

Semmelweis University
Department of Anatomy, Histology and Embryology

Faculty of Medicine
2nd year 1st semester

ANATOMY HANDBOOK

September 2017



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Associate Professor
Course Director of the English Language Program

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Full Professor
Head of Department, Rector



Anatomy, Histology and Embryology for EM students

TEACHING DEPARTMENT:

SEMMELWEIS UNIVERSITY

Department of Anatomy, Histology and Embryology

Budapest, Tűzoltó utca 58.

H-1094 Budapest

<http://semmelweis.hu/anatomia>

LEARNING OBJECTIVES

Aims of the lectures in anatomy: Presentation of the important and/or complicated chapters such as introductory chapters, thorax, pelvis, hand, foot, skull, heart, chapters of the visceral organs, central nervous system, **organs of special senses, topographical anatomy.**

Aims of the lectures in cell biology and histology: Presentation of the cell, basic principles in cell biology (mitosis, cytoskeleton, cellular motility), detailed presentation of the basic tissues (epithelial, connective, muscle and nervous). Completing the gross anatomy with the detailed presentation of the fine structure of the organs, including the ultrastructural details as well as the molecular arrangement. Important chapters: basic tissues, viscera, central nervous system.

Aims of the lectures in embryology: Presentation of the early development from the differentiation of the germ cells to the formation of the human embryo (general embryology). Presentation of the development of the organs and functional systems parallel with the gross anatomical and histological lectures including the frequently occurring malformations.

Aims of the practical sessions in the dissecting room: Based on the weekly programs the students study the preparations (bones, joints, muscles, viscera, brain) and dissect (parts of or an entire cadaver). They are aided by the lab instructors. Bones, joints, muscles and peripheral nervous system will be taught primarily in the dissecting room.

Aims of the practical sessions in the histology room: Facilitate the understanding of the basic tissues (epithelial, connective, muscle and nervous) and the fine structure of the organs through the observation and interpretation of histological specimens.

Discussion of the more complicated chapters of the embryology is presented on small group discussions connected to the practical sessions in the dissecting room.

The knowledge of the students will be checked by mid-term tests.

Lectures: first semester: 3x 45 min; second semester: 3x 45 min; third semester: 3x 45 min; fourth semester: 1x 45 min.

Topics of the lectures:

First semester: Gross anatomy of the bones, joints and muscles, basic cytology, basic histology, basic embryology, development of the skull, spine and limbs.

Second semester: Heart and vessels, lymphatic organs, viscera and body cavities; integrated gross anatomy, cytology, histology and embryology.

Third semester: Central and peripheral nervous system, organs of special senses, endocrine organs; integrated gross anatomy, cytology, histology and embryology.

Fourth semester: Topographical anatomy of the head, neck and body cavities (thorax, abdomen, pelvis), cross sectional anatomy.

Practical course

6x 45 min; second semester: 6x 45 min; third semester: 4x 45 min; fourth semester: 2x 45 min;

First semester: Gross anatomy of the bones, joints and muscles, basic cytology, basic histology, basic embryology, development of the skull, spine and limbs.

Second semester: Heart and vessels, lymphatic organs, viscera, topography of body cavities; integrated gross anatomy, cytology, histology and embryology. Topographical anatomy of the ventral regions of limbs and the trunk.

Third semester: Central and peripheral nervous system, organs of special senses, endocrine organs; integrated gross anatomy, cytology, histology and embryology. Topographical anatomy of the dorsal regions of limbs and the trunk, including spinal cord.

Fourth semester: Topographical anatomy of the head, neck and body cavities (thorax, abdomen, pelvis), cross sectional anatomy. Review of the subjects taught and studied during the four semesters.

Type of exams: first semester: semifinal; second semester: semifinal; third semester: semifinal; fourth semester: final exam from the subjects of the four semesters..

ECTS credits: four semesters together: 28 (first semester: 9; second semester: 9; third semester: 7; fourth semester: 3)

EM II ANNOUNCEMENTS

Evaluation is made using a five-grade scale (1-5).

Signing of the lecture book: active participation in lectures, dissection room and histology lab sessions is obligatory. Students should attend at least 75% of the scheduled hours to gain a signature proving the validity of the semester (and see below *). Absences are therefore limited in **25%**.

Midterm examinations: During the semester, both practical and theoretical knowledge will regularly be evaluated. The midterm tests may be oral or written exams and cannot be done at a different time. