial cord of the plexus and supplies the skin on the medial surface of the upper arm up to the ulnar joint.

- ***The medial cutaneous nerve of the forearm*** also arises from the medial cord of the plexus and lies next to the ulnar nerve; in the upper part of the upper arm it is located medially of the brachial artery next to basilic vein. It innervates

the skin on the ulnar side of the forearm down to the radiocarpal joint.

• ***The radial nerve*** (Fig. 14) is the largest branch of the brachial plexus. It is a continuation of the posterior cord.

The radial nerve runs in the radial canal and supplies the long, lateral and medial heads of the triceps brachii and anconeus muscles. Also posterior cutaneous nerves of the arm and forearm pass to the skin, which are the supply on the posterior surface of the arm and forearm. Radial nerve crosses the elbow joint and divides at the level of the head of the radius into its two terminal branches, the superficial and deep branch.

The deep branch gives off numerous muscular branches and finally extends to the wrist joint as the posterior interosseous nerve. Radial nerve supplies all superficial and deep posterior antebrachial muscles, brachioradialis muscle, also skin in posterior region.

On the back of the hand the superficial branch gives off the 5 dorsal digital nerves which supply only the skin of a radial part of the hand, the back surface of the 1st, 2nd, and lateral side of 3rd fingers (Fig. 16).

Trauma to the radial nerve results in the wrist drop, inability to extend the hand at the wrist.

The nerves of the brachial plexus are summarized in the table 3.

Table 3 – Nerves of the brachial plexus

NERVE	DISTRIBUTION
1	2
SHORT BRANCHES	
Dorsal scapular	Levator scapulae, rhomboid major, and rhomboid minor muscles

Continuation of the table 3

1	2
Long thoracic	Serratus anterior muscle
Subclavius	Subclavius muscle
Suprascapular	Supraspinatus and infraspinatus muscles
Lateral pectoral	Pectoralis major muscle
Medial pectoral	Pectoralis major and pectoralis minor muscles
Subscapular	Subscapularis and teres major muscles
Thoracodorsal	Latissimus dorsi muscle
Axillary	Deltoid and teres minor muscles; skin over deltoid and superior posterior aspect of arm
LONG BRANCHES	
Musculocutaneous	Coracobrachialis, biceps brachii, and brachialis muscles, skin along lateral border of forearm when it becomes *the lateral cutaneous nerve of forearm*
Median	– Pronator teres, flexor carpi radialis, palmaris longus, flexor digitorum superficialis, abductor pollicis brevis, superficial head of flexor pollicis brevis, opponens pollicis, first two lumbricals (by way of anterior interosseous branch), flexor pollicis longus, flexor digitorum profundus (lateral half), pronator quadratus; – palmar cutaneous branch to lateral half of palm and digital branches to palmar surface of lateral three and a half fingers; – articular branches to elbow, wrist, and carpal joints

Continuation of the table 3

1	2
Ulnar	Flexor carpi ulnaris, ulnar half of the flexor digitorum profundus, flexor digiti minimi, opponens digiti minimi, abductor digiti minimi, adductor pollicis, deep head of flexor pollicis brevis, third and fourth lumbricals, interossei, palmaris brevis; skin of medial side of palmar surface of the hand, little finger, and medial half of ring finger, skin of the dorsal surface of the medial two fingers and medial side of the 3rd finger
Medial cutaneous nerve of arm	Skin of medial aspect of distal third of arm
Medial cutaneous nerve of forearm	Skin of medial aspect of forearm
Radial	– Triceps brachii, anconeus, and extensor muscles of forearm; skin of posterior arm and forearm, lateral two-thirds of dorsum of hand, and fingers over proximal and middle phalanges; – articular branches to elbow, wrist, and hand

THE ANTERIOR RAMI OF THORACIC NERVES

The anterior rami of spinal nerves T2–T11 do not enter into the formation of plexuses and are known as intercostal nerves. The anterior ramus of the 12th thoracic nerve is distributed to the abdominal wall as the ***subcostal nerve***.

Because these nerves connect directly to the structures they supply in the intercostal spaces and are mainly distributed to a single body segment, they are referred to as segmental

nerves. After leaving its intervertebral foramen, the anterior ramus of nerve T2 innervates the intercostal muscles of the second intercostal space and supplies the skin of the axilla and posteromedial aspect of the arm. Nerves T3–T6 extend along the costal grooves of the ribs and then to the intercostal muscles and skin of the anterior and lateral chest wall. Nerves T7–T12 supply the intercostal muscles, the abdominal muscles, and the overlying skin.

Each intercostal nerve enters the corresponding intercostal space between the posterior intercostal membrane and the parietal pleura. The nerve then forwards with the intercostal vessels in the subcostal groove of the corresponding rib between the external and internal intercostal muscles (Fig. 23).

Each intercostal nerve gives off:

- ***Lateral cutaneous branch***: it innervates the skin on the side of the thoracic wall by dividing into anterior and posterior branches.
- ***Anterior cutaneous branch***: it is the terminal portion of the intercostal nerves and innervates the skin near the midline of chest by dividing into medial and lateral branches.
- ***Muscular branches***: all the muscles of the intercostal spaces are innervated by the various muscular branches of intercostal nerves.

The first intercostal nerve joins to the brachial plexus through a branch, which is equivalent to the lateral cutaneous branches of remaining intercostal nerves. Another exception with the first intercostal nerve is that there is no anterior cutaneous branch. It is also very small as compared to the remaining nerves.

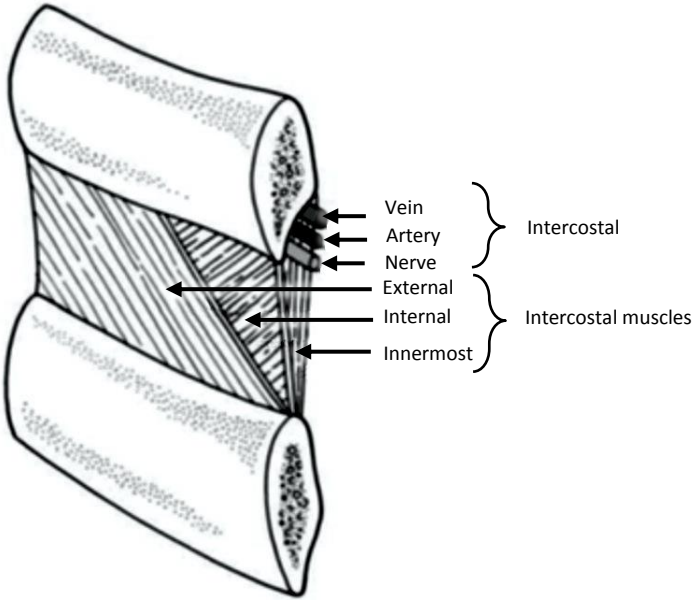

Figure 23 – The relationship of an intercostal space

V. THE LUMBAR PLEXUS. THE SACRAL PLEXUS

The sacral and lumbar plexuses overlap substantially. Because many fibers of the lumbar plexus contribute to the sacral plexus via the lumbosacral trunk, the two plexuses are often referred to as the lumbosacral plexus.

The lumbar plexus supplies the anterolateral abdominal wall, external genitals, and part of the lower limbs. The lumbar plexus is formed by anterior rami of spinal nerves L1–L4 and lies within the psoas major muscle. Its proximal branches

innervate parts of the abdominal wall muscles and the psoas muscle, but its major branches descend to innervate the anterior and medial thigh (Fig. 24).

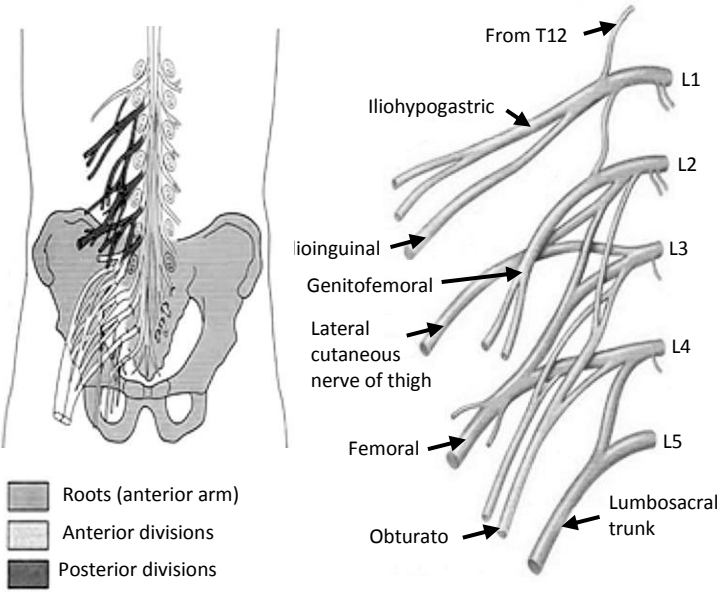

Figure 24 – Origin of lumbar plexus

The branches of lumbar plexus arising from the lateral border of the psoas major are following (Fig. 25):

• **The iliohypogastric nerve** is the first major branch of the lumbar plexus. It runs to the iliac crest, across the quadratus lumborum muscle. It then perforates the transversus abdominis, and supplies the internal oblique and transversus abdominis muscles, the superolateral gluteal skin.

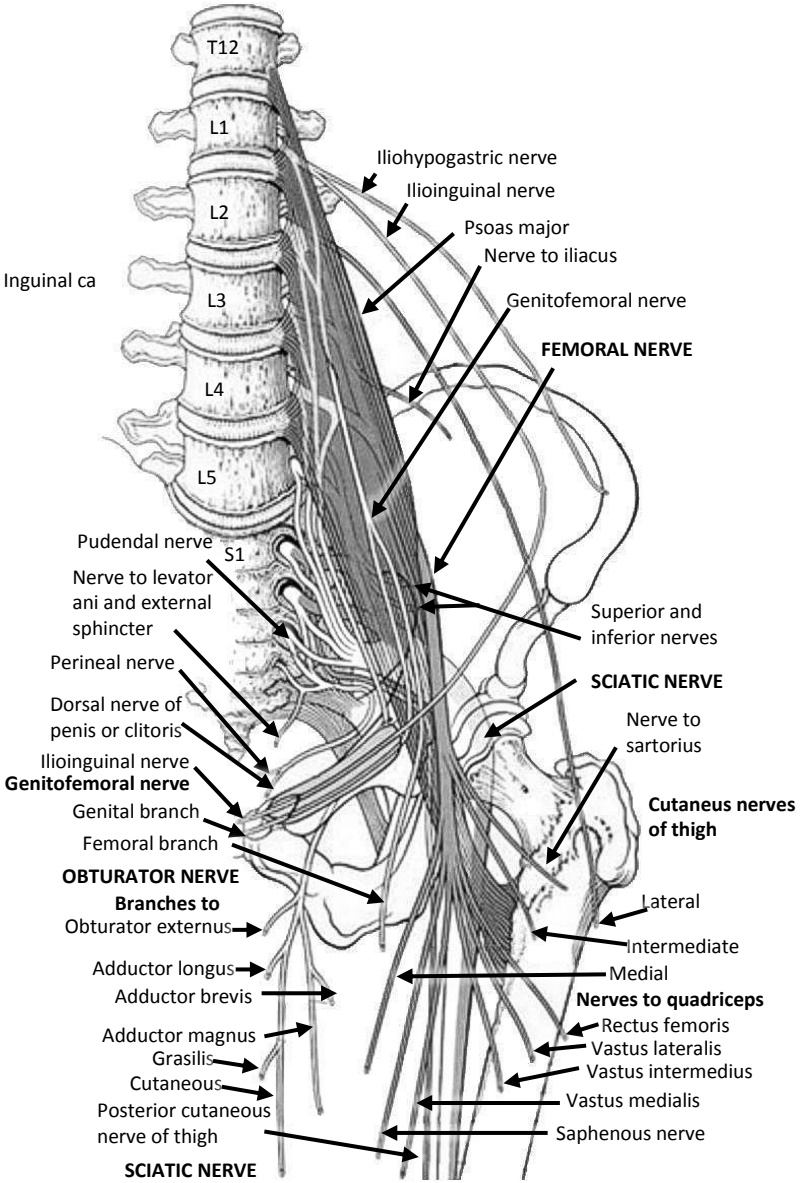

Figure 25 – Branches of lumbar plexus

• **The ilioinguinal nerve** follows the same anatomical course as the iliohypogastric nerve. After innervating the muscles of the anterior abdominal wall, it passes inguinal canal anterior to the spermatic cord (the round ligament of uterus) and innervates the skin of the pubic region and the scrotum (the labia majoria).

• **The lateral cutaneous nerve of the thigh** has a purely sensory function. It enters the thigh at the lateral aspect of the inguinal ligament, where it provides cutaneous innervation to the skin there down to the level of the knee.

• **The femoral nerve** is the largest branch of the lumbar plexus.

The nerve descends from the lumbar plexus behind the lateral border of the psoas major muscle and passes behind the inguinal ligament through the muscular space to the thigh. It passes through the femoral triangle lateral to the femoral vessels (enclosed within the femoral sheath) and gives off articular branches to the hip and knee joints.

The terminal cutaneous branch of the femoral nerve is the saphenous nerve which continues, with the femoral artery and vein, through the adductor canal. Motor branches innervate the illiacus, pectineus, sartorius muscles, all the muscles of quadriceps femoris.

The first cutaneous branches of the femoral nerve are the anterior cutaneous branches that arise in the femoral triangle. They supply the skin on the anteromedial thigh.

The last cutaneous branch of the femoral nerve is the ***saphenous nerve***. It leaves adductor canal through the aponeurotic covering and gives off an ***infrapatellar branch*** to supply the skin anterior to the patella. The saphenous nerve

descends along the tibia and supplies the skin of medial surface of the leg and medial side of the dorsal surface of the foot.

Nerve, which arises from the medial border of the psoas major is **the obturator nerve.** It descends through the fibres of the psoas major muscle and emerges from its medial border, running posteriorly to the common iliac arteries and along the lateral pelvic wall to the obturator foramen, entering the thigh by the obturator canal.

Near the foramen it divides into anterior and posterior branches. Obturator nerve provides articular branches to hip joint and innervates the obturator externus, pectineus, adductor longus, adductor brevis, adductor magnus, gracilis muscles, and the skin over the medial thigh.

Nerve, which traverses the psoas major is **the genitofemoral nerve.** It descends obliquely forwards through the psoas major to emerge on its anterior surface. It divides into ***genital*** and ***femoral branches***.

The genital branch passes inguinal canal posterior to the spermatic cord (the round ligament of uterus) and innervates the cremasteric muscle and the skin of the anterior scrotum (in males) or the skin over mons pubis and labia majora (in females).

The femoral branch passes through the vascular space and innervates the skin on the upper anterior thigh.

The nerves of the lumbar plexus are summarized in the table 4.

When the spinal roots of the lumbar plexus are compressed, as by a herniated disc, gait problems occur because the femoral nerve serves the prime movers that flex the hip and extend the knee. Other symptoms are pain or numbness

of the anterior thigh and (if the obturator nerve is impaired) of the medial thigh.

The anterior rami of spinal nerves L4–L5 and S1–S4 form **the sacral plexus**. This plexus is situated largely anterior to the sacrum, immediately caudal to the lumbar plexus.

Table 4 – Lumbar plexus

NERVE	DISTRIBUTION
Iliohypogastric	Muscles of anterolateral abdominal wall; skin of inferior abdomen and buttock
Ilioinguinal	Muscles of anterolateral abdominal wall; skin of superior and medial aspect of thigh, root of penis and scrotum in male, and labia majora and mons pubis in female
Genitofemoral	Cremaster muscle; skin over middle anterior surface of thigh, scrotum in male, and labia majora in female
Lateral cutaneous nerve of thigh	Skin over lateral aspect of thigh
Femoral	Flexor muscles of hip joint and extensor muscles of knee joint and skin over anterior and medial aspect of thigh and medial side of leg and foot
Obturator	Adductor muscles of hip joint; skin over medial aspect of thigh

Some fibers of the lumbar plexus contribute to the sacral plexus via ***the lumbosacral trunk***, as mentioned earlier. The sacral plexus has about a dozen named branches. About half of these serve the buttock and lower limb; the others innervate pelvic structures and the perineum (Fig. 26).

The anterior rami of spinal nerves S4–S5 and the coccygeal nerves form a small **coccygeal plexus**, which supplies a small area of skin in the coccygeal region.

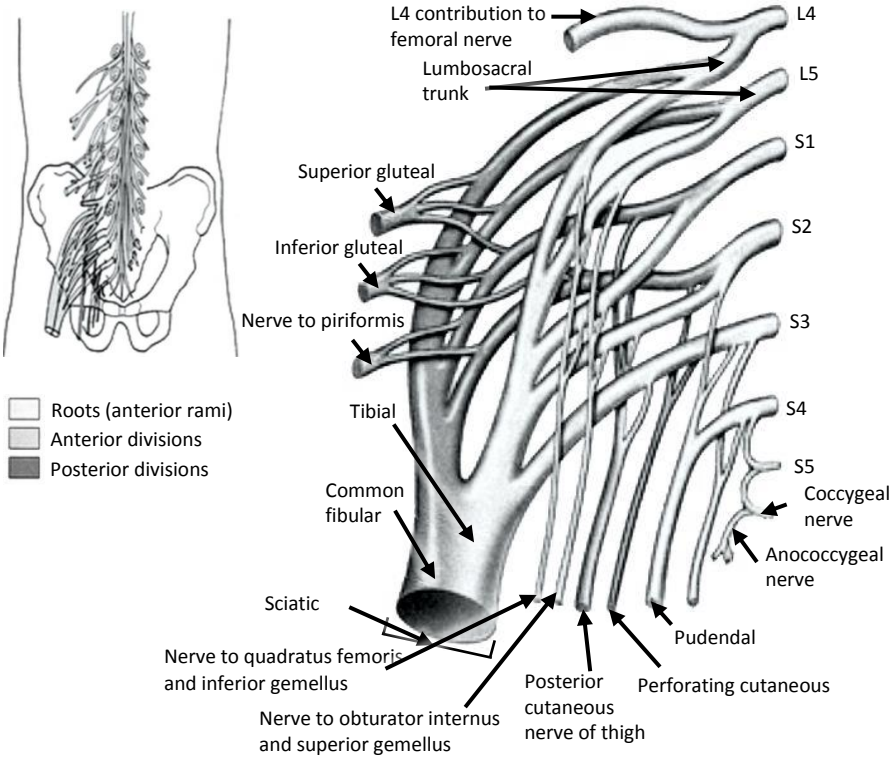

Figure 26 – Origin of sacral plexus

The branches of the sacral plexus (Fig. 27) are divided into short and long.

Short branches:

• ***Muscular branches*** supply posterior group of the muscles of pelvic girdle (superior gluteal nerve to gluteus minimus, gluteus medius, and tensor fasciae latae muscles, inferior gluteal nerve to gluteus maximus muscle, nerves to

piriformis, quadratus femoris, gemelli, obturator internus and externus).

• **The superior gluteal nerve** leaves the pelvis via the greater sciatic foramen, entering the gluteal region superiorly to the piriformis muscle. It is accompanied by the superior gluteal artery and vein for much of its course. The superior gluteal nerve innervates the gluteus minimus, gluteus medius and tensor fascia lata.

• **The inferior gluteal nerve** leaves the pelvis via the greater sciatic foramen, entering the gluteal region inferiorly to the piriformis muscle. It is accompanied by the inferior gluteal artery and vein for much of its course and innervates gluteus maximus.

The long branches of sacral plexus:

• **The posterior cutaneous nerve** of thigh leaves the pelvis via the greater sciatic foramen, entering the gluteal region inferiorly to the piriformis muscle. It descends deep to the gluteus maximus and runs down the back of the thigh to the knee. It innervates the skin on the posterior surface of the thigh.

• **The pudendal nerve** leaves the pelvis via the infrapiriform foramen, then reenters via the lesser sciatic foramen into the ischioanal fossa, and terminates by dividing into several branches:

– *inferior rectal and perineal nerves;*

– *dorsal nerve of the penis or clitoris.*

The pudendal nerve innervates the skeletal muscles in the perineum, the penis or the clitoris and most of the skin of the perineum.

• **The sciatic nerve** is a major nerve of the lower limb. It is a thick flat band, approximately 2 cm wide – the largest nerve in the body. It innervates the muscles of the posterior thigh and the ischial part of the adductor magnus.

The sciatic nerve is derived from the lumbosacral plexus. After its formation, it leaves the pelvis and enters the gluteal region via greater sciatic foramen. It emerges inferiorly to the piriformis muscle and descends in an inferolateral direction.

As the nerve moves through the gluteal region, it crosses the posterior surface of the superior gemellus, obturator internus, inferior gemellus and quadratus femoris muscles. It then enters the posterior thigh by passing deep to the long head of the biceps femoris. When the sciatic nerve reaches the apex of the popliteal fossa, it terminates by bifurcating into **the tibial and common fibular nerves**.

The sciatic nerve does not have any direct cutaneous functions. It provides indirect sensory innervation via its terminal branches.

Damage to the sciatic nerve is followed by paralysis of the hamstrings and all the muscles of the leg and foot (supplied by its distributing branches); there is loss of all movements in the lower limb below the knee joint with foot drop deformity. Sensory loss is complete below the knee, except for an area along the medial side of the leg, over the medial malleolus and down to the hallux, which is innervated by the saphenous branch of the femoral nerve.

The tibial nerve is the largest of the two terminal branches of the sciatic nerve; it traverses the popliteal fossa superficial to the popliteal vein and artery, crossing them from

the lateral to the medial side. Then it passes through the cruropopliteal canal, in company with the posterior tibial vessels, behind the medial malleolus it is divided into its terminal branches **– the medial and lateral plantar nerves.**

The branches of tibial nerve are following:

• ***medial sural cutaneous nerve*** which descends over the back of the calf and is joined by lateral sural cutaneous nerve from the common peroneal nerve to form ***the sural nerve.*** It descends lateral to calcaneal tendon to the region between the lateral malleolus and calcaneus and supplies skin of the posterolateral side of the leg, and lateral aspect of the foot up to the 5^{th} toe;

• ***muscular branches*** to triceps surae and popliteus, flexor halluces longus, flexor digitorum longus, tibialis posterior, plantar muscles;

• ***branch to the knee joint***.

The medial plantar nerve runs along the corresponding groove. It supplies skin of the medial aspect of the foot, the toes 1–3 and a medial half of the 4^{th} toe, giving off common plantar digital nerves, that in turn branch into the proper plantar digital nerves. The muscular branches supply the flexor digitorum brevis, muscles of great toe (exept for the adductor hallucis and the lateral head of flexor hallucis brevis) and two medial lumbricalis muscles.

The lateral plantar nerve also passes through the corresponding groove of the foot, spliting into the deep and superficial branches. The superficial branch supplies skin of the lateral aspect of the foot, the 5^{th} toe and a lateral half of the 4^{th} toe, giving off common plantar digital nerves, that in turn branch into the proper plantar digital nerves. The deep branch

supplies all interossei muscles, two lateral lumbricalis muscles, the adductor hallucis and the lateral head of flexor hallucis brevis.

The common peroneal nerve is the smallest of the terminal branches of the sciatic nerve. It enters the upper part of the popliteal fossa, passes along the medial border of the biceps tendon, then curves around the neck of the fibula where it lies in the substance of peroneus longus and divides into its terminal branches, ***the deep peroneal and superficial peroneal nerves***.

In the popliteal fossa, the common peroneal nerve gives off the lateral sural cutaneous nerve, and branch to the knee joint, but has no muscular branches.

The deep peroneal (fibular) nerve passes on the anterior part of the leg through the anterior opening of the cruropopliteal canal, pierces extensor digitorum longus, then descends, in company with the anterior tibial vessels, over the interosseous membrane and then over the ankle joint.

Its branches are:

- ***muscular*** – to the muscles of the anterior compartment of the leg – extensor digitorum longus, extensor hallucis longus, tibialis anterior;
- ***articular*** – to the ankle joint.

The deep peroneal (fibular) nerve then runs distally on the dorsum of the foot lateral to the dorsalis pedis artery and supplies extensor digitorum brevis and extensor halluces brevis, and skin of adjacent sides of the great and second toes.

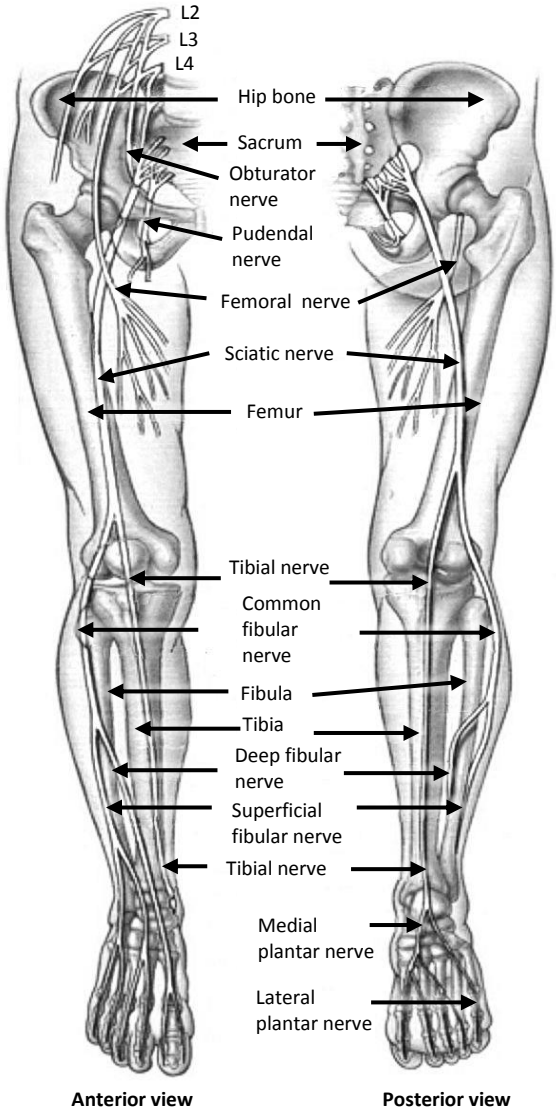

Figure 27 – Distribution of nerves from lumbar and sacral plexus

Table 5 – Sacral plexus

NERVE	DISTRIBUTION
1	2
SHORT BRANCHES	
Superior gluteal	Gluteus minimus, gluteus medius, and tensor fasciae latae m.m.
Inferior gluteal	Gluteus maximus muscle
Nerve to piriformis	Piriformis muscle
Nerve to quadratus femoris	Quadratus femoris muscle
Nerve to obturator internus and externus	Obturator internus and externus muscles
Nerve to gemelli muscles	Superior and inferior gemelli muscles
Pudendal	Muscles of perineum; skin of penis and scrotum in male and clitoris, labia majora, labia minora, and vagina in female
LONG BRANCHES	
Posterior cutaneous nerve of thigh	Skin over anal region, inferior lateral aspect of buttock, superior posterior aspect of thigh, superior part of calf, scrotum in male, and labia majora in female
Sciatic. ***Terminal branches of sciatic nerve:*** – tibial ***Terminal branches of tibial nerve:*** – medial plantar nerve;	Posterior muscles of the thigh. Gastrocnemius, plantaris, soleus, popliteus, tibialis posterior, flexor digitorum longus, and flexor hallucis longus muscles; abductor hallucis, flexor digitorum brevis, and flexor hallucis brevis muscles; skin over medial two-thirds of plantar surface of foot and 1–3 toes and medial half of the 4th toe;

Continuation of the table 5

1	2
– lateral plantar nerve.	remaining muscles of foot not supplied by medial plantar nerve; skin over lateral third of plantar surface of foot and 5th toe and lateral aspect of the 4th toe.
Common fibular divides into:	
– superficial fibular;	Fibularis longus and fibularis brevis muscles; skin over distal third of anterior aspect of leg and dorsum of foot, skin of dorsal surface of foot exept for adjacent sides of first and second toes;
– deep fibular	tibialis anterior, extensor hallucis longus, and extensor digitorum longus and extensor digitorum brevis muscles; extensor digitorum brevis, skin on adjacent sides of great and second toes

The superficial peroneal (fibular) nerve runs in the lateral compartment of the leg through the superior musculorperoneal canal and pierces the deep fascia in the distal third of the leg.

Its branches are:

• ***muscular*** – to the lateral compartment muscles (peroneus longus and brevis);

• ***medial dorsal cutaneous nerve*** – to the skin of the medial side of the hallux and adjacent side of the 2nd and 3rd toes;

• ***intermediate dorsal cutaneous nerve*** – to contiguous sides of the third to fifth toes and skin of the lateral aspect of an ankle.

Damage to this nerve is followed by foot drop (due to paralysis of the ankle and foot extensors) and inversion of the foot due to paralysis of the peroneal muscles with unopposed action of the foot flexors and invertors). There is also anaesthesia over the anterior and lateral aspects of the leg and foot, although the medial side escapes, since this is innervated by the saphenous branch of the femoral nerve.

The nerves of the sacral plexus are summarized in the table 5.

VI. THE AUTONOMIC PART OF THE NERVOUS SYSTEM. THE PARASYMPATHETIC DIVISION OF THE AUTONOMIC NERVOUS SYSTEM. THE SYMPATHETIC DIVISION OF THE AUTONOMIC NERVOUS SYSTEM. THE AUTONOMIC PLEXUSES OF THE ABDOMINOPELVIC CAVITY

The entire nervous system is conventionally divided into two main sections – somatic sensor (animal) and vegetative (visceral).

The vegetative nervous system is responsible for regulation of functioning of the cardiovascular system, respiratory organs, digestive apparatus, endocrine glands, urogenital organs. It also controls feeding of muscles. The vegetative nervous system coordinates and adapts the activity of all organs by the nerve and humoral way, and participates in preservation of the dynamic balance of living functions (Tab. 6).

Table 6 – Comparison of somatic and autonomic nervous system

SOMATIC	VEGETATIVE
Functional differences	
	Maintains the stability of the internal state of the organism
Controls the striated musculature of the body and skin	Controls the smooth muscles, glands and vessels
Submission to the cortex of the brain	Works autonomously
Structural differences	
Fibers	
Myelinated (d 12–14)	Unmyelinated (d 4–5)
Velocity of stimulation conduction	
70–100 m/sec	1–3 m/sec
Reflex arch	
Uninterrupted	Interrupted

The vegetative nervous system works autonomously, but under the control of a CNS (the intellectual activity of the person also is one of a constituent of CNS work, directed in the issue on maintenance of a "comfortable" safe existence).

The particulars of the vegetative nervous system are following:

• Smaller caliber of the nervous fibers

• Lower velocity of stimulation conduction

• Absence of myelin coat in many nervous conductors

• The focal disposition of the vegetative nuclei in the central nervous system

• Accumulation of the effector cell bodies ganglia as components of the vegetative plexuses

• Two-neuron pathway from the cell nucleus in the central nervous system to the innervated organ: preganglionic neurons extending from CNS synapse with postganglionic neurons in an autonomic ganglion, and postganglionic neurons extending from ganglion synapse with a visceral effector

The autonomic nervous system (ANS) is divided into two parts: ***sympathetic nervous system*** and ***parasympathetic nervous system*** (Tab. 7). Most organs have dual innervation: they receive impulses from both sympathetic and parasympathetic neurons. In general, nerve impulses from one division of the ANS stimulate the organ to increase its activity (excitation), whereas impulses from the other division decrease the organ's activity (inhibition).

For example, an increased rate of nerve impulses from the sympathetic division increases heart rate, whereas an increased rate of nerve impulses from the parasympathetic division decreases heart rate.

Sympathetic-parasympathetic duality by which either stimulation or brake of working organs is induced contributes to preservation of the dynamic balance of corresponding functions.

Parasympathetic stimulation causes the inhibition action in some organs and the stimulation effect in others. Also, sometimes, the sympathetic system is of the stimulating character, sometimes, of inhibition. Though often sympathetic activation causes the change of functioning of the corresponding organ opposite to the effect of parasympathetic activation it is not correct to look at interconnection of two sections of the ANS as antagonistic. On the contrary, together they ensure the complete adaptation of the body to the

changing conditions of environment, i. e. act in the final end as synergists (collaborators).

Centers of the vegetative nervous system:

parasympathetic:

1) midbrain center – accessory oculomotor nucleus (III CN);

2) ponto-bulbar center – the superior salivary nucleus (VII CN); the inferior salivary nucleus (IX CN); dorsal nucleus of the vagus nerve (X CN);

sympathetic:

3) thoracolumbar center – lateral intermediate nucleus (C VIII–LII);

4) sacral center – between the anterior and posterior horns of the spinal cord of S II–S IV segments.

Table 7 – Comparison of sympathetic and parasympathetic nervous system

SYMPATHETIC	PARASYMPATHETIC
Centers	
In the spinal cord	In the brain and spinal cord
Function	
Feeding of tissues	Protective, secretive
Fibres	
Preganglionic axons are short, postganglionic are long	Preganglionic axons are long, postganglionic are short
Ganglia	
Paravertebral ganglia and prevertebral ganglia	Terminal external and intramural

The autonomic (vegetative) ganglion is a collection of cell bodies of the second neurons of the vegetative nervous

system outside the CNS. The first of the two motor neurons in any autonomic motor pathway is called a preganglionic neuron. Its cell body is in the brain or spinal cord, and its axon exits the CNS as part of a cranial or spinal nerve. The axon of a preganglionic neuron is a small-diameter, myelinated fiber that extends to an autonomic ganglion. There it synapses with a postganglionic neuron, the second neuron in the autonomic motor pathway. Notice that the postganglionic neuron lies entirely outside the CNS. Its cell body and dendrites are located in an autonomic ganglion, where it forms synapses with one or more preganglionic axons. The axon of a postganglionic neuron is a small-diameter, unmyelinated fibers that terminates in a visceral effector.

Thus, preganglionic neurons convey nerve impulses from the CNS to autonomic ganglia, and postganglionic neurons relay impulses from autonomic ganglia to visceral effectors (Fig. 28).

There are two groups of sympathetic ganglia:

1) *paravertebral ganglia* or sympathetic trunk ganglia. These ganglia lie in a vertical row on either side of the vertebral column and extend from the base of the skull to the coccyx;

2) *prevertebral ganglia* lie anterior to the vertebral column and close to the large abdominal arteries. There are three major prevertebral ganglia:

• the coeliac ganglion is on either side of the coeliac artery;

• the superior mesenteric ganglion is near the superior mesenteric artery;

• the inferior mesenteric ganglion is near the inferior mesenteric artery.

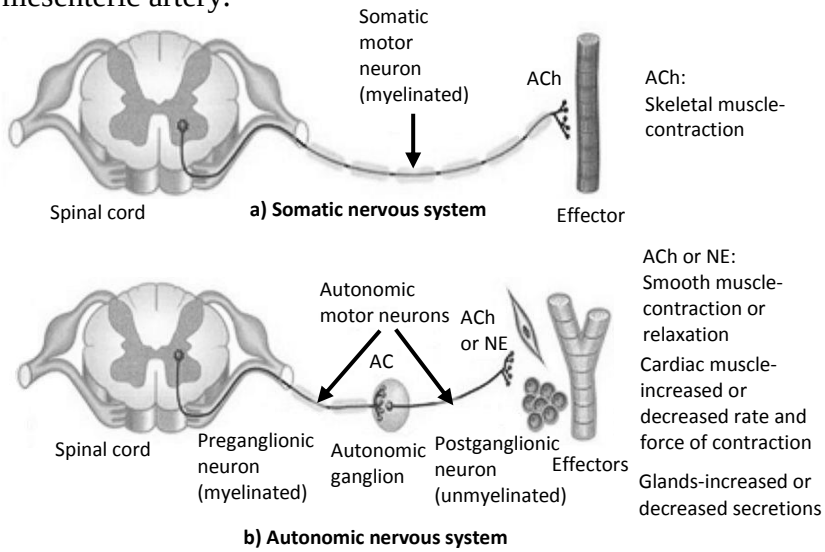

Figure 28 – Motor neuron pathways in the somatic (a) and autonomic (b) nervous system

Each parasympathetic ganglion (Fig. 29) receives three types of innervation:

1) parasympathetic fibers which are divided into preganglionic and postganglionic. Preganglionic parasympathetic fibers are formed by axons of parasympathetic nuclei of the cranial nerves. They end as synapses with cells of the parasympathetic ganglia. Postganglionic axons extend from ganglion synapse and pass to smooth muscles and glands;

2) sensory fibers which pass through the ganglion;

3) postganglionic sympathetic fibers which pass through the ganglion.

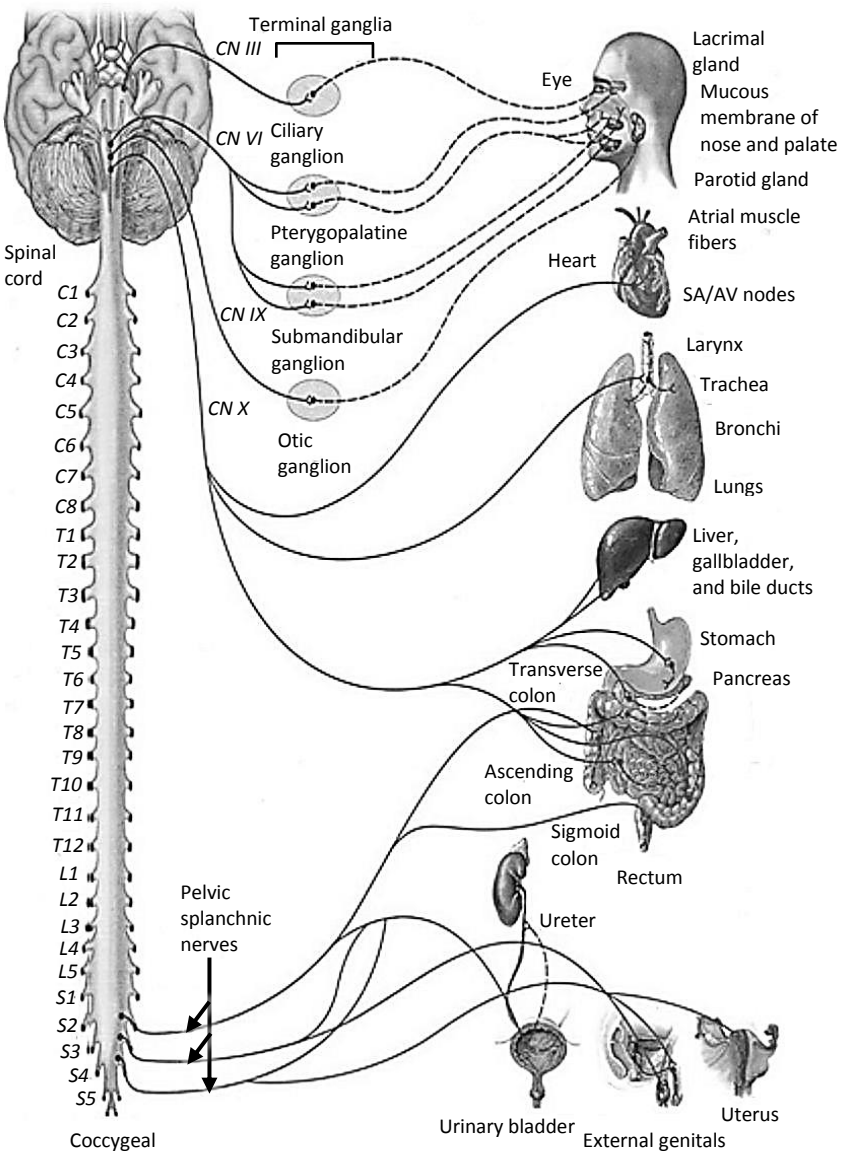

Figure 29 – Parasympathetic part of autonomic nervous system

The ciliary ganglion lies laterally to each optic nerve near the posterior aspect of the orbit.

Parasympathetic fibers: preganglionic axons of accessory oculomotor nucleus pass with the oculomotor nerve to the ciliary ganglion. Postganglionic axons from the ganglion innervate smooth muscle fibers in the eyeball – the ciliary muscle and the sphincter pupillae.

Sympathetic postganglionic fibers: from the cavernosus plexus to dilatator pupillae muscle.

Sensory fibers: ganglionic branch or long branch from the nasociliary nerve (I branch of the trigeminal nerve).

Short ciliary nerves exit from the ciliary ganglion.

The pterygopalatine ganglion is located laterally to the sphenopalatine foramen.

Parasympathetic fibers: they receive preganglionic axons from superior salivatory nucleus as a *greater petrosal nerve* (facial nerve) and send postganglionic axons to the nasal mucosa, palate, pharynx, and lacrimal glands.

Sympathetic postganglionic fibers: deep petrosal nerve from internal carotid plexus.

The greater petrosal nerve (preganglionic parasympathetic) and the deep petrosal nerve (postganglionic sympathetic) together form the nerve of the pterygoid canal, which comes out into the pterygopalatine fossa and proceeds to the pterygopalatine ganglion.

Sensory fibers: pterygopalatine nerve or ganglionic branch (II branch of the trigeminal nerve).

The submandibular and sublingual ganglia are found near the ducts of the submandibular salivary glands.

Parasympathetic fibers: they receive preganglionic axons from superior salivatory nucleus as a *chorda tympany* (the facial nerve) and send postganglionic axons to the submandibular and sublingual salivary glands.

Sympathetic postganglionic fibers: the facial plexus (the external carotid plexus).

Sensory fibers: submandibular or sublingual branches of the lingual nerve (III branch of the trigeminal nerve).

The otic ganglion is situated just inferior to each oval foramen.

Parasympathetic fibers: they receive preganglionic axons from inferior salivatory nucleus as a *lesser petrosal nerve* of the tympanic nerve (the glossopharyngeal nerve) and send postganglionic axons to the parotid salivary glands.

Sympathetic postganglionic fibers: the middle meningeal plexus (the external carotid plexus).

Sensory fibers: the auriculotemporal nerve (III branch of the trigeminal nerve).

Sacral part of parasympathetic nervous system

The pelvic efferent cell bodies reside in the parasympathetic nuclei between anterior and posterior grey columns of the spinal cord with respect to segments S II through S IV.

Pelvic splanchnic nerves arise from the anterior rami of sacral spinal nerves S II – S IV. Most of them pass into network of nerves that form inferior hypogastric plexus. From here they pass to the pelvic viscera. After reaching inferior hypogastric plexus, the pelvic splanchnic nerves ramify throughout the pelvic and lower abdomen innervating ganglia embedded in walls of the descending and sigmoid colon,

rectum, ureter, prostate, urinary bladder, urethra and penis (clitoris).

THE SYMPATHETIC NERVOUS SYSTEM

innervates all smooth muscles and various glands of the body, and the striated muscle of the heart.

The central portion of the sympathetic part of the autonomic nervous system (Fig. 30) is located in the grey matter of the spinal cord and presented by the intermediolateral nuclei, which are situated in the lateral horns of the spinal cord between the levels of the C8 up to L2 or L3 segments.

The peripheral portion of the sympathetic nervous system consists of sympathetic trunks with ganglia and nerves arise from them as well as of plexuses, which are formed by nerves and intrinsic or extrinsic organ's ganglia.

The right and left sympathetic trunks are situated anterolaterally to the vertebral column from the base of the skull to the apex of the coccyx, where they terminate forming the unpaired coccygeal ganglion. Ganglia of the sympathetic trunk are connected with interganglionic branches and separated into some divisions, which are:

a) the cervical ganglia (3);

b) the thoracic ganglia (9–12);

c) the lumbar ganglia (3–5);

d) the sacral ganglia (4);

e) the ganglion impar inconstantly present in the coccygeal region.

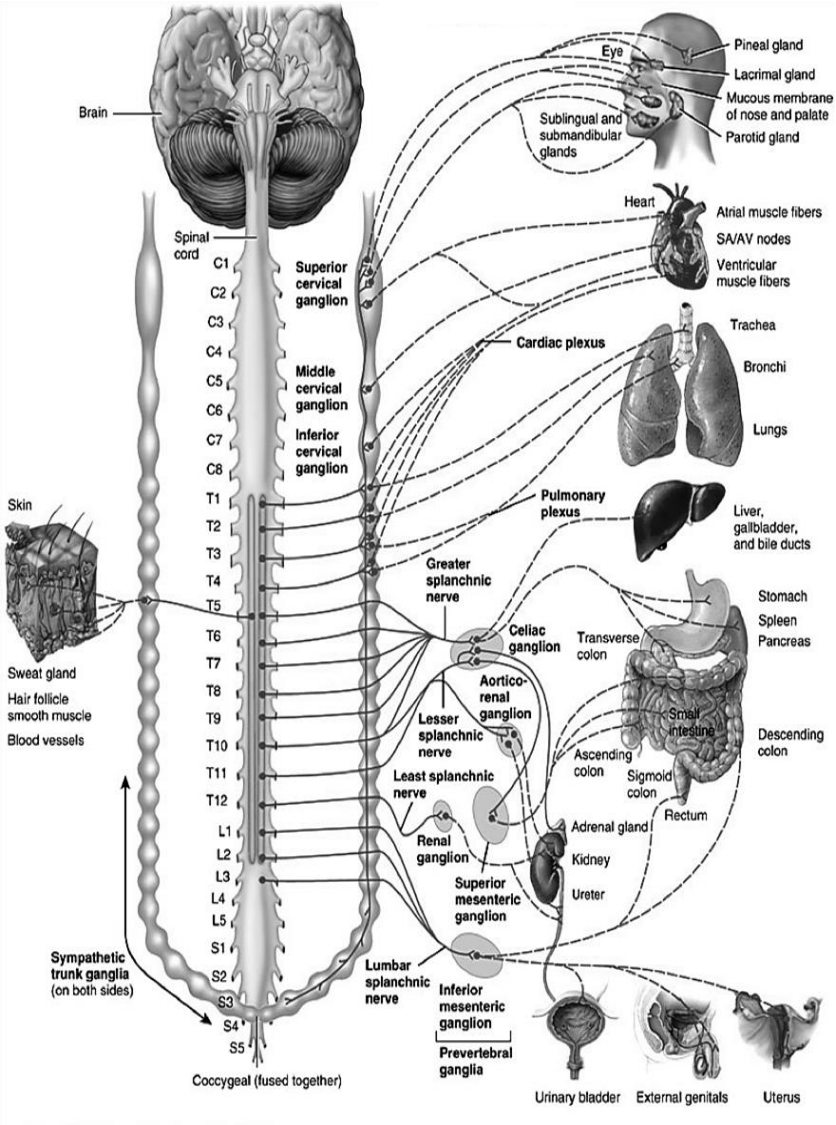

Figure 30 – Sympathetic part of autonomic nervous system

As partly mentioned, each ganglion gives rise to two types of branches:

1. The communicating branches, which are classified into:

a) *the white communicating* branches – are the preganglionic sympathetic fibers connecting the spinal cord with the ganglia of the sympathetic trunk. They contain efferent myelinated nerve fibers, which are processes of neurons of the lateral horns of the spinal cord. Because the centers are situated at the level of the thoracic and upper lumbar segments, the white communicating branches are present only in the area from C8 to L3 spinal nerves;

b) the grey communicating branches are connected with the spinal nerves to provide the innervation of the soma. Each grey communicating branch unites the sympathetic trunk with a spinal nerve, and contains unmyelinated efferent fibers of the cells of a sympathetic trunk's ganglion, and runs into a spinal nerve. These fibers are called the postganglionic fibers and terminate on the periphery.

2. The visceral branches – the branches, which pass to the autonomic plexuses.

PARTS OF THE SYMPATHETIC TRUNK

The cervical part of the sympathetic trunk (Fig. 31)

1. **The superior cervical ganglion** lies at the level of the bodies of the C2 and C3 vertebrae. It gives rise to some branches, which are:

a) *the grey communicating branches* to the C1–C4 spinal nerves;

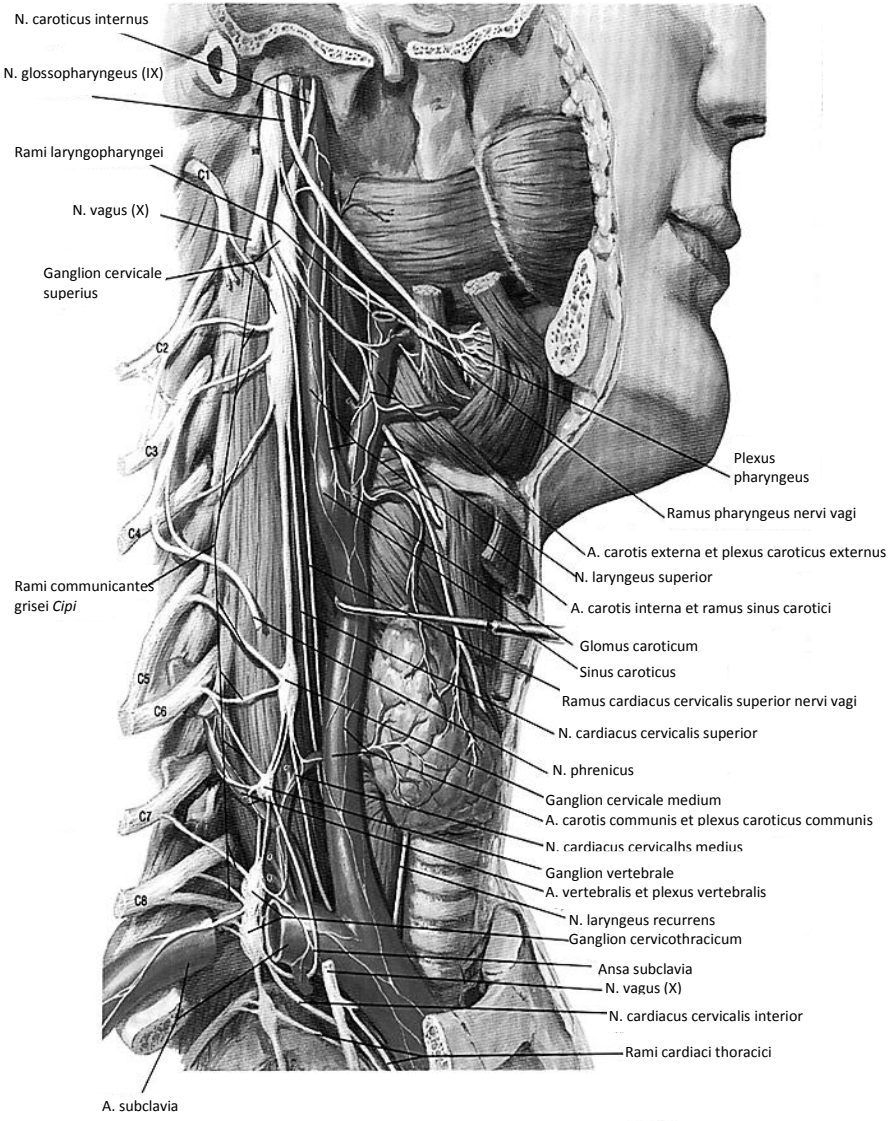

Figure 31 – Cervical part of sympathetic trunk

b) *the external carotid nerve* forms external carotid plexus around the artery and is distributed along the branches arising from it contributing to the formation of plexuses surrounding the same named vessels (facial, lingual, middle meningeal, lingual and other);

c) *the internal carotid nerve* forms the internal carotid plexus which surrounds the artery and gives the following nerves:

– caroticotympanic nerves;

– the deep petrosal nerve, which unites with the greater petrosal nerve to form the nerve of the pterygoid canal and enters the pterygopalatine ganglion;

– the cavernous plexus;

d) *the jugular nerve*. It gives two branches to the superior ganglion of the CN X and to the inferior ganglion of the CN IX;

e) *the laryngopharyngeal* branches innervate the larynx and pharynx, together with the pharyngeal branches of the CN IX and CN X to form the pharyngeal plexus;

f) *the superior cervical cardiac nerve* takes part of the formation of the deep part of the extraorganic cardiac plexus.

2. **The middle cervical ganglion** is inconstant. It lies at the level of the transverse process of the C V and C 6 vertebrae. It is connected to the superior cervical ganglion with one interganglionic branch and with the inferior cervical ganglion with two interganglionic branches. They embrace the subclavian artery from front to back and form the ansa subclavia (loop of Vieussens). The middle cervical ganglion gives some branches, which are:

a) *the grey communicating branches* to the C IV–C VI spinal nerves;

b) *the common carotid nerve* forms the same plexus;

c) *the middle cervical cardiac nerve* takes part of the formation of the deep part of the extraorganic cardiac plexus.

3. **The inferior cervical ganglion** is often fused with the first thoracic ganglion to form the ganglion cervicothoracicum or stellate ganglion. It is situated at the level of the transverse process of the C VII vertebra and the head of the first rib. This ganglion gives the following branches:

a) *the grey communicating branches* to the C VII–C VIII spinal nerves;

b) *vertebral nerve* to the vertebral plexus;

c) branches to the *subclavian plexus*;

d) branches to the *inferior thyroid plexus*;

e) *the inferior cervical cardiac nerve.*

The branches of the thoracic part of the symphatetic trunk

The thoracic ganglia are situated in the intercostal spaces along the line of heads of the ribs. The thoracic part is characterized by the presence of white communicating branches which connect the anterior roots of the spinal nerves with the sympathetic trunk ganglia. The branches of the thoracic part are:

1. *The grey communicating branches* pass to the corresponding intercostal nerves.

2. *Thoracic cardiac branches*.

3. *The visceral branches* which take part in innervation of the vessels and viscera of the thoracic cavity:

a) oesophageal branches;
b) bronchial branches;
c) pulmonary branches

4. *The greater splanchnic nerve* arises by several branches from T V–T IX ganglia. All branches unite into a single trunk which descends to the lumbar part of the diaphragm and enters the abdominal cavity. It ends in the coeliac plexus.

5. *The lesser splanchnic nerve* originates from the T X–T XI (sometimes T XII) ganglia and usually follows the course of the greater splanchnic nerve. It takes part in the formation of the coeliac plexus.

6. *The lowest (list) splanchnic nerve* is an inconstant branch. It originates from the T XII ganglion.

The branches of the lumbar part of the sympathetic trunk

The lumbar ganglia are situated on the anterolateral surface of the lumbar vertebral bodies. Each lumbar ganglion has two types of branches:

1. *The grey communicating branches* to the lumbar nerves.

2. *The lumbar splanchnic nerves* which contain mostly preganglionic fibers and go to the coeliac autonomic plexuses of the abdominal cavity.

The branches of the sacral part of the sympathetic trunk

The sacral or pelvic part of the sympathetic trunk is situated on the pelvic surface of the sacrum medial to the sacral foramina. They give some branches:

1. *The grey communicating branches* to the sacral nerves.

2. *The sacral splanchnic nerves* which contain mostly preganglionic fibers and proceed to the superior and inferior hypogastric plexuses.

VEGETATIVE PLEXUSES OF THE ABDOMINAL CAVITY AND PELVIS

The largest vegetative plexus is the **abdominal aortic plexus**, which is located on the aorta and consists of some primary plexuses (Fig. 32). They are:

– the celiac plexus;
– the superior mesenteric plexus;
– the intermesenteric plexus;
– the inferior mesenteric plexus;
– the superior hypogastric plexus.

1. **The coeliac plexus** is unpaired and lies at the origin of the coeliac artery. There are two semilunar coeliac ganglia (or one horse shoe shape) within the coeliac plexus. The coeliac plexus receives branches from the:

a) greater and lesser splanchnic nerves (sympathetic);
b) thoracic and lumbar spinal nerves (sensory);
c) phrenic nerve (sensory);
d) vagus nerve (parasympathetic).

A greater number of nerve branches arise from the celiac plexus and run in all directions to form secondary plexuses. They are:

– the phrenic plexus;

– the hepatic plexus;

– the splenic plexus;

– the gastric plexus;

– the pancreatic plexus.

2. **The superior mesenteric plexus** is situated at the origin of the superior mesenteric artery. It is a complex of the:

a) superior mesenteric ganglion;

b) greater and lesser splanchnic nerves and upper lumbar splanchnic nerves (sympathetic);

c) lumbar spinal nerves (sensory);

d) vagus nerve (parasympathetic).

The secondary plexuses of the superior mesenteric plexus are:

– the pancreatic plexus;

– the jejunal and ileal plexuses;

– the caecal plexus;

– the right colic plexus;

– the middle colic plexus.

3. **The intermesenteric plexus** is situated between the superior and inferior mesenteric plexuses. It is formed by:

a) aorticorenal ganglia;

b) greater and lesser splanchnic nerves and lumbar splanchnic nerves (sympathetic);

c) lumbar spinal nerves (sensory);

d) vagus nerve (parasympathetic).

The secondary plexuses of the intermesenteric plexus are:

– the renal plexus;

– the suprarenal plexus;

– the testicular or ovarian plexuses.

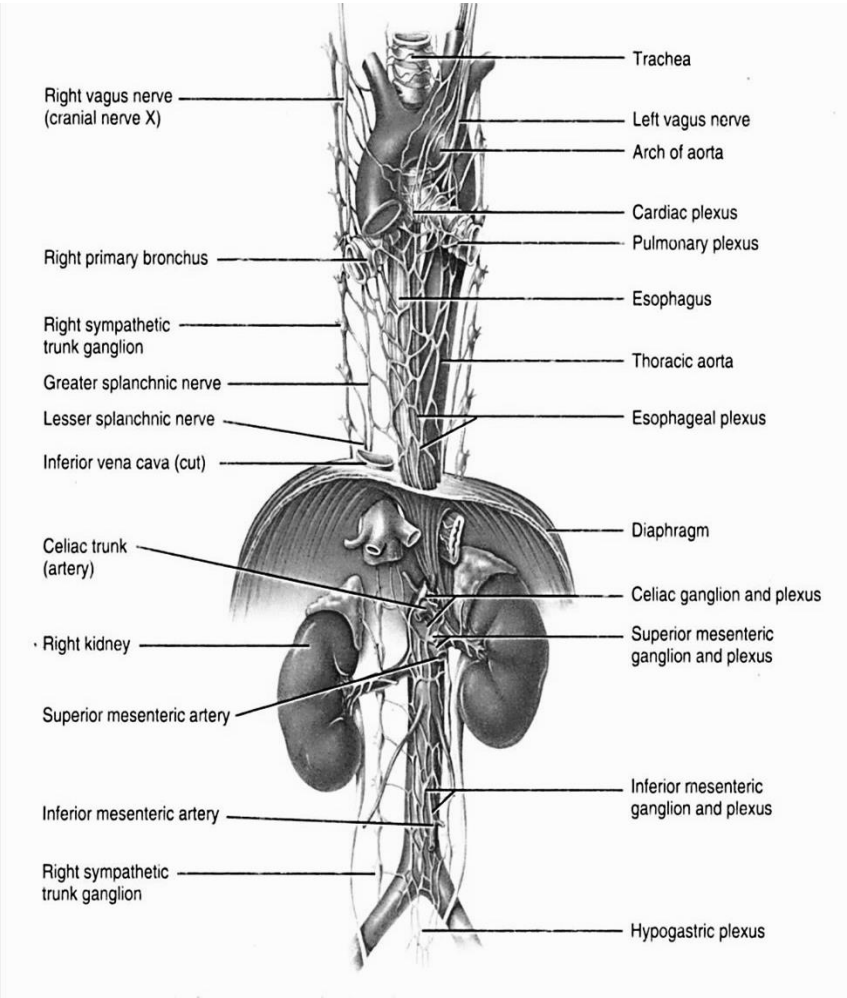

Figure 32 – Autonomic plexuses in the thorax and abdomen

4. **The inferior mesenteric plexus** lies at the root of the inferior mesenteric artery. It is formed by:

a) inferior mesenteric ganglion;

b) greater and lesser splanchnic nerves and lumbar and sacral splanchnic nerves (sympathetic);

c) lumbar spinal nerves (sensory);

d) the pelvic splanchnic nerves (parasympathetic).

The secondary plexuses of the inferior mesenteric plexus are:

– the superior rectal plexus;

– the left colic plexus;

– the sigmoid plexus.

5. The superior hypogastric plexus lies below the bifurcation of the abdominal aorta. It is formed by:

a) superior hypogastric ganglion;

b) lumbar and sacral splanchnic nerves (sympathetic);

c) sacral spinal nerves (sensory);

d) the pelvic splanchnic nerves (parasympathetic).

The superior hypogastric plexus does not give secondary plexus.

THE PELVIC PLEXUS

6. **The inferior hypogastric plexus** is paired, and is continuation of the unpaired superior hypogastric plexus. It lies on the posterior wall of the lesser pelvis.

The secondary plexuses of the inferior hypogastric plexus are:

- the rectal plexus;
- the vesical plexus;
- the prostatic plexus;
- the uterovaginal plexus;
- the plexus of the vas deferens

TEST QUESTIONS (COMPUTER)

What is the name of the V cranial nerve?
+ Trigeminal nerve
– Facial nerve
– Oculomotor nerve
– Abducent nerve

The trigeminal nerve comprises the following fibers:
+ Sensory and motor
– Sensory
– Motor
– Sympathetic

How many roots does the trigeminal nerve have?
+ 2
– 3
– 1
– 4

The roots of trigeminal nerve are:
+ Sensory and motor
– Motor
– Anterior and posterior
– Sensory

How many nuclei does the trigeminal nerve have?
+ 4
– 3
– 6
– 2

What area does the trigeminal nerve arise from the base of the brain:
+ Between the pons and middle cerebellar peduncle
– From medial surface of cerebral peduncle
– Between pyramid and pons
– In pontocerebellar angle

How many motor nuclei does the trigeminal nerve have?
+ 1
– 3
– 2
– 4

How many sensory nuclei does the trigeminal nerve have?
+ 3
– 1
– 4
– 2

What is the first branch of the trigeminal nerve?
+ Ophthalmic nerve
– Oculomotor nerve

– Optic nerve
– Infraorbital nerve

What is the function of the mesencephalic nucleus of the trigeminal nerve?
+ Proprioceptive sensitivity
– Motor
– General sensitivity
– Vegetative parasympathetic

What is the function of the spinal nucleus of the trigeminal nerve?
+ General sensitivity
– Taste sensitivity
– Proprioceptive sensitivity
– Motor

What ganglion does the sensory root of the trigeminal nerve arise from?
+ Trigeminal ganglion
– Geniculate ganglion
– Superior ganglion
– Inferior ganglion

What cells does the trigeminal ganglion comprise?
+ Sensory pseudounipolar cells
– Motor cells
– Vegetative parasympathetic cells
– Vegetative sympathetic cells

Where is the trigeminal ganglion located?
+ On the floor of trigeminal impression on the apex of the petrous part of temporal bone
– On the arcuate eminence of the petrous part of temporal bone
– On the subarcuate fossa of the petrous part of temporal bone
– On the jugular fossa of the petrous part of temporal bone

The ophthalmic nerve proceeds to the orbit via:
+ Superior orbital fissure
– Inferior orbital fissure
– Optic canal
– Entrance of orbit

The lacrimal nerve anastomoses via communicating branch with the following nerve:
+ Zygomatic nerve
– Nasociliary nerve

– Frontal nerve
– Infraorbital nerve

How is the second branch of the trigeminal nerve called?
+ Maxillary nerve
– Mandibular nerve
– Ophthalmic nerve
– Oculomotor nerve

How is the third branch of the trigeminal nerve called?
+ Mandibular nerve
– Maxillary nerve
– Ophthalmic nerve
– Facial nerve

Where do the branches of the trigeminal nerve begin?
+ From trigeminal ganglion
– From base of the brain
– From geniculate ganglion
– From optic canal

Before entering the orbit the ophthalmic nerve gives the following:
+ Meningeal branch
– Lacrimal nerve
– Frontal nerve
– Nasociliary nerve

The frontal nerve splits into the following branches:
+ Supraorbital and supratrochlear nerves
– Infraorbital and zygomatic nerves
– Nasociliary and lacrimal nerves
– Anterior and posterior ethmoidal nerves

The ophthalmic nerve splits into the following branches:
+ Frontal, lacrimal and nasociliary nerves
– Infraorbital, supraorbital and zygomatic nerves
– Meningeal, ganglionic and infratrochlear branches
– Supraorbital, supratrochlear and infraorbital nerves

The supraorbital nerve leaves the orbit via the:
+ Supraorbital notch
– Frontal notch
– Infraorbital foramen
– Foramen caecum

The supraorbital nerve terminates within the following structures:

+ The skin of the forehead
– Frontal belly of epicranius muscle
– Orbicularis oculi muscle
– Skin and conjunctiva of the upper eyelid

***The supratrochlear nerve terminates within the following structures*:**

+ Skin of the root of a nose, skin and conjunctiva of the upper eyelid in the medial angle of an eye
– Superior oblique muscle of an eye
– The skin of the forehead
– Skin and conjunctiva of the lower eyelid

Where is the otic ganglion located?

+ Below the foramen ovale medially from the mandibular nerve
– Within the parotid gland
– In a temporal fossa
– On the floor of an external acoustic meatus

The nasociliary nerve branches into the following nerves:

+ Anterior and posterior ciliary nerves, long ciliary nerves, infratrochlear nerve, sensory root of ciliary ganglion
– Supraorbital and supratrochlear nerve, communicating branch with zygomatic nerve, infraorbital nerve
– Superior and inferior branches, supraorbital and supratrochlear nerve
– Lacrimal, frontal, abducent and trochlear nerves

The maxillary nerve escapes from cranial cavity via:

+ Foramen rotundum
– Superior orbital fissure
– Foramen ovale
– Foramen spinosum

The anterior and posterior ethmoidal nerves supply the following:

+ Ethmoidal cells, sphenoidal sinus, anterior portion of the nasal mucosa
– Tunics of the eyeball
– Skin in the medial angle of an eye and root of a nose
– Smooth muscles of an eye

The infratrochlear nerve supplies the following:

+ Skin and conjunctiva in the medial angle of an eye
– Nasal mucosa and ethmoidal cells
– Eyeball tunics
– Smooth muscles of an eye

The long ciliary nerves supply the following:

+ Eyeball tunics
– Smooth muscles of an eye
– Nasal mucosa
– Skin in the medial angle of an eye and root of a nose

The short ciliary nerves supply the following:

+ Smooth muscles of an eye
– Striated muscles of an eye
– Nasal mucosa
– Skin in the medial angle of an eye and the root of a nose

What branches does the maxillary nerve give in the pterygopalatine fossa?

+ Infraorbital and zygomatic nerves, ganglionic branches
– Supraorbital, supratrochlear, trochlear nerves
– Nasociliar, frontal, lacrimal nerves
– Abducent, throchlear and infratrochlear nerves

What branch does the maxillary nerve give in the cranial cavity?

+ Meningeal branch
– Posterior superior posterior alveolar branch
– Anterior superior alveolar branch
– Tonsillar branches

The infraorbital nerve enters the orbit via:

+ Inferior orbital fissure
– Superior orbital fissure

– Optic canal
– Entrance of the orbit

Within the orbit the infraorbital nerve runs along the following:
+ Infraorbital groove
– Lateral wall of the orbit
– Medial wall of the orbit
– Superior wall of the orbit

On leaving the infraorbital foramen, the infraorbital nerve gives the following branches:
+ Inferior palpebral, external nasal and superior labial branches
– Posterior, middle and anterior superior alveolar branches
– Internal nasal branches
– Superior dental and superior gingival branches

Where does the infraorbital nerve emerge on the face?
+ On anterior surface of maxilla in the area of an infraorbital foramen
– In the area of a supraorbital notch
– In the area of a mental foramen
– In the area of a zygomaticofacial foramen

The zygomatic nerve enters the orbit via the:
+ Inferior orbital fissure
– Entrance of the orbit
– Anterior ethmoidal foramen
– Posterior ethmoidal foramen

What branches does the infraorbital nerve give within the infraorbital canal?
+ Posterior, middle and anterior superior alveolar branches
– Superior labial branches
– Superior palpebral branches
– External and internal nasal branches

The communicating branch with the zygomatic nerve carries the following fibers:
+ Parasympathetic postganglionic fibers to a lacrimal gland

– Parasympathetic preganglionic fibers to a ciliary ganglion
– Sensory fibers to a lacrimal gland
– Motor fibers to muscles of an eye

Within a zygomatic bone the zygomatic nerve gives the following branches:
+ Zygomaticotemporal branch and zygomaticofacial branch
– External and internal nasal branches
– Superior dental branches
– Superior gingival branches

In the orbit the zygomatic nerve gives the following branch:
+ Communicating branch
– Zygomaticotemporal branch
– Zygomaticofacial branch
– Superior alveolar branch

What nerve is not a branch of the pterygopalatine ganglion?
+ Zygomatic nerve
– Posterior superior medial and lateral nasal branches
– Greater and lesser palatine nerves
– Inferior posterior nasal branches

Where is the pterygopalatine ganglion located?
+ In the pterygopalatine fossa
– In the temporal fossa
– In the infratemporal fossa
– In the sphenoethmoidal recess

The mandibular nerve escapes from the cranial cavity via the:
+ Foramen ovale
– Foramen rotundum
– Foramen lacerum
– Foramen spinosum

What branch of the mandibular nerve is not motor?
+ Meningeal branch
– Masseteric nerve
– Deep temporal nerve
– Medial and lateral pterygoid nerves

The mandibular nerve supplies the following muscles:

+ Tensor veli palatini and tensor tympani muscles

– Levator veli palatini and uvulae muscles

– Palatoglossus and palatopharyngeus muscles

– Buccinators and risorius muscles

What branch of the mandibular nerve has no sensory fibers?

+ Masseteric nerve

– Meningeal and buccal branches

– Auriculotemporal and lingual nerves

– Inferior alveolar nerves

What branches of the mandibular nerve receive parasympathetic secretory fibers?

+ Auriculotemporal and lingual nerves

– Meningeal and buccal branches

– Masseteric and musculi tensor tympani

– Inferior alveolar nerves

The meningeal branch of the mandibular nerve supplies the following:

+ Dura mater of the middle cranial fossa

– Dura mater of the anterior cranial fossa

– Dura mater of the posterior cranial fossa

– Mucosa of a cheek

The auriculotemporal nerve does not supply the following region of the skin:

+ Zygomatic and buccal regions

– Anterior part of the auricle

– External acoustic meatus and tympanic membrane

– Temporal region

The buccal nerve supplies the following:

+ Buccal mucosa and mucosa of the angle of a mouth

– Muscles of the upper jaw and lower jaw

– Buccinators muscle
– Anterior part of an auricle

What branches of auriculotemporal nerve contain postganglionic parasympathetic secretory fibers?
+ Parotid branches
– Anterior auricular branches
– Superficial temporal branches
– Tympanic membrane branches

The lingual nerve supplies the following region of oral mucosa:
+ Anterior 2/3 of the tongue
– Posterior 1/3 of the tongue
– Uvula
– Palatoglossal arches

What branch of the VII cranial nerve joins with lingual nerve?
+ Chorda tympani nerve
– Greater petrosal nerve
– Stapedius nerve
– Posterior auricular nerve

What is the name of the VII cranial nerve?
+ Facial nerve
– Abducent nerve
– Glossopharyngeal nerve
– Intermediate nerve

The inferior alveolar nerve supplies the following muscles:
+ Mylohyoid and anterior belly of digastric muscles
– Muscles of the tongue
– Muscles of the soft palate
– Muscles of palatine arches

The third branch of trigeminal nerve emerges on the face in the region of:
+ Mental foramen
– Infraorbital foramen
– Mandibular angle
– Near anterior margin of digastric muscle

What is the function of the nucleus of a solitary tract?
+ Taste sensitivity
– Proprioceptive sensitivity
– General sensitivity
– Vegetative parasympathetic

The sensory branches of the inferior alveolar nerve supply the following:

+ Teeth and gums of the lower jaw
– Mucosa of the tongue
– Buccal mucosa
– Mucosa of the hard and soft palate

The terminal branch of the mandibular nerve supplies the following:

+ Skin of the chin and lower lip
– Buccal mucosa
– Teeth and gums of the lower jaw
– Mylohyoid muscle and anterior belly of digastric muscle

The nucleus of a solitary tract is the common nucleus for the following nerves:

+ VII, IX and X
– VI, VII and IX
– VII, VIII and X
– VII, X and XI

What nerves form the VII cranial nerve?

+ Facial and intermediate nerves
– Lingual and facial nerves
– Lingual and pharyngeal nerves
– Facial and accessory nerves

How many nuclei does the VII cranial nerve have?

+ 3
– 4
– 2
– 1

What is the name of the motor nucleus of the VII cranial nerve?

+ Motor nucleus of the facial nerve
– Superior salivary nucleus
– Nucleus of a solitary tract
– Nucleus ambiguus

Where do the nuclei of the VII cranial nerve reside?

+ Within pons and medulla oblongata
– Within the midbrain

– Within upper segments of the spinal cord
– Within the middle cerebellar peduncle

What is the sensory nucleus of the VII cranial nerve called?
+ Nucleus of a solitary tract
– Superior salivary nucleus
– Nucleus of the facial nerve
– Nucleus ambiguus

What is the vegetative nucleus of the VII cranial nerve called?
+ Superior salivary nucleus
– Inferior salivary nucleus
– Nucleus ambiguus
– Nucleus of solitary tract

The VII cranial nerve does not comprise the following nerve fibers:
+ Vegetative sympathetic
– Vegetative parasympathetic
– Motor
– Taste sensitivity

The VII cranial nerve passes through the following canal of the temporal bone:
+ Facial canal
– Carotid canal
– Musculotubal canal
– Tympanic canaliculus

The VII cranial nerve leaves the cranial cavity via:
+ Stylomastoid foramen
– Jugular foramen
– Lacerum foramen
– Internal acoustic meatus

The geniculate ganglion is made up of:
+ Sensory pseudounipolar cells
– Motor neurons
– Vegetative parasympathetic neurons
– Vegetative sympathetic neurons

The greater petrosal nerve leaves the cranial cavity via:
+ Foramen lacerum
– Foramen spinosum
– Jugular foramen
– Stylomastoid foramen

Where are the hiatus for the greater petrosal nerve and the same groove located?

+ On anterior surface of a pyramid of the temporal bone
– On superior surface of a pyramid of the temporal bone
– On inferior surface of a pyramid of the temporal bone
– On posterior surface of a pyramid of the temporal bone

What nerve does not arise from the VII cranial nerve in a facial canal?

+ Posterior auricular nerve
– Greater petrosal nerve
– Nerve to stapedius
– Chorda tympani nerve

The greater petrosal nerve carries the following fibers:

+ Parasympathetic preganglionic
– Parasympathetic postganglionic
– Motor
– Sensory

The greater petrosal nerve joins with the:

– Deep petrosal nerve
– Lesser petrosal nerve
– Chorda tympani nerve
– Nerve to stapedius

The greater and deep petrosal nerves together form the following nerve:

+ Nerve of pterygoid canal
– Glossopharyngeal nerve
– Vestibulocochlear nerve
– Chorda tympani nerve

The nerve of the pterygoid canal goes to the following ganglion:

+ Pterygopalatine ganglion
– Otic ganglion
– Ciliary ganglion
– Superior cervical ganglion

The chorda tympani nerve is a branch of the:

+ Intermediate nerve
– Proper facial nerve
– Lingual nerve
– Inferior alveolar nerve

The chorda tympani nerve passes through the following canal of the temporal bone:

+ Chorda tympani canaliculus
– Facial canal

– Musculotubal canal
– Carotid canal

What fibers does the chorda tympani contain?
+ Parasympathetic preganglionic and taste sensitivity
– Parasympathetic postganglionic and taste sensitivity
– Motor and taste sensitivity
– General sensitivity and taste sensitivity

The chorda tympani nerve leaves the cranial cavity through:
+ Petrotympanic fissure
– Petrosquamous fissure
– Tympanomastoid fissure
– Tympanosquamous fissure

The parasympathetic preganglionic fibers of chorda tympani nerve run to the following ganglion:
+ Sublingual and submandibular ganglia
– Otic ganglion
– Ciliary ganglion
– Pterygopalatine ganglion

Where are the taste receptors of the chorda tympani nerve located?
+ Anterior 2/3 of lingual mucosa
– 1/3 of lingual mucosa
– Pharyngeal mucosa
– Mucosa of pharyngeal arches

The chorda tympany nerve joints with the following nerve:
+ Lingual nerve
– Glossopharyngeal nerve
– Inferior alveolar nerve
– Hypoglossal nerve

The stapedius nerve innervates the following:
+ Stapedius muscle
– Mucosa of tympanic cavity
– Tensor tympani muscle
– Posterior belly of digastric muscle

What nerve does not form the parotid plexus (pes anserinus major)?
+ Stapedius nerve
– Temporal branch

– Zygomatic and buccal branches
– Marginal mandibular and cervical branches

What is the name of the IX cranial nerve?
+ Glossopharyngeal nerve
– Vestibulocochlear nerve
– Facial nerve
– Vagus nerve

Where are nuclei of the IX cranial nerve situated?
+ Within the medulla oblongata
– Within the pons
– Within the midbrain
– In upper segments of spinal nerve

The branches of parotid plexus innervate the following muscles:
+ Muscles of facial expression
– Muscles of mastication
– Muscles of soft palate
– Muscles of pharynx

What is the vegetative nucleus of the IX cranial nerve called?
+ Inferior salivary nucleus
– Superior salivary nucleus
– Nucleus of solitary tract
– Nucleus ambiguous

What is the motor nucleus of the IX cranial nerve called?
+ Nucleus ambiguous
– Nucleus of solitary tract
– Superior salivary nucleus
– Inferior salivary nucleus

The IX cranial nerve arises from the following region of base of the brain:
+ Posterolateral sulcus
– Anterolateral sulcus
– Between pons and pyramids
– Between pons and middle cerebellar peduncle

The IX cranial nerve leaves the cranial cavity via:
+ Jugular foramen
– Stylomastoid foramen
– Foramen magnum
– Foramen lacerum

Where is the superior ganglion of the IX cranial nerve situated?

+ In the area of jugular foramen
– In the area of fossula petrosa
– In tympanic cavity
– In tympanic canaliculus

What nerve is not the branch of the IX cranial nerve?

+ Chorda tympani nerve
– Tympanic nerve
– Pharyngeal branches
– Lesser petrosal fossa

The parasympathetic fibers of the tympanic nerve go to the following ganglion:

+ Otic ganglion
– Pterygopalatine ganglion
– Ciliary ganglion
– Superior ganglion

What branch of the IX cranial nerve is a mixed branch?

+ Tympanic nerve
– Lingual branch
– Pharyngeal branch
– Stylopharyngeal branch

What branch of the IX cranial nerve is a motor branch?

+ Stylopharyngeal branch
– Lingual branch
– Pharyngeal branch
– Tympanic nerve

What is the name of the X cranial nerve?

+ Vagus nerve
– Abducent nerve
– Glossopharyngeal nerve
– Hypoglossal nerve

What is the name of the XI cranial nerve?

+ Accessory nerve
– Vagus nerve
– Glossopharyngeal nerve
– Hypoglossal nerve

Where are the nuclei of the X cranial nerve located?

+ In the medulla oblongata
– In the pons
– In the cerebral peduncle
– In the upper segments of spinal nerve

What is the motor nucleus of the X cranial nerve called?

+ Ambiguous nucleus
– Solitary tract nucleus
– Dorsal nucleus
– Inferior salivary nucleus

What is the sensory nucleus of the X cranial nerve called?

+ Solitary tract nucleus
– Ambiguous nucleus
– Dorsal nucleus
– Inferior salivary nucleus

What is the vegetative nucleus of the X cranial nerve called?

+ Dorsal nucleus
– Solitary tract nucleus
– Ambiguous nucleus
– Inferior salivary nucleus

How many nuclei does the XI cranial nerve have?

+ 2
– 3
– 4
– 6

Where do the roots of the X cranial nerve arise?

+ In posterolateral sulcus of medulla oblongata
– Between pyramid and pons
– Between pons and middle cerebellar peduncle
– Between pyramid and olive

Where do the roots of the XI cranial nerve arise?

+ In posterolateral sulcus of medulla oblongata
– Between pyramid and pons
– Between pons and middle cerebellar peduncle
– Between pyramid and olive

The X cranial nerve leaves the cranial cavity through:

+ Jugular foramen
– Foramen rotundum (round)
– Foramen magnum
– Foramen lacerum

The X cranial nerve enters the thoracic cavity through the:

+Superior aperture of thorax (thoracic inlet)
– First intercostal space

– Second intercostal space
– Inferior aperture of thorax

The X cranial nerve enters the abdominal cavity through the:
+ Oesophageal hiatus of diaphragm
– Aortic hiatus of diaphragm
– Caval foramen of diaphragm
– Right and left triangles of diaphragm

Where is the left vagus nerve located in the lower part of the thoracic cavity?
+ On anterior surface of oesophagus
– On posterior surface of oesophagus
– Between aorta and oesophagus
– To the left from aorta

Where is the right vagus nerve located in the lower part of the thoracic cavity?
+ On posterior surface of oesophagus
– On anterior surface of oesophagus
– To the left from aorta
– Behind the aorta

Which of the following is not the branch of the thoracic part of the vagus nerve?
+ Superior cervical cardiac branch
– Recurrent laryngeal nerve
– Inferior laryngeal nerve
– Inferior cervical cardiac branch

Which of the following is not the part of the vagus nerve?
+ Pelvic
– Cranial and cervical
– Cervical and thoracic
– Thoracic and abdominal

Which of the following is the branch of the cranial part of the vagus nerve?
+ Meningeal branch
– Superior cervical cardiac branch
– Pharyngeal branch
– Bronchial branch

The meningeal branch of the vagus nerve supplies:

+ Dura mater of posterior cranial fossa
– Dura mater of middle cranial fossa
– Dura mater of anterior cranial fossa
– Skin of occipital region

The superior laryngeal nerve does not supply the following structure:

+ Vocal muscle
– Cricothyroid muscle
– Mucosa of larynx above the vocal fold
– Mucosa of the tongue

Which of the following is the branch of the cranial part of the vagus nerve?

+ Auricular branch
– Pharyngeal branch
– Tracheal branch
– Oesophageal branch

The auricular branch of the vagus nerve passes through the:

+ Mastoid canaliculus
– Facial canal
– Tympanic canaliculus
– Carotid canal

What is the name of the XII cranial nerve?

+ Hypoglossal nerve
– Vagus nerve
– Glossopharyngeal nerve
– Accessory nerve

The auricular branch of the vagus nerve supplies the following:

+ Skin of auricle and skin of posterior wall of external acoustic meatus
– Mucosa of tympanic cavity
– Structures of internal ear
– Parotid gland

Which of the following is not the branch of the cervical part of the vagus nerve?

+ Bronchial branches
– Superior cervical cardiac branch
– Pharyngeal branch
– Superior laryngeal nerve

The vagus nerve does not supply the following structure:

+ Tensor velli palatine muscle
– Mucosa of pharynx
– Constrictor muscles of pharynx
– Levator velli palatine muscle

The left recurrent laryngeal nerve loops around the:

+ Aortic arch
– Left subclavian artery
– Left bronchus
– Left brachiocephalic vein

The right recurrent laryngeal nerve loops around the:

+ Right subclavian artery
– Right subclavian vein
– Right brachiocephalic vein
– Right bronchus

The inferior laryngeal nerve is a branch of the:

+ Recurrent laryngeal nerve
– Superior laryngeal nerve
– Glossopharyngeal nerve
– Directly from vagus nerve

The recurrent laryngeal nerve does not supply the following:

+ Mucosa of larynx above vocal fold
– Mucosa of larynx below vocal fold
– Muscles of larynx except cricothyroid muscle
– Heart, esophagus, trachea

The vagus nerve does not supply the following organ of abdominal cavity:

+ Sigmoid colon
– Small intestine
– Liver
– Spleen

Where is the nucleus of the XII cranial nerve located?

+ In inferior angle of rhomboid fossa
– In region of vestibular area
– In superior angle of rhomboid fossa
– In facial colliculus of rhomboid fossa

How many nuclei does the XII cranial nerve have?

+ 1
– 2
– 3
– 4

Where do the roots of the XII cranial nerve arise?

+ Between pyramid and olive
– In posterolateral sulcus of medulla oblongata
– Between pyramid and pons
– Between pons and middle cerebellar peduncle

How many spinal nerves do you know?

+ 31 pairs
– 12 pairs
– 30 pairs
– 32 pairs

How many cervical spinal nerves are there?

+ 8 pairs
– 7 pairs
– 9 pairs
– 12 pairs

How many thoracic spinal nerves are there?

+ 12 pairs
– 8 pairs
– 5 pairs
– 10–12 pairs

How many lumbar spinal nerves are there?

+ 5 pairs
– 8 pairs
– 12 pairs
– 10–12 pairs

The white communicantes branches of the spinal nerves comprise:

+ Sympathetic preganglionic fibers that reach the ganglia of sympathetic trunk
– Motor fibers
– Sensory fibers
– Sympathetic postganglionic fibers

How many sacral spinal nerves are there?

+ 5 pairs
– 8 pairs
– 1 pairs
– 12 pairs

How many coccygeal spinal nerves are there?

+ 1 pair
– 8 pairs
– 12 pairs
– 5 pairs

What branch is absent in the I–VII spinal nerves?

+ White communicantes branch
– Anterior (ventral) branch
– Posterior (dorsal) branch
– Meningeal branch

What branch of the spinal nerves contains only motor fibers?

+ Posterior branch of CI
– Anterior branch of CII
– Meningeal branch CII
– Anterior branch CI

The spinal nerves supply the following:

+ Skin and skeletal muscles
– Organs of digestive system
– Heart and blood vessels
– Organs of urogenital system

The anterior root of the spinal nerve is formed with:

+ Axons of neurons of anterior horn of the spinal cord
– Axons of motor neurons of the cerebral cortex
– Axons of motor neurons of the nucleus ruber
– Central processes of pseudounipolar neurons of the spinal ganglion

The posterior root of the spinal nerve is formed with:

+ Central processes of pseudounipolar neurons of the spinal ganglion
– Peripheral processes of pseudounipolar neurons of the spinal ganglion
– Dendrites of neurons of posterior horn of the spinal cord
– Dendrites of thoracic nucleus of the spinal cord

The posterior branches of the spinal nerves do not supply the following:

+ Muscles of limbs

– Deep muscles of the back
– Muscles of occipital region
– Skin of posterior surface of the back and head

Where does the cervical plexus lie:
+ On deep cervical muscles anterior to transverse process of cervical vertebrae
– On anterior surface of bodies of four upper cervical vertebrae
– On anterior surface of sternocleidomastoid muscles under the skin
– Between anterior and middle scalenus muscles

What is the name of the posterior branch of the first cervical nerve?
+ Suboccipital nerve
– Greater occipital nerve
– Lesser occipital nerve
– Great auricular nerve

What is the name of the posterior branch of the second cervical nerve?
+ Greater occipital nerve
– Suboccipital nerve
– Lesser occipital nerve
– Great auricular nerve

The grey communicantes branches of the spinal nerves comprise the following fibers:
+ Sympathetic postganglionic
– Sympathetic preganglionic
– Motor
– Sensory

The long branch of the greater occipital nerve supplies the following:
+ Skin of occipital region
– Skin of temporal region
– Suboccipital muscles
– Skin of posterior region of neck

The anterior branches of spinal nerves supply the following:
+ Skin and muscles of upper and lower limbs
– Organs of digestive system
– Heart and blood vessels
– Organs of urogenital system

The anterior branches of spinal nerves supply the following:

+ Skin and muscles of the neck, thorax and abdomen
– Skin and muscles of the back
– Skin and muscles of the head
– Organs of thoracic and abdominal cavities

What branches of spinal nerves retain segmental arrangement?

+ Anterior branches of thoracic spinal nerves
– Anterior branches of cervical spinal nerves
– Anterior branches of sacral spinal nerves
– Anterior branches of lumbar spinal nerves

What branches of spinal nerves take part in formation of somatic nervous plexuses?

+ Anterior branches
– Posterior branches
– Communicantes branches
– Meningeal branches

What plexus is somatic nervous plexus?

+ Cervical plexus
– Coeliac plexus
– Superior mesenteric plexus
– Inferior hypogastric plexus

The cervical plexus arises from the:

– Anterior branches of four upper cervical spinal nerves (C1–C 4)
– Posterior branches of four upper cervical spinal nerves (C1–C 4)
– Anterior branches of four lower cervical spinal nerves (C1–C 4)
– Anterior branches of all cervical spinal nerves (C1–C 8)

The cervical plexus joints with the following cranial nerves:

+ Accessory and hypoglossal cranial nerves
– Vagus and glossopharyngeal cranial nerves

– Vestibulocochlear and abducent cranial nerves
– Trigeminal and throchlea cranial nerves

What branches are absent in the cervical plexus?
+ Vegetative sympathetic
– Muscular (motor)
– Cutaneous (sensory)
– Mixed (sensory and motor)

The muscular (motor) branches of the cervical plexus supply the following:
+ Deep muscles of the neck
– Muscles of the back
– Skin of posterior surface of the neck
– Platysma muscle

The ansa cervicalis is formed of the:
+ Cervical plexus and hypoglossal nerve
– Cervical plexus and accessory nerve
– Cervical plexus and brachial plexus
– Cervical plexus and lingual nerve

Where is the ansa cervicalis located?
+ On anterior surface of the common carotid artery
– On anterior surface of the internal jugular vein
– On anterior surface of deep muscles of the neck
– On anterior surface of a sternocleidomastoid muscle

The ansa cervicalis supplies the following:
+ Infrahyoid muscles
– Suprahyoid muscles
– Deep muscles of the neck
– Platysma muscle

What nerve is not a sensory branch of the cervical plexus?
+ Greater occipital nerve
– Lesser occipital nerve
– Transverse cervical nerve
– Great auricular nerve

The great auricular nerve supplies the following:
+ Skin of auricle and external acoustic meatus
– Skin of occipital region

– Mucosa of tympanic cavity
– Skin of parotido-masseteric region of the face

The lesser occipital nerve supplies:
+ Skin of occipital region and posterior surface of auricle
– Skin of parotido-masseteric region of the face
– Mucosa of tympanic cavity
– Skin of external acoustic meatus

What nerve is a mixed branch of the cervical plexus?
+ Phrenic nerve
– Lesser occipital nerve
– Great auricular nerve
– Supraclavicular nerves

The transverse cervical nerve supplies:
+ Skin of anterior cervical region
– Skin of occipital region
– Platysma muscle
– Skin of posterior cervical region

The supraclavicular nerves supply the following:
– Skin of the region of trapezoid muscle
– Skin of the region of sternocleidomastoid muscle
+ Skin above deldoideus and pectoral major muscles
– Deltoideus and pectoralis minor muscles

The sensory branches of the phrenic nerve in abdominal cavity supply the following:
+ Peritoneum, which covers diaphragm
– Peritoneum, which covers the anterior abdominal wall
– Greater omentum
– Lesser omentum

Where is the phrenic nerve located?
+ On anterior surface of anterior scalene muscle
– On anterior surface of sternocleidomastoid muscle
– In interscalenus space
– On sternohyoid muscle

The phrenic nerve enters the thoracic cavity through the:

+ Thoracic inlet
– First intercostal space
– Interscalenus space
– Second intercostal space

The sensory branches of the phrenic nerve supply:

+ Pleura and pericardium
– Skin of thorax
– Skin of abdomen
– Skin of anterior cervical region

The motor branches of the phrenic nerve supply:

+ Diaphragm
– Diaphragmatic pleura
– Internal intercostal muscle
– Subcostal muscle

Where is the phrenic nerve located in a middle mediastinum?

+ Between pericardium and mediastinal pleura
– In pericardial cavity
– In pleural cavity
– On the mediastinal surface of a corresponding lung

What is the origin of the brachial plexus?

+ The anterior rami of spinal nerves C5–C8 and T1
– The posterior rami of spinal nerves C5–C8 and T1
– The anterior rami of spinal nerves C1–C5
– The posterior rami of spinal nerves T1–T5

Which of the following takes place in formation of the brachial plexus?

– The part of anterior ramus T1
– The part of anterior ramus T2
– The posterior ramus T1
– The anterior rami C1–C4

How are the trunks of supraclavicular portion of bracial plexus named?

+ The superior, middle and inferior trunks
– The posterior, medial and lateral trunks
– The posterior, middle and anterior trunks
– The medial, the lateral and intermediate trunks

The cords of the infraclavicular part of the brachial plexus are as follows:

+ The lateral, medial and posterior cords

– The superior, middle and inferior cords

– The posterior, middle and inferior cords

– The superficial, medial and deep cords

The supraclavicular part of brachial plexus passes through the following space:

– The anterscalenus

– The 1st intercostal

+ The interscalenus

– The suprasternal

What groups of periferal branches arise from the brachial plesus?

+ Short and long branches

– Anterior and posterior branches

– Superficial and deep branches

– Lateral and medial branches

What parts are distinguished in the brachial plexus?

+ The supraclavicular part and the infraclavicular part

– The supracostal part and the infracostal part

– The anterclavicular part and the postclavicular part

– The anterscalenus part and the interscalenus part

Which of the following is not the short branch of the brachial plexus?

+ The medial cutaneous nerve of an arm

– The dorsal scapular nerve

– The long thoracic nerve

– The subclavian nerve

What nerve provides the nerve supply of the levator scapulae muscle and the rhomboid muscles?

+ The dorsal scapular nerve

– The thoracodorsal nerve

– The subclavian nerve

– The musculocutaneous nerve

Which of the following is not the short branch of the brachial plexus?

+ The musculocutaneous nerve
– The lateral pectoral nerve
– The axillary nerve
– The medial pectoral nerve

Which of the following is not the short branch of the brachial plexus?

+ The medial cutaneous nerve of a forearm
– The suprascapular nerve
– The subclavian nerve
– The thoracodorsal nerve

What does the long thoracic nerve supply?

+ The serratus anterior muscle
– The serratus posterior superior muscle
– The pectaralis major muscle
– The joint capsule of shoulder joint

What does the subclavian nerve supply?

+ The subclavius muscle
– The subscapularis and teres major muscles
– The supraspinatus and infraspinatus muscles
– The deltoid and teres minor muscles

What nerve provides the nerve supply of the supra- and infraspinatus muscles?

+ The suprascapular nerve
– The long thoracic nerve
– The musculocutaneous nerve
– The axillary nerve

What nerve gives fibers to the shoulder joint and to the skin of the posterolateral surface of a shoulder?

+ The axillary nerve
– The musculocutaneous nerve
– The thoracodorsal nerve
– The suprascapular nerve

What does the subscapular nerve supply?

+ The subscapularis and the teres major muscles
– The latissimus dorsi muscle

– The deltoid and the teres minor muscles
– The supra- and infraspinatus muscles

What nerve provides the nerve supply of the latissimus dorsi muscle?
+ The thoracodorsal nerve
– The long thoracic nerve
– The dorsal scapular nerve
– The subscapular nerve

What nerve provides the nerve supply of the pectoralis minor muscle?
+ The lateral pectoral nerve
– The subscapular nerve
– The dorsal scapular nerve
– The subclavian nerve

Which short branch of the brachial plexus arises from the posterior cord?
+ The axillary nerve
– The dorsal scapular nerve
– The subscapular nerve
– The medial cutaneous nerve of an arm

What does the medial pectoral nerve supply?
+ The pectoralis major muscle
– The deltoid and the teres minor muscles
– The subclavius muscle
– The serratus anterior muscle

The thickest nerve among the short branches of the brachial plexus is:
+ The axillary nerve
– The median nerve
– The long thoracic nerve
– The musculocutaneous nerve

Which nerve injury could cause paralysis of the serratus anterior muscle?
+ The long thoracic nerve
– The thoracodorsal nerve
– The axillary nerve
– The lateral pectoral nerve

The axillary nerve passes onto the posterior surface of the surgical neck of the humerus through:
+ The quadrangular foramen
– The triangular foramen

– The interscalenus space
– The 1st intercostal space

What short branch of the brachial plexus passes through the quadrangular foramen?
+ The axillary nerve
– The ulnar nerve
– The subscapular nerve
– The dorsal scapular nerve

What nerve originates from the lateral cord of the brachial plexus?
+ The musculocutaneous nerve
– The ulnar nerve
– The radial nerve
– The median nerve

The continuation of the posterior cord of the brachial plexus is:
+ The radial nerve
– The ulnar nerve
– The musculocutaneous nerve
– The median nerve

The medial cutaneous nerve of an arm, the medial cutaneous nerve of a forearm and the ulnar nerve emerge from:
+ The medial cord of the brachial plexus
– The lateral cord of the brachial plexus
– The posterior cord of the brachial plexus
– The lateral and the medial cords of the brachial plexus

What nerve arises from the medial cord of the brachial plexus?
+ The ulnar nerve
– The median nerve
– The radial nerve
– The long thoracic nerve

In the forearm region, the median nerve lies within the following structure:
+ The median groove of a forearm
– The ulnar groove of a forearm
– The radial groove of a forearm
– The anatomical snuffbox

Which long branch of the brachial plexus arises from the medial and lateral cords in two roots?

+ The median nerve
– The ulnar nerve
– The radial nerve
– The axillary nerve

The musculocutaneous nerve gives off the muscular fibers to:

+ The coracobrachialis, biceps brachii, and brachialis muscles
– The deltoid and teres minor muscles
– The pectoralis major and pectoralis minor muscles
– The flexor carpi ulnaris, deep flexor digitorum, and most muscles of the hand

How is the cutaneous branch of the musculocutaneous nerve called?

+ The lateral cutaneous nerve of a forearm
– The medial cutaneous nerve of an arm
– The superior lateral cutaneous nerve of an arm
– The posterior cutaneous nerve of the forearm

The cutaneous branch of the musculocutaneous nerve terminates within:

+ The skin of anterolateral area of a forearm
– The skin of a medial area of a forearm
– The skin of a superodorsal area of an arm
– The skin on the ulnar side of a palm

On the upper arm, the median nerve gives off the following branches:

+ No branches
– The medial cutaneous nerve of the arm
– The muscular branches for triceps brachii and anconeus muscles
– The posterior cutaneous nerve of the arm

The median nerve gives off muscular branches to:

+ Muscles of the anterior group of the forearm, with the exception of flexor carpi ulnaris and part of deep flexor digitorum muscles

– Muscles of the anterior group of the upper arm

– Muscles of the posterior group of the upper arm

– Muscles of the posterior group of the forearm

What muscles of the hand are not innervated by the median nerve?

+ The 3^{rd}–4^{th} lumbrical muscles

– The 1^{st}–2^{nd} lumbrical muscles

– The opponens pollicis muscle

– The abductor pollicis brevis

What muscles of the forearm does the ulnar nerve innervate?

+ The flexor carpi ulnaris and the ulnar part of deep flexor digitorum muscles

– The pronator teres and pronator quadratus muscles

– The superficial flexor digitorum and long palmar muscles

– The flexor carpi radialis and flexor pollicis longus muscles

What joints of the upper limb are not innervated by the median nerve?

+ The shoulder joint

– The elbow joint

– The radiocarpal joint

– The mediocarpal joint

What muscles of the hand does the deep branch (from the palmar branch of the ulnar nerve) innervate?

+ The 3^{rd} and 4^{th} lumbrical muscles

– The 1^{st} and 2^{nd} lumbrical muscles

– The abductor pollicis brevis muscle

– The skin of the 1^{st}, 2^{nd}, 3rd fingers and the radial side of the 4^{th} finger

Seven proper palmar digital nerves (the terminal branches of the median nerve) supply:

+ The skin of palmar surface of the 1st, 2nd, 3rd fingers and the radial side of the 4th finger

− The skin of dorsal surface of the 1st, 2nd fingers and the radial side of the 3rd finger

– The skin of palmar surface of the 5th finger and the ulnar side of the 4th finger

– The skin of the 5th, 4th fingers and the ulnar side of the 3rd finger

What muscles of the hand does the deep branch (from the palmar branch of the ulnar nerve) supply?

+ All interosseal muscles

– The superficial head of the flexor pollicis brevis muscle

– The opponens pollicis muscle

– The 1st and 2nd lumbrical muscles

The superficial branch (from the palmar branch of the ulnar nerve) supplies the following:

+ The skin of the 5th finger and the ulnar side of the 4th finger

– The skin of the 1st, 2nd fingers and the radial side of the 3rd finger

– All muscles of hypothenar, all interosseal muscles, the 3rd and 4th lumbrical muscles

– The muscles of the thenar with the exception of the adductor pollicis and the deep head of the flexor pollicis brevis muscles

The medial cutaneous nerve of the arm terminates within:

+ The skin of a medial area of the arm

– The skin of a medial area of the forearm

The skin of a posterior area of the arm

– The skin of an anterior area of the forearm

The dorsal branch of the ulnar nerve reaches the dorsal

surface of the hand, where it supplies the following:

+ The skin of the 5th, 4th fingers and the ulnar side of the 3rd finger

– The skin of the 1st, 2nd fingers and the radial side of the 3rd finger

– All muscles of hypothenar, all interosseal muscles, the 3rd and 4th lumbrical muscles

– The adductor pollicis and the deep head of the flexor pollicis brevis muscles

What muscles of the hand does the deep branch (from the palmar branch of the ulnar nerve) supply?

+ All muscles of hypothenar

– The 1st and 2nd lumbrical muscles

– The opponens pollicis muscle

– The abductor pollicis brevis muscle

The medial cutaneous nerve of a forearm supplies:

+ The skin of an anteromedial side of the forearm

– The skin of a medial side of the arm

– The skin of an anterolateral side of the forearm

– The skin of a superolateral side of the arm

In the arm region, the radial nerve passes within:

+ The radial (humeromuscular) canal

– The quadrangular foramen

– The triangular foramen

– The lateral bicipital groove

In the forearm region, the superficial branch of the radial nerve runs within:

+ The radial groove

– The ulnar groove

– The median groove

– The lateral bicipital groove

What muscles does the radial nerve supply in the upper arm region?

+ The triceps brachii and the anconeus muscles

– The biceps brachii and the brachial muscles

– The skin of the medial area of the arm
– The skin of the superolateral area of the arm

The superficial branch of the radial nerve innervates the following:
+ The skin of a dorsal surface of the 1st, 2nd fingers and the radial side of the 3rd finger
– The skin of a palmar surface of the 1st, 2nd fingers and the radial side of the 3rd finger
– All posterior muscles of the forearm
– The skin of a posterior surface of the forearm

The posterior cutaneous nerve of the arm (from the radial nerve) supplies:
+ The skin of a posterolateral area of the arm
– The skin of a medial area of the arm
– The skin of an anterolateral area of the forearm
– The skin of a deltoid area

The deep branch of the radial nerve supplies:
+ All posterior muscles of the forearm
– The deep anterior muscles of the forearm
– The skin of a posterior surface of the forearm
– The thenar muscles

The posterior cutaneous nerve of the forearm (from the radial nerve) supplies:
+ The skin of a posterior surface of forearm
– The skin of a medial surface of the arm
– The skin of an anteromedial surface of the forearm
– The skin of a dorsal surface of the 5th, 4th fingers and the ulnar side of the 3rd finger

How many pairs of thoracic nerves do you know?
+ 12 pairs
– 11 pairs
– 10 pairs
– 8 pairs

How are the anterior branches of the thoracic nerves called?

+ Intercostal nerves
– Muscular nerves
– Cutaneous nerves
– Supracostal nerves

How are the anterior branches of the 12th thoracic nerves called?

+ Subcostal nerves
– Supracostal nerves
– Infracostal nerves
– Collateral nerves

Where are the intercostal nerves located?

+ In the intercostal spaces between the external and internal intercostal muscles
– In the intercostal spaces within the subcutaneous adipose tissue
– In the intercostal spaces between the thoracic fascia and external intercostal muscles
– In the intercostal spaces between the endothoracic fascia and internal intercostal muscles

The components of intercostal vasculonervous bundles are located in the sequence (from up to down):

+ The vein, the artery, the nerve (v. a. n.)
– The vein, the nerve, the artery (v. n. a.)
– The artery, the nerve, the vein (a. n. v.)
– The artery and nerve (a. n.)

How are the terminal branches of the 6th upper intercostal nerves called?

+ The anterior cutaneous pectoral branches
– The anterior cutaneous abdominal branches
– The lateral cutaneous pectoral branches
– The muscular branches

The muscular branches of intercostal nerves do not supply:

+ The longissimus muscles
– The subcostal muscles

– The external oblique abdominis muscles
– The quadratus lumborum muscles

The terminal branches of the 5th lower intercostal nerves are called:
+ The anterior cutaneous abdominal branches
– The anterior cutaneous pectoral branches
– The lateral cutaneous abdominal branches
– The anterior muscular abdominal branches

The lumbar plexus arises from:
+ The anterior branches of L1–L3 nerves and partially from T12 and L4 nerves
– The posterior branches of L1–L3 nerves and partially from T11–T12 nerves
– The communicating branches of L1–L5 nerves
– The meningeal branches of L1−L4 nerves and partially from T12 nerve

What muscles are not supplied by the muscular branches of the intercostal nerves?
+ The iliocostal muscles
– The internal intercostal muscles
– The external intercostal muscles
– The transversus abdominis muscles

The muscular branches of intercostal nerves do not supply:
+ The spinal muscles
– The transversus thoracic muscles
– The internal oblique abdominis muscles
– The rectus abdominis muscles

The anterior branches of L4–L5 lumbar nerves merge into:
+ The lumbosacral trunk
– The lumbosacral fasciculus
– The lumbosacral pathway
– The lumbosacral horn

Where does the lumbar plexus reside?

+ In the thickness of the psoas major muscle
– Behind the iliacus muscle
– In the thickness of the quadratus lumborum muscle
– On the anterior surface of the psoas major muscle

What muscles do the muscular branches of the lumbar plexus supply?

+ The psoas major and psoas minor muscles
– The iliocostalis lumborum muscle
– The subcostal muscles
– The rotatores lumborum muscles

Which of the following is not the branch of the lumbar plexus?

+ The pudendal nerve
– The lateral cutaneous nerve of thigh
– The obturator nerve
– The femoral nerve

The muscular branches of the lumbar plexus do not supply:

+ The iliocostalis lumborum muscles
– The quadratus lumborum muscles
– The psoas major muscles
– The psoas minor muscles

Which of the following is not the branch of the lumbar plexus?

+ The subcostal nerve
– The iliohypogastric nerve
– The ilioinguinal nerve
– The genitofemoral nerve

What branch of the lumbar plexus stretches parallel to the 12th intercostal nerve?

+ The iliohypogastric nerve
– The obturator nerve
– The genitofemoral nerve
– The femoral nerve

What nerve runs through the inguinal canal?

+ The ilioinguinal nerve
– The iliohypogastric nerve

– The lateral cutaneous nerve of thigh
– The obturator nerve

What nerve innervates the skin of the upper part of the buttock and inferior abdomen?
+ The iliohypogastric nerve
– The obturator nerve
– The femoral nerve
– The genitofemoral nerve

The iliohypogastric nerve does not innervate the following muscles:
+ The quadratus lumborum
– The transverse abdominis
– The rectus abdominis
– The internal oblique abdominis

What branch of the lumbar plexus supplies the skin of the root of penis and the scrotum in male?
+ The ilioinguinal nerve
– The femoral nerve
– The lateral cutaneous nerve of thigh
– The obturator nerve

The skin of labia majora and mons pubis in female is supplied by:
+ The ilioinguinal nerve
– The femoral nerve
– The iliohypogastric nerve
– The obturator nerve

What branch of the lumbar plexus runs through the thickness of the psoas major muscle onto its anterior surface?
+ The genitofemoral nerve
– The lateral cutaneous nerve of the thigh
– The obturator nerve
– The iliohypogastric nerve

What branch of the lumbar plexus enters the inguinal canal?
+ The genital branch of the genitofemoral nerve
– The femoral branch of genitofemoral nerve
– The anterior cutaneous branch of the iliohypogastric nerve
– The obturator nerve

What branch of the lumbar plexus supplies the cremaster and dartos muscles?

+ The genital branch of the genitofemoral nerve
– The femoral branch of the genitofemoral nerve
– The anterior scrotal branches of the ilioinguinal nerve
– The muscular branches of the obturator nerve

The joint capsule of the hip joint is innervated with:

+ The obturator nerve
– The femoral nerve
– The ilioinguinal nerve
– The lateral cutaneous nerve of the thigh

What branch of the lumbar plexus innervates the skin of a small anterior portion of the femoral triangle (Scarpa's triangle)?

+ The femoral branch of the genitofemoral nerve
– The genital branch of the genitofemoral nerve
– The anterior cutaneous branch of the ilioinguinal nerve
– The cutaneous branch of the obturator nerve

What branch of the lumbar plexus supplies the round ligament of uterus and the skin of labia majora?

+ The genital branch of the genitofemoral nerve
– The femoral branch of the genitofemoral nerve
– The anterior curaneous branch of the ilioinguinal nerve
– The cutaneous branch of the obturator nerve

What branch of the lumbar plexus passes through the vascular space onto the thigh?

+ The femoral branch of the genitofemoral nerve
– The genital branch of the genitofemoral nerve
– The anterior branch of the obturator nerve
– The posterior branch of the obturator nerve

What branch of the lumbar plexus runs down to the anterior superior iliac spine?

+ The lateral cutaneous nerve of the thigh
– The femoral nerve
– The ilioinguinal nerve
– The obturator nerve

What nerve supplies the skin of inferior buttock and lateral aspect of the thigh?

+ The lateral cutaneous nerve of the thigh
– The anterior cutaneous branches of the femoral nerve
– The lateral cutaneous branch of the iliohypogastric nerve
– The cutaneous branches of the obturator nerve

What nerve of the lumbar plexus runs along the lesser pelvis wall?

+ The obturator nerve
– The femoral nerve
– The genitafemoral nerve
– The lateral cutaneous nerve of the thigh

What nerve supplies the adductor group of muscles of the thigh?

+ The obturator nerve
– The femoral nerve
– The genitofemoral nerve
– The ilioinguinal nerve

What nerve supplies the skin over a medial aspect of the thigh?

+ The obturator nerve
– The lateral cutaneous nerve of the thigh
– The femoral branch of the genitofemoral nerve
– The anterior cutaneous branch of the iliohypogastric nerve

The obturator nerve passes to the thigh through:

+ The obturator canal
– The muscular space
– The vascular space
– The infrapiriform foramen

The femoral nerve emerges onto the anterior surface of the thigh via:

+ The muscular space
– The vascular space
– The obturator canal
– The adductor canal

What nerve supplies the anterior group of muscles of the thigh?

+ The femoral nerve
– The obturator nerve
– The femoral branch of the genitofemoral nerve
– The saphenous nerve

What nerve supplies the skin over anterior aspect of the thigh?

+ The femoral nerve
– The saphenous nerve
– The lateral cutaneous nerve of the thigh
– The cutaneous branch of the obturator nerve

The saphenous nerve is the longest branch of the femoral nerve. It enters:

+ The adductor canal
– The obturator canal
– The infrapiriform foramen
– The vascular space

What nerve supplies the skin of a medial side of the leg and foot?

+ The saphenous nerve
– The cutaneous branch of the obturator nerve
– The femoral branch of the genitofemoral nerve
– The lateral cutaneous nerve of the thigh

What is the origin of the sacral plexus?

+ The anterior brances of upper four sacral nerves, L5 and L4 nerves
– the posterior branches of all sacral nerves, L5 and L4 nerves
– The anterior branches of S1–S3 nerves
– The posterior branches of S1–S4 nerves

The anterior branches of L4 and L5 merge into:

+ The lumbosacral trunk

– The lumbosacral fasciculus
– The lumbosacral nerve
– The lumbosacral crus

What structure descends to the lesser pelvis cavity and joins the sacral plexus?
+ The lumbosacral trunk
– The lumbosacral nerve
– The lumbosacral fasciculus
– The sacrococcygeal trunk

The branches of the sacral plexus may be divided into:
+ The short and long branches
– The visceral and parietal branches
– The lateral and medial branches
– The anterior and posterior branches

The shape of the sacral plexus is:
+ The triangular plate
– The quadrangular plate
– The cubic body
– The cylindrical body

The branches of the sacral plexus leave the lesser pelvis via:
+ The suprapiriform and the infrapiriform foramen
– The greater and lesser sciatic foramen
– The obtutator foramen
– The pelvic outlet

Which of the following is the long branch of the sacral plexus?
+ The posterior cutaneous nerve of the thigh
– The superior gluteal nerve
– The inferior gluteal nerve
– The pudendal nerve

The short branches of the sacral plexus supply:
+ The muscles of the pelvic girdle and the skin
– The muscles of the lower limb and the skin
– The muscles of the anterior abdominal wall and the skin
– The organs of the lesser pelvis

Which of the following is not the short branch of the sacral plexus?

+ The sciatic nerve
– The superior gluteal nerve
– The inferior gluteal nerve
– The pudendal nerve

The long branches of the sacral plexus supply:

+ The skin and muscles of the lower extremity
– The skin and muscles of the pelvic girdle
– The skin and muscles of the lateral abdominal wall
– The muscles of the anterior abdominal wall

Which of the following is not the short branch of the sacral plexus?

+ The posterior cutaneous nerve of the thigh
– The nerve of the piriforme muscle
– The nerve of the quadratus femoris muscle
– The superior gluteal nerve

The superior gluteal nerve leaves the pelvic cavity via:

+ The suprapiriform foramen
– The infrapiriform foramen
– The greater sciatic foramen
– The pelvic outlet

Which of the following is the long branch of the sacral plexus?

+ The sciatic nerve
– The inferior gluteal nerve
– The nerve of the uadratus femoris muscle
– The nerve of the internal obturator muscle

What nerve does not leave the pelvic cavity via the infrapiriform foramen?

+ The superior gluteal nerve
– The nerve of the quadratus femoris muscle
– The nerve of the piriformis muscle
– The nerve of the internal obturator muscle

The inferior gluteal nerve leaves the pelvic cavity through:

+ The infrapiriform foramen
– The suprapiriform foramen
– The lesser sciatic foramen
– The pelvic outlet

What does the inferior gluteal nerve supply?

+ The gluteus maximus muscle
– The gluteus minimus muscle
– The piriform muscle
– The internal obturator muscle

The pudendal nerve leaves the pelvic cavity via:

+ The infrapiriform foramen
– The suprapiriform foramen
– The greater sciatic foramen
– The pelvic outlet

The pudendal nerve enters the ischioanal fossa via:

+The lesser sciatic foramen
– The infrapiriform foramen
– The suprapiriform foramen
– The obturator canal

What nerve supplies the external anal sphincter muscle and the skin of the region around the anus?

+ The inferior rectal nerve
– The posterior labial nerve
– The posterior scrotal nerve
– The perineal nerve

What branches of the pudendal nerve innervate the muscles of the perineum?

+ The perineal nerves
– The posterior labial nerves
– The posterior scrotal nerves
– The dorsal nerve of the penis

What branches of the pudendal nerve are in males only?

+ The posterior scrotal nerves
– The perineal nerves
– The muscular branches
– The posterior labial nerves

What branches of the pudendal nerve are in females only?

+ The posterior labial nerves
– The posterior scrotal nerves
– The inferior rectal nerves
– The perineal nerves

In males the terminal branch of the pudendal nerve is called:

+ The dorsal nerve of penis
– The dorsal nerve of clitoris
– The perineal nerves
– The posterior scrotal nerves

In females the terminal branch of the pudendal nerve is called:

+ The dorsal nerve of clitoris
– The dorsal nerve of penis
– The posterior labial nerves
– The inferior rectal nerves

The posterior cutaneous nerve of the thigh emerges from the pelvis via:

+ The infrapiriform foramen
– The suprapiriform foramen
– The obturator canal
– The adductor canal

What nerve supplies the skin of the posterior surface of the thigh and inferior medial aspect of the buttock?

+ The posterior cutaneous nerve of the thigh
– The lateral cutaneous nerve of the thigh
– The cutaneous branch of the obturator nerve
– The pudendal nerve

What branch of the sacral plexus has the sensory nerve fibers only?

+ The posterior cutaneous nerve of the thigh
– The sciatic nerve
– The pudendal nerve
– The tibial nerve

The sciatic nerve emerges from the pelvic cavity through:

+ The infrapiriform foramen
– The suprapiriform foramen
– The obturator canal
– The pelvic outlet

What nerve is the largest nerve in the entire body?

+ The sciatic nerve
– The posterior cutaneous nerve of the thigh
– The inferior gluteal nerve
– The tibial nerve

What muscle do the muscular branches of the sciatic nerve supply?

+ The long head of the biceps femoris muscle
– The short head of the biceps femoris muscle
– The pectineus muscle
– The gracilis muscle

What muscle is not supplied by the sciatic nerve?

+ The vastus medialis muscle
– The semitendinosus muscle
– The semimembranosus muscle
– The long head of biceps femoris muscle

What nerve passes through the cruropopliteal canal?

+ The tibial nerve
– The common fibular nerve
– The deep fibular nerve
– The sural nerve

Where does the tibial nerve divide into its terminal branches?

+ Behind the medial malleolus
– In front of the medial malleolus
– Behind the lateral malleolus
– In the lateral plantar groove

In the upper part of the popliteal fossa the sciatic nerve splits into its two main branches:

+ The tibial and the common fibular nerve
– The superior and inferior gluteal nerves
– The superficial and deep fibular nerves
– The tibial and the sural nerve

Within the popliteal fossa, the tibial nerve occupies the position (from superficial to deep):

+ The tibial nerve, the popliteal vein, the popliteal artery (N, V, A)
– The popliteal artery, the popliteal vein, the tibial nerve (A, V, N)

– The popliteal vein, the popliteal artery, the tibial nerve (V, A, N)
– The popliteal vein, the tibial nerve, the popliteal artery (V, N, A)

Behind the medial malleolus, the tibial nerve divides into the following terminal branches:
+ The lateral and medial plantar nerves
– The lateral and medial sural nerves
– The superficial and deep fibular nerves
– The lateral and medial dorsal cutaneous nerves

The medial plantar nerve together with the eponymous artery passes:
+ In the medial plantar groove
– In the lateral plantar groove
– Behind the lateral malleolus
– In the thickness of the adductor hallucis muscle

What nerves are the terminal branches of the medial plantar nerve?
+ The proper plantar digital nerves (7)
– The proper plantar digital nerves (3)
– The dorsal digital branches (2)
– The superficial and deep branches

The lateral plantar nerve together with the eponymous artery runs:
+ In the lateral plantar groove
– In the medial plantar groove
– Behind the lateral malleolus
– In the thickness of the flexor digitorum brevis muscle

Within the popliteal fossa, the common fibular nerve gives rise to the following branch:
+ The lateral sural cutaneous nerve
– The medial sural cutaneous nerve

– The sural nerve
– The deep fibular nerve

In the popliteal fossa, the tibial nerve gives rise to the following long branch:
+ The medial sural cutaneous nerve
– The lateral sural cutaneous nerve
– The sural nerve
– The superficial fibular nerve

The superficial branch of the lateral plantar nerve supplies the following:
+ The skin of the 5th toe and a lateral half of the 4th toe
– The skin of toes 1 through 3 and a medial half of the 4th toe
– The skin of the 1st–2nd toes and amedial half of the 3rd toe
– The muscles of the medial group of muscles of the foot

The sural nerve loops around the lateral malleolus and gives off the following terminal branches:
+ The lateral calcaneal branches and the lateral dorsal cutaneous nerve
– The common plantar digital nerves
– The superficial and deep fibular branches
– The medial and lateral plantar nerves

Which muscles of the foot are not supplied with the medial plantar nerve?
+ The adductor hallucis, all interossei, the 3rd–4th lumbricals
– The 1st–2nd lumbricals
– All muscles of the big toe, the flexor digitorum brevis
– All muscles of the big toe, all lumbricals

The terminal branches of the superficial fibular nerve are as follows:
+ The medial and intermedial dorsal cutaneous nerves
– The medial and lateral plantar nerves

– The lateral and medial sural cutaneous nerves
– The proper plantar digital nerves

Which muscle of the shin is not supplied with the tibial nerve?
+ The tibialis anterior
– The tibialis posterior
– The flexor digitorum longus
– The flexor hallucis longus

What muscle of the leg does the tibial nerve supply?
+ The triceps surae muscle
– The peroneus longus muscle
– The peroneus brevis muscle
– The extensor digitorum longus muscle

The common fibular nerve is divided into:
+ The superficial and deep fibular nerves
– The lateral and medial sural cutaneous nerves
– The medial and lateral plantar nerves
– The dorsal digital nerves of the foot

What muscles do the muscular branches of the superficial fibular nerve supply?
+ The fibularis longus and fibularis brevis muscles
– All interossei, two lumbricals and adductor hallucis muscles
– The tibialis anterior and tibialis posterior muscles
– The triceps surae muscle

Where does the deep fibular nerve pass?
+ Along the anterior side of an interosseous membrane of the shin
– Through the superior musculoperoneal canal
– Through the inferior musculoperoneal canal
– Along the posterior side of interosseous membrane of the shin

The superficial fibular nerve runs within the:
+ Superior musculoperoneal canal

– Inferior musculoperoneal canal
– Cruropopliteal canal
– Adductor canal

What muscle of the leg does not the deep fibular nerve supply?
+ The triceps surae muscle
– The tibialis anterior muscle
– The extensor hallucis longus muscle
– The extensor digitorum longus muscle

What nuclei are found in the cell bodies of parasympathetic neurons?
+ In nuclei in the brain stem and in the lateral horns of the S2–S4 of the spinal cord
– In nuclei in the brain stem and in the lateral horns of the C1–C8 of the spinal cord
– In nuclei of the lateral horns of the T1–L2 of the spinal cord
– In nuclei of the brain stem and in nuclei of the cerebellum

The coccygeal plexus is composed of:
+ The anterior branches of the S5 and Co1
– The anterior branches of the S3–S5 and Co1
– The posterior branches of the S4–S5 and Co1
– The posterior branches of the Co1–Co3

The cranial parasympathetic outflow consists of preganglionic axons that extend from the brain stem in cranial nerves:
+ The CN III, VII, IX and X
– The CN III, IV, V and VI
– The CN IX, X, XI and XII
– The CN V, VII, VIII and X

Which of the following is the ganglion of the cranial part of a parasympathetic division of the autonomic nervous system?
+ The ciliary ganglion
– The geniculi ganglion
– The trigeminal ganglion
– The superior cervical ganglion

The anococcygeal nerves branch out:
+ In the skin at the top of the coccyx and the anus
– In the deep muscles of the perineum
– In the skin of the external genital organs
– In the superficial muscles of the perineum

Which of the following are nuclei of the cranial part of a parasympathetic division?
+ The parasympathetic nuclei of the CN III, VII, IX and X
– The motor nuclei of the CN III, IV, V and VI
– The motor nuclei of the CN IX, X, XI and XII
– The sensory nuclei of the CN V, VII, VIII and X

***Which of the following is the ganglion of the cranial part of a parasympathetic division of the autonomic nervous system*?**
+ The pterygopalatine ganglion
– The trigeminal ganglion
– The vestibular ganglion
– The cochlear ganglion

***Which of the following is the ganglion of the cranial part of a parasympathetic division of the autonomic nervous system*?**
+ The submandibular ganglion
– The geniculi ganglion
– The vestibular ganglion
– The trigeminal ganglion

***Which of the following is the ganglion of the cranial part of a parasympathetic division of the autonomic nervous system*?**
+ The sublingual ganglion
– The superior cervical ganglion
– The cochlear ganglion
– The superior ganglion of the vagus nerve

Which of the following is the ganglion of the cranial part of a parasympathetic

***division of the autonomic nervous system*?**

+ The otic ganglion

– The superior ganglion of the vagus nerve

– The inferior ganglion of the glossopharyngeal nerve

– The geniculi ganglion

***Which of the following is not the ganglion of the cranial part of a parasympathetic division of the autonomic nervous system*?**

+ The inferior ganglion of the vagus nerve

– The ciliary ganglion

– The pterygopalatine ganglion

– The otic ganglion

Which of the following is not the ganglion of the cranial part of a parasympathetic division of the autonomic nervous system?

+ The trigeminal ganglion

– The otic ganglion

– The sublingual ganglion

– The submandibular ganglion

Nuclei of the parasympathetic division of the autonomic nervous system are found in:

– The intermediolateral nuclei of the spinal cord

– The nuclei of the pudendal nerve

– The posterior thoracic nuclei of the spinal cord

+ The sacral parasympathetic nuclei (S2–S4)

***Which of the following are the nerves of the sacral part of a parasympathetic division of the autonomic nervous system*?**

+ The pelvic splanchnic nerves

– The sacral splanchnic nerves

– The short ciliary nerves

– The greater and lesser splanchnic nerves

***Which of the following are the ganglia of the sacral part of a parasympathetic division of the autonomic nervous system*?**

+ The pelvic ganglia
– The sacral ganglia
– The lumbar ganglia
– The ciliary ganglia

How is the parasympathetic nucleus of the oculomotor nerve (CN III) called?

+ The accessory nucleus of the oculomotor nerve
– The nucleus of the oculomotor nerve
– The interpeduncular nucleus
– The nucleus of the trochlear nerve

Postganglionic fibres from the ciliary ganglion innervate the following:

+ The ciliary muscle and the sphincter pupillae muscle
– The lacrimal gland
– The dilator pupillae muscle
– The tunics of the eyeball

Where is the ciliary ganglion located?

+ Lateral to each optic nerve near the posterior aspect of the orbit
– Medial to each optic nerve near the medial aspect of the orbit
– Inferior to each ophtalmic nerve near the inferior aspect of the orbit
– Superior to each ophtalmic nerve near the posterior aspect of the orbit

Which of the following is not the central part of the autonomic nervous system?

+ The motor and sensory nuclei of the CN III–XII
– The parasympathetic nuclei of the CN III, VII, IX, and XII
– The sympathetic nuclei of the lateral horns of the spinal cord with respect to the segments C8–L2
– The sacral parasympathetic nuclei of the grey matter of

the spinal cord with respect to the segments S2–S4

How is the parasympathetic nucleus of the facial nerve (CN VII) called?

+ The superior salivatory nucleus
– The inferior salivatory nucleus
– The nucleus of the solitary tract
– The motor nucleus of the facial nerve

Which of the following is the parasympathetic branch of the facial nerve?

+ The greater petrosal nerve
– The lesser petrosal nerve
– The tympanic nerve
– The superior laryngeal nerve

The greater petrosal nerve passes through the pterygoid canal and terminates within the following ganglion:

+ The pterygopalatine ganglion
– The ciliary ganglion
– The submandibular ganglion
– The otic ganglion

What glands do the postganglionic fibres of the pterygopalatine ganglion supply?

+ The lacrimal gland
– The parotid gland
– The submandibular gland
– The sublingual gland

Which of the following nerves has the preganglionic fibers from the superior salivatory nucleus, which reach the submandibular ganglion to synapse within it?

+ The chorda tympani
– The tympanic
– The greater petrosal
– The lesser petrosal

The postganglionic fibres from the otic ganglion reach the folowing gland:

+ Parotid
– Lacrimal
– Submandibular
– Sublingual

What gland do the postganglionic fibres of the

submandibular ganglion supply?

+ The submandibular gland
– The lacrimal gland
– The parotid gland
– The sublingual gland

How is the parasympathetic nucleus of the glossopharyngeal nerve (CN IX) called?

+ The inferior salivatory nucleus
– The ambiguus nucleus
– The superior salivatory nucleus
– The nucleus of the solitary tract

The preganglionic fibers from the inferior salivatory nucleus terminate within the otic ganglion as the folowing nerve:

+ The lesser petrosal
– The greater petrosal
– The chorda tympani
– The deep petrosal

Which of the following are parasympathetic branches of the glossopharyngeal nerve?

+ The tympanic nerve and the lesser petrosal nerve
– The greater petrosal nerve and the chorda tympani nerve
– The deep petrosal nerve and the internal carotid nerve
– The jugular nerve and the vertebral nerve

Which of the following is the parasympathetic nucleus of the vagus nerve?

+ The dorsal nucleus of the vagus nerve
– The nucleus of the solitary tract
– The nucleus ambiguus
– The inferior salivatory nucleus

Preganglionic fibers, which are parts of the vagal branches, extend to:

+ The terminal ganglia in the thorax and abdomen
– Cells of the superior ganglion of the vagus nerve

– Cells of the inferior ganglion of the vagus nerve
– The ganglia of the sympathetic trunk

The vegetative (autonomic) part of the nervous system does not provide with:
+ Motor innervation of the skeletal (striated) muscles
– Secretory innervation of the glands
– Innervation of the heart
– Innervation of the smooth (non-striated) muscles of the viscera, vessels and eyes

The vegetative (autonomic) part of the nervous system controls:
+ The activity of all internal organs (viscera)
– The activity of muscles of the head and neck
– The sensitivity of skin of the head and neck
– The activity of muscles of upper and lower extremities

Where are centre of the sympathetic division of the autonomic nervous system located?
+ In the intermediolateral nuclei of the lateral grey horns of the spinal cord with respect to the segments C8–L2
– In the proper nuclei of the posterior grey horns of the spinal cord
– In the sacral nuclei of the grey mater of the spinal cord with respect to the segments S2–S4
– In the thoracic nuclei of the posterior grey horns of the spinal cord

The vegetative (autonomic) part of the nervous system regulates:
+ The trophic processes of all organs and tissues
– The function of the cerebral cortex
– The function of the sensory nuclei of the brainstem
– The function of the motor nuclei of the brainstem

Which of the following is not the peripheral compartment of the autonomic nervous system?

+ The spinal ganglia

– The vegetative (visceral and periarterial) plexuses

– The paravertebral sympathetic ganglia that form the paired sympathetic trunks

– The prevertebral sympathetic ganglia of the abdominal autonomic plexuses

The vegetative (autonomic) part of the nervous system does not supply:

+ The skin (sensory innervation)

– The heart

– The blood vessels

– The lymphatic vessels

Which of the following is the part of the sympathetic division of the autonomic nervous system?

+ The right and left sympathetic trunks

– The posterior roots of the spinal cord

– The motor roots of the cranial nerves

– The sensory roots of the cranial nerves

Which of the following is the part of the sympathetic division of the autonomic nervous system?

+ The white and grey rami communicantes of the spinal nerves

– The anterior rami of the spinal nerves

– The posterior rami of the spinal nerves

– The posterior roots of the spinal cord

How many sympathetic ganglia are in each of two sympathetic trunks?

+ 20–25 ganglia

– 3–4 ganglia

– 31 ganglia

– 10–12 ganglia

Which of the following is the part of the sympathetic

division of the autonomic nervous system?

+ The prevertebral sympathetic ganglia situated anterior to the vertebral column and form the autonomic plexuses

– The spinal ganglia belong to posterior roots of the spinal nerves

– The sensory ganglia of CN I–XII

– The somatic nervous plexuses

All ganglia of the sympathetic trunk give rise to the following types of branches as:

+ The grey rami communicantes and the visceral branches

– The white rami communicantes and the interganglionic branches

– The interganglionic branches and the anterior branches

– The anterior, posterior and meningeal branches

What structures connect ganglia of the sympathetic trunks?

– The white rami communicantes

– The grey rami communicantes

– The dorsal branches

– The ventral branches

The grey rami communicantes are represented with:

+ The postganglionic fibers (axons) of the neurons of ganglia of the sympathetic trunks

– The preganglionic fibers (axons) of the intermediolateral nuclei of the spinal cord

– The motor nervous fibers of the anterior nuclei of the spinal cord

– The peripheral fibers of the pseudounipolar neurons of the spinal ganglia

The white rami communicantes are represented with:

+ The preganglionic fibers (axons) of the intermediolateral nuclei of the spinal cord

– The postganglionic fibers (axons) of the neurons of ganglia of the sympathetic trunks

– The motor nervous fibers of the anterior nuclei of the spinal cord

– The central fibers of the pseudounipolar neurons of the spinal ganglia

What do all thoracic and two upper lumbar ganglia of the sympathetic trunks accept?

+ The white rami communicantes

– The grey rami communicantes

– The interganglionic branches

– The meningeal branches

Which spinal nerves have no white rami communicantes?

+ C1–C7

– C8

– T1–T12

– L1–L2

Which of the following is not part of the sympathetic trunk?

+ The cranial part

– The lumbar part

– The cervical part

– The thoracic part

Which of the following is the part of each sympathetic trunk?

+ The sacral part

– The cranial part

– The spinal part

– The carotid part

How many sympathetic ganglia does the cervical part of the sympathetic trunk have?

+ 3 ganglia

– 5 ganglia

– 10–12 ganglia

– 20–25 ganglia

Where are the ganglia of the cervical part of the sympathetic trunk disposed?

+ On the deep cervical muscles posterior to the prevertebral layer of the cervical fascia

– Anterior the bodies of the vertebrae C3–C8

– Under the skin posterior to the sternocleidomastoid muscles

– Posterior the spinous progesses of the vertebrae C3–C6

Where is the superior cervical ganglion of the sympathetic trunk located?

+ Anterior the transverse processes of the vertebrae C2–C3

– Posterior the transverse processes of the vertebrae C1–C3

– Anterior the bodies of the vertebrae C1–C3

– Anterior the spinous process of the vertebra C4

What is located anterior the superior cervical ganglion?

+ The internal carotid artery

– The sternocleidomastoid muscle

– The external jugular vein

– The pretracheal layer of the cervical fascia

Which of the following is not the branch (nerve) of the superior cervical ganglion?

+ The vertebral nerve

– The internal carotid nerve

– The jugular nerve

– The superior cervical cardiac nerve

What sympathetic and parasympathetic nerves join to form the nerve of the pterygoid canal?

+ The deep petrosal nerve and the greater petrosal nerve

– The deep petrosal nerve and the lesser petrosal nerve

– The greater petrosal nerve and the lesser petrosal nerve

– The deep petrosal nerve and the jugular nerve

Which of the following is not the branch (nerve) of the superior cervical ganglion?

+ The middle cervical cardiac nerve
– The jugular nerve
– The external carodid nerve
– The superior cervical cardiac nerve

The nerve of the pterygoid canal stretches through the pterygoid canal to the folowing ganglion:

+ Pterygopalatine
– Ciliary
– Otic
– Trigeminal

How does the internal carotid plexus enter the skull cavity?

+ Through the carotid canal
– Through the facial canal
– Through the musculotubal canal
– Through the canaliculus for chorda tympani

Where is the middle cervical ganglion located?

+ Anterior the transverse processes of the vertebra C4
– Anterior the spinous process of the vertebra C6
– Posterior the transverse processes of the vertebrae C2–C3
– Anterior the neck of the 1st rib

What nerve originates from the internal carotid plexus inside the skull cavity?

+ The deep petrosal nerve
– The greater petrosal nerve
– The lesser petrosal nerve
– The vertebral nerve

The postganglionic sympathetic fibers (the short ciliary nerves) of the ciliary ganglion supply the following:

+ Dilator of the pupil muscle
– Sphincter of the pupil muscle
– Orbicularis oculi muscle
– Lacrimal gland

Where is the inferior cervical ganglion (cervicothoracic or stellate) located?

+ At the level of the neck of the 1st rib, posterior to the subclavian artery

– Between the subclavian artery and the subclavian vein

– Anterior the body of the vertebra C7

– Anterior the transverse process of the C5 vertebra

Which of the following is not the branch (nerve) of the cervicothoracic (inferior cervical) ganglion?

+ The jugular nerve

– The vertebral nerve

– The inferior cervical cardiac nerve

– The subclavian branches

What sympathetic plexus is formed with branches of the cervicothoracic (inferior cervical) ganglion?

+ The subclavian plexus

– The internal carotid plexus

– The cervical plexus

– The jugular plexus

Which of the following is the branch of the cervicothoracic (inferior cervical) ganglion?

+ The vertebral nerve

– The jugular nerve

– The superior cervical cardiac nerve

– The phrenic nerve

How many sympathetic ganglia does the thoracic part of the sympathetic trunk have?

+ 10–12 ganglia

– 5–6 ganglia

– 3 ganglia

– 31 ganglia

What sympathetic nervous plexus is not formed by the branches of the thoracic ganglia of the sympathetic trunk?

+ The subclavian plexus

– The pulmonary plexus

– The esophageal plexus

– The thoracic aortic plexus

Which of the following is the branch of the cervicothoracic (inferior cervical) ganglion?

+ The inferior cervical cardiac nerve
– The jugular nerve
– The middle cervical cardiac nerve
– The phrenic nerve

Which of the following are not the branches of the thoracic ganglia of the sympathetic trunk?

+ The lumbar splanchnic nerves
– The greater splanchnic nerve
– The lesser splanchnic nerve
– The least splanchnic nerve

How do the greater and lesser splanchnic nerves penetrate into the abdominal cavity?

+ Between the muscular bundles of the lumbar part of the diaphragm
– Through the oesophageal hiatus of the diaphragm
– Through the aortic tiatus of the diaphragm
– Through the foramen venae cavae of the diaphragm

Where do the preganglionic sympathetic fibers pass as the components of the greater and lesser splanchnic nerves?

+ To the ganglia of the coeliac plexus
– To the lumbar ganglia of the sympathetic trunk
– To the sacral ganglia of the sympathetic trunk
– To the ganglia of the inferior hypogastric plexus

The lumbar sympathetic ganglia give rise to the following types of branches:

+ The lumbar splanchnic nerves and the grey rami communicantes
– The greater and lesser splanchnic nerves

– The esophageal and pulmonary branches
– The lumbar and sacral splanchnic nerves

How many sympathetic ganglia does the lumbar part of sympathetic trunk have?
+ 2–5 ganglia
– 10–12 ganglia
– 7–8 ganglia
– 31 ganglia

How many sympathetic ganglia does the sacral part of sympathetic trunk have?
+ 4 ganglia
– 10 ganglia
– 2–5 ganglia
– 31 ganglia

What autonomic plexus is the largest plexus of the abdominal cavity (the "abdominal brain")?
+ The coeliac plexus
– The hepatic plexus
– The superior mesenteric plexus
– The superior hypogastric plexus

The sacral sympathetic ganglia give rise to the following types of branches:
+ The sacral splanchnic nerves and the grey rami communicantes
– The greater splanchnic nerve and the white rami communicantes
– The white and grey rami communicantes
– The greater and lesser splanchnic nerves

Which of the following is not the autonomic plexus of the abdominopelvic cavity?
+ The thoracic aortic plexus
– The abdominal aortic plexus
– The coeliac plexus
– The inferior mesenteric plexus

What autonomic nerves bring the preganglionic sympathetic fibers to the coeliac plexus?
+ The splanchnic major and minor nerves

– The right and left vagus nerves
– The pelvic splanchnic nerves
– The right phrenic nerve

Which of the following is not ganglion of the coeliac plexus?
+ The phrenic ganglion
– The coeliac ganglion
– The superior mesenteric ganglion
– The aortorenal ganglion

Where is the coeliac plexus found?
+ On the anterior surface of the aorta next to the coeliac trunk
– On the anterior surface of the inferior vena cava below the liver
– On the anterior surface of the aorta next to the inferior mesenteric artery
– On the anterior surface of the aorta between the superior and inferior mesenteric arteries

What secondary periarterial plexus does not arise from the coeliac plexus?
+ The superior rectal plexus
– The pancreatic plexus
– The hepatic plexus
– The gastric plexus

What secondary periarterial plexus arises from the coeliac plexus?
+ The hepatic plexus
– The testicular plexus
– The superior rectal plexus
– The uterovaginal plexus

Where is the secondary renal plexus found?
+ Around the renal arteries
– On the superior pole of the kidney
– On the anterior surface of kidney
– Around the ureter

What secondary autonomic plexus do only the females have?
+ The ovaric plexus
– The testicular plexus

– The intermesenteric plexus
– The inferior mesenteric plexus

Where is the superior mesenteric plexus located?
+ Around the superior mesenteric artery
– Around the abdominal aorta between the superior and inferior mesenteric arteries
– Around the renal artery
– Around the thoracic aorta

Where is the inferior mesenteric plexus situated?
+ Around the inferior mesenteric artery
– Around the ureter
– Around the abdominal aorta between the superior and inferior arteries
– Around the superior mesenteric artery

What secondary autonomic plexus do only the males have?
+ The testicular plexus
– The ovaric plexus
– The renal plexus
– The ureteric plexus

How is a segment of the abdominal aortic plexus, enclosed between the superior and inferior mesenteric arteries, called?
+ The intermesenteric plexus
– The renal plexus
– The superior mesenteric plexus
– The inferior hypogastric plexus

What secondary autonomic plexus originates from the inferior mesenteric plexus?
+ The superior rectal plexus
– The inferior rectal plexus
– The ureteric plexus
– The prostatic plexus

Which of the following is not the autonomic plexus of the pelvic cavity?
+ The renal plexus
– The vesical plexus
– The inferior hypogastric plexus
– The inferior rectal plexus

Where is the inferior hypogastric plexus located?

+ Above the levator ani muscle on the right and left sides of rectum
– In front of the to rectum
– Behind the rectum
– Under the urinary bladder

What auronomic plexus of the pelvic cavity is in males only?

+ The deferential plexus
– The vesical plexus
– The superior rectal plexus
– The inferior rectal plexus

What autonomic plexus of the pelvic cavityis in females only?

+ The uterovaginal plexus
– The prostatic plexus
– The vesical plexus
– The inferior rectal plexus

Where is the superior hypogastric plexus located?

+ Below the aortic bifurcation between the common iliac arteries
– Above the aortic bifurcation at the level L3
– Around the inferior epigastric arteries
– Around the internal iliac arteries

What autonomic plexus of the pelvic caviry is in males and females?

+ The vesical plexus
– The uterovaginal plexus
– The prostatic plexus
– The deferential plexus

CLINICAL TASKS (KROK-1)

After a knife wound of an external surface of a right knee joint below the head of fibula the foot hangs down, is flexed, the dorsal flexion is impossible. What nerve is damaged?

+ N. peroneus communis
– N. tibialis
– N. cutaneus surae lateralis
– N. peroneus superficialis
– N. peroneus profundus

The damage of posterior fascicles of the brachial plexus is revealed in the victim. What muscles group functions will be broken at the upper limb?

+ Muscles of a posterior group of the forearm
– Anterior group of forearm muscles
– Muscles of thenar
– Muscles of hypothenar
– Anterior group of shoulder muscles

The impossibility to hand pronation is exposed in the patient with a cutting wound in the left axillary region. What nerve is damaged?

+ N. medianus
– N. ulnaris
– N. radialis
– N. cutaneus brachii medialis.
– N. cutaneus antebrachii medialis

The patient has breach of function of lateral group flexor muscles after a trauma of a forearm. What nerve is damaged?

+ N. medianus
– N. ulnaris
– N. radialis
– N. musculocutaneus
– N. cutaneus antebrachii

The victim has damaging of the vessel which passes together with n. axillaris through the foramen quadrilaterum. What is the vessel?

+ Circumflexa humeri posterior
– Brachialis
– Circumflexa humeri anterior
– Profunda brachii
– Circumflexa scapulae

The patient has "monkey hand". What nerve is damaged?

+ Median
– Musculocutaneous
– Radial
– Axillary
– Ulnar

In a patient with the neuritis of a femoral nerve flexion of

a hip and an extension of a leg in a knee the joint is broken. Which muscle function is broken?

+ Musculus quadriceps femoris
– Semitendinous muscle
– Triceps femoris muscle
– Semimembranosus muscle
– Musculus biceps femoris

The patient has neuritis of the femoral nerve. What movement cannot be carried out?

+ Extension of a knee joint
– Plantar flexion of foot
– Flexion of a knee joint
– Dorsal flexion of foot
– Pronation of foot

The skin sensitivity is absent on the medial surface of a thigh and there is impossibility of adduction of the right lower extremity to the midline. What nerve is injured?

+ N. obturatorius
– N. ischiadicus
– N. femoralis
– N. genitofemoralis
– N. ilioinguinalis

The victim has a deep wound on an external surface of a right leg. The impossibility of extension of the foot is revealed. What nerve is damaged?

+ N. peroneus profundus
– N. peroneus superficialis
– N. peroneus communis
– N. peroneus longus
– N. peroneus brevis

The infringement of skin sensitivity on a posterior surface of a leg is revealed in a patient. What nerve is damaged?

+ Sciatic nerve
– Posterior cutaneous nerve of the thigh
– Femoral nerve
– Obturator nerve
– Inferior gluteal nerve

The patient is diagnosed with neuritis of the tibial

nerve. Which of the listed functions is broken?

+ Plantar flexion of the foot
– Dorsal flexion of the foot
– Extension in a knee joint
– Flexion in a knee joint
– Extension of toes

The palpation around of the anus and the external sphincter of a rectum is painful in a patient. What nerve is damaged?

+ N. pudendus
– N. ischiadicus
– N. femoralis
– N. tibialis
– N.obturatorius

The patient is diagnosed with neuritis of the common fibular nerve. Which of the listed functions is broken?

+ Dorsal flexion of the foot
– Plantar flexion of the foot
– Extension in a knee joint
– Flexion in a knee joint
– Extension of toes

In the patient the right superior ganglion of the sympathetic trunk was involved in a tumoral process. What symptom will be observed?

+ Constriction of the right pupil
– Accommodation disorder at the left
– A paralysis of a medial rectus muscle of the right eyeball
– Mydriasis (dilation of a pupil) at the right
– Disorder of a lacrimation at the right

The victim with a broken function of extension in a hip joint is delivered to the traumatology department. What nerve is injured in the victim most likely?

+ Superior gluteal
– Sciatic
– Obturator
– Pudendal
– Femoral

The patient has impossible flexion of a forearm in a

position of supination, the absence of cutaneous sensitivity on the anterolateral surface of the forearm. What nerve is damaged?

+ Musculocutaneus
– Ulnar
– Radial
– Median
– Axillary

Regular excursions of a diaphragm were broken because of an operational trauma of soft tissues of a neck on the right side. What nerve has suffered?

+ N. phrenicus dexter
– N. intercostales
– N. vagus
– N. accessorius
– Rr. dorsales nervi spinalis

The patient has lost an opportunity to flex a forearm in the elbow joint. The skin sensitivity of anterolateral surface of a forearm was broken. What nerve was damaged?

+ N. musculocutaneus
– N. radialis
– N. ulnaris
– N. medianus
– N. axillaris

The patient complains about disorder of the skin sensitivity on a medial part of a dorsal and palmar surface of a hand. What nerve is damaged?

+ N. ulnaris
– N. medianus
– N. musculocutaneus
– N. cutaneus antebrachii medialis
– N. radialis

The active extension of a leg in a knee joint is absolutely impossible in the patient. The looseness of patella appeared. What nerve damage is possible?

+ Femoral
– Obturator
– Sciatic

– Superior gluteal
– Inferior gluteal

The patient had a pricking of the skin on a medial surface of the forearm after a trauma of a posteriomedial surface of the humerus. Which of nerves is damaged?
+ N. cutaneus autebrachii medialis
– N. musculocutaneus
– N. dorsalis scapularis
– N. subscapularis
– N. radialis

The patient complains about the increased pain of the skin of an auricle and an external acoustic meatus. Which of nerves is damaged?
+ N. auricularis magnus
– N. occipitalis minor
– Nn. supraclaviculares
– N. vagus
– N. transversus colli

The sensitivity of the skin of anterior and lateral surfaces of a neck is reduced in the patient after the operation. What nerve provides the sensitivity of this area of a neck?
+ N. transversus colli
– N. auricularis magnus
– Nn. supraclaviculares
– N. occipitalis minor
– N. phrenicus

The patient has a hyperesthesia of the skin at the medial surface of the arm. What nerve is injured?
+ Medial cutaneous nerve of the arm
– Median nerve
– Ulnar nerve
– Radial nerve
– Axillary nerve

The patient complains to a stomatologist about extra salivation. What vegetative ganglion stimulation can hyperproduction of serous saliva cause?
+ Ganglion oticum
– Ganglion pterygopalatinum

– Ganglion submandibulare
– Ganglion ciliare
– Ganglion sublinguale

A radiograph shows enlarged lymph nodes in the region of roots of the lungs which press the heart. What nerves are squeezed?
+ Rr. cardiaci n. vagi
– N. phrenicus
– Nn. intercostales
– Truncus sympaticus
– N. splanchnicus major

The victim has anaesthesia of the 5th and half of the 4th fingers on a palmar surface, and half of the 3rd, 4th and 5th on a dorsum. What nerve is injured?
+ Ulnar
– Radial
– Musculo-cutaneous
– Median
– Medial cutaneous nerve of a forearm

In a man, who has a fracture of the right humerus in the middle third of the humeral diaphysis with displaced fragments, fingers of the right hand do not extend. What nerve is damaged?
+ Radial
– Ulnar
– Median
– Musculo-cutaneous
– Axillary

The patient complains about a loss of the skin sensation on the posterior middle and inferior thirds of the leg. What nerve is damaged?
+ N. suralis
– N. cutaneus femoris posterior
– N. saphenus
– N.obturatorius
– N. tibialis

The patient cannot flex a forearm and has loss of sensation on anterior-lateral surface of the forearm. What nerve is damaged?
+ Musculo-cutaneous
– Axillary
– Radial

– Median
– Ulnar

A loss of sensation of the 4th and 5th fingers is revealed in the patient after the trauma of the medial humeral epicondyle. What nerve is injured?
+ Ulnar
– Radial
– Median
– Medial cutaneous nerve of the forearm
– Musculo-cutaneous

The patient has lost ability to hold pronated foot. What nerve is injured?
+ Superficial peroneal
– Deep peroneal
– Tibial
– Sciatic
– Common peroneal

After the trauma of soft tissues of the neck the respiratory excursion of the diaphragm was disturbed in the victim. ***What nerve was injured during the operation?***
+ N. phrenicus
– N. vagus
– N. accessorius
– Rr. dorsales nervi spinalis
– N. intercostales

What nerve can be damaged under removal of the great saphenous vein (v. saphena magna)?
+ N. saphenus
– N. cutaneus surae medialis
– N. peroneus superficialis
– N. cutaneus surae lateralis
– N. tibialis

A patient has a loss of skin sensation at the pubis and external genital organs after appendectomy. What nerve branches were damaged during operation?
+ Ilio-inguinal
– Obturator
– Femoral
– Genito-femoral
– Ilio-hypogastric

A patient has loss of a skin sensation in anterior-medial surface of the leg. What nerve is injured?

+ Saphenus
– Obturator
– Sciatic
– Lateral cutaneous nerve of thigh
– Common fibular

Disturbance of the tactile and temperature sense in the region of inferior 2/3 of the lateral surface of the thigh (Roth's disease) is caused by damage of the:

+ Lateral cutaneous nerve of thigh
– Genito-femoral nerve
– Femoral nerve
– Sciatic nerve
– Tibial nerve

A patient feels a pain in the region of anterior surface of the thigh, and he has atrophy of quadriceps femoris muscle. What nerve is injured?

+ Femoral
– Obturator
– Sciatic
– Tibial
– Common fibular

A patient cannot flex the foot and toes, and abduct the foot. He complains about loss of sensation on the sole and lateral edge of the foot. What nerve is damaged?

+ Tibial nerve
– Common fibular nerve
– Femoral nerve
– Obturator nerve
– Inferior gluteal nerve

The patient has signs of loss of the visual watch reflex. What nuclei of the brainstem are damaged?

+ Nuclei of superior colliculi of tectal lamina
– Nuclei of the third cranial nerve
– Nuclei of the inferior colliculi of tectal lamina

– Nuclei of the trochlear nerve
– Nuclei of the abducent nerve

The patient has infringements of an accommodation, bilateral ptosis (droped upper eyelids), divergent strabismus. Pupils are dilated. Which of cranial nerves nuclei are affected?
+ III
– IV
– V
– VI
– V1I

The patient has an inflammation of the maxillary nerve. What foramen of the sphenoid bone does the nerve pass through?
+ Rotundum
– Oval.
– Jugulare
– Venosus
– Spinosus

The victim has the left-side splintered fracture of the zygomatic bone with loss of skin sensitivity above it. What nerve is injured?
+ Zygomaticofacial nerve
– Facial nerve
– Infraorbital nerve
– Buccal nerve
– Pes anserinus minor

A doctor injects an anesthetic solution into the infraorbital foramen. What nerves are thus anesthetized?
+ Infraorbital nerve and anterior superior alveolar branches
– Abducent nerve
– Oculomotor nerve
– Trochlear nerve
– Mandibular nerve and motor branches

The patient has an asymmetry of the face especially at attempts to make active contractions of facial muscles. What nerve

damage should a doctor think about?

+ Facial – its motor fibers
– Trigeminal – the 1st branch (ophtalmic)
– Trigeminal – the 2nd branch (maxillary)
– Trigeminal – the 3rd branch (mandibular)
– Hypoglossal

The boxer has left-side paralysis of muscles of the facial expression after a blow at the parotid area. What nerve is damaged?

+ Facial
– Lesser petrosal nerve
– Ophtalmic
– Maxillary
– Mandibular

After the operation, the peristalsis of the stomach and a secretion of its glands has slowed down, and the sphincter muscle of pylorus has weakened. What nerve has been damaged?

+ Vagus nerve
– Accessory nerve
– Glossopharyngeal nerve
– Trigeminal nerve
– Trochlear nerve

The patient has a functional disorder of the parotid gland. What nerve intensifies secretion of the parotid gland?

+ N. petrosus minor
– N. auricularis major
– N. petrosus major
– N. petrosus profundus
– N. auricularis minor

The patient complains about the pain in the root of the tongue and palatine tonsiles. What nerve innervates these areas?

+ Glossopharyngeal
– Hypoglossal
– Accessory
– Trigeminal
– Trochlear

The patient has a thrombosis of a sigmoid sinus in the place of a jugular foramen. Thus, IX,

X, XI, pairs of cranial nerves are involved. What are muscles of the neck involved?

+ Mm. trapezius, m. stenocleidomastoideus
– M. sternohyoideus
– M. scalenus anterior
– M. scalenus posterior
– M. omohyoideus

The patient complains about difficulty rising the right upper extremity above a horizontal level. What nerve is damaged?

+ Right accessory nerve
– Left accessory nerve
– Greater pectoral nerve
– Lesser pectoral nerve
– Right vagus nerve

The patient cannot turn the head to left and throw it back. What nerve is injured?

+ Right accessory
– Greater pectoral
– Left accessory
– Lesser pectoral
– Right vagus

The patient has deviation of the apex of the tongue to the right. What cranial nerve motor innervation is broken in this case?

+ N. hypoglossus dexter
– N. glossopharingeus dexter
– N. vagus dexter
– N. trigeminus sinister
– N. facialis sinister

During the stomatologic manipulations the fibers of CN12 were damaged at the left side. What are the symptoms?

+ Deformity of tongue muscles contraction at the left
– Deformity of soft palate muscles contraction
– Deformity of a larynx muscles contraction
– Deformity of suprahyoid muscles contraction
– Deformity of pharynx muscles contraction

The patient says the words with effort, and also

complains about difficulty in swallowing. What nerve damage has caused such clinic symptoms?

+ N. vagus
– N. facialis
– N. glossopharyngeus
– N. accessorius
– N. hypoglossus

The patient has an increased secretion of the parotid gland. What nucleus stimulation can cause this?

+ Nucleus salivatorius inferior
– Nucleus solitarius
– Nucleus salivatorius superior
– Nucleus ambiguus
– Nucleus dorsalis n. vagi

In the patient, a lens accommodation disorder caused by damage of the function of a vegetative ganglion caring out parasympathetic innervation of m. ciliaris. What is the ganglion?

+ G. ciliare
– G. pterygopalatinum
– G. oticum
– G. submandibulare
– G. sublinguale

A doctor has detected an atrophy of the muscles of mastication in the patient. What cranial nerve branches does this group of muscles innervate?

+ N. trigeminus
– N. ophthalmicus
– N. glossopharyngeus
– N. vagus
– N. facialis

Which of nerves can be damaged because of the highmoritis (inflammation of the maxillary sinus mucosa)?

+ Nn. alveolares superiores
– N. oculomotorius
– N. facialis
– N. mandibularis
– N. ophthalmicus

The patient with an inflammation mucosa of the tongue complains about a disorder of the general sensitivity of the anterior two thirds of the tongue. What nerve is damaged?

+ Lingual
– Tympanic
– Chorda tympani
– Vagus
– Glossopharyngeal

Disorder of salivation and taste is detected in the patient with an inflammation of the middle ear. What nerve is injured?

+ Chorda tympani
– Tympanic
– Lingual
– Glossopharyngeal
– Vagus

In the patient, the right nasolabial fold is flattened, the right eyelids are not closed. There are difficulties during talking, smiling, whistling. What nerve is struck?

+ N. facialis dexter
– N. abducens dexter
– N. glossopharyngeus sinister
– N. vagus dexter
– N. glossopharyngeus dexter

The patient has a masklike [Parkinson's] face after grippe: the lowered angles of a mouth and lowered eyelids, flattened nasolabial folds. What nerve is damaged?

+ N. facialis
– Maxillary
– Mandibular
– Greater petrosal
– N. vagus

The male patient has gone to hospital with complaints about anesthesia of posterior 1/3 of the tongue. What cranial nerve's function is broken?

+ IX
– X
– VII

– V
– XI

The patient has difficulties during swallowing concerned with paralysis of the soft palate. What nerve is damaged?
+ III branch of the trigeminal nerve
– Facial nerve
– I branch of the trigeminal nerve
– II branch of the trigeminal nerve
– Hypoglossal nerve

The patient feels the pain and numbness of the gingival mucosa of the upper jaw. The damage of what nerves can cause these signs?
+ Nn. alveolaris superiores (n. maxillaris)
– N. facialis
– N. glosspharyngeus
– N. vagus
– N. ophtalmicus

Irritation of what nerve might cause an appearance of a hoarse voice in the patient with aneurism of the right subclavian artery?
+ N. laryngeus reccurens dexter
– N. laryngeus inferior sinister
– N. laryngeus superior dexter
– N. laryngeus reccurens sinister
– N. laryngeus superior sinister

The patient has a loss of sensation of the anterior 2/3 of the tongue. The taste sensation is persisted. What nerve is damaged?
+ Lingual nerve before joining chorda tympani
– Hypoglossal
– Chorda tympani
– Lingual nerve after joining chorda tympani
– Glossopharyngeal

The patient does not feel bitter, the tactile sensitivity of a posterior third of the tongue is disturbed. What nerve is involved in the pathological process?

+ Glossopharyngeal
– Hypoglossal
– Lingual
– Facial
– Trigeminal

The patient had been undergone a resection of a thyroid gland. The hoarseness was observed long time after the operation. What nerve was damaged during the operation?

+ Recurrent laryngeal
– Hypoglossal
– Superior laryngeal
– Mandibular
– Lingual

The patient complains about dryness in a mouth, reduction of salivation. What nerves are injured?

+ Parasympathetic fibers of the chorda tympani
– Motor fibers of the hypoglossal nerve
– Sensory fibers of the lingual nerve
– Parasympathetic fibers of the vagus nerve
– Sympathetic fibers of the sympathetic trunk

The victim has a fracture and haemorrhage at an anterior third of the mandible, a loss of the skin sensitivity at a chin. What nerve is injured?

+ N. alveolaris inferior
– N. transversus coli
– N. alveolaris superior
– N. buccalis
– N. mylohyoideus

REFERENCES

1. Gilroy, Anne M., MacPherson, Brian R., Ross, Lawrence M., Schue (2012). Atlas of Anatomy Latin Nomenclature Second edition. [New York] : Stuttgart/Thieme.

2. Anne M. R. Agur, Arthur F. Dalley (2008). Grant's Atlas of Anatomy, 12th ed. [Philadelphia, PA and London] : Lippincott Williams & Wilkins.

3. Standring, S., Borley, N. R., & Gray, H. (2008). Gray's anatomy: the anatomical basis of clinical practice. 40th ed., anniversary ed. [Edinburgh]: Churchill Livingstone/Elsevier.

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(Англійською мовою)

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Редактор Л. В. Штихно
Комп'ютерне верстання К. В. Тернюк

Формат 60×84/16. Ум. друк. арк. 10,70. Обл.-вид. арк. 10,12. Тираж 300 пр. Зам. №

Видавець і виготовлювач
Сумський державний університет,
вул. Римського-Корсакова, 2, м. Суми, 40007
Свідоцтво суб'єкта видавничої справи ДК № 3062 від 17.12.2007.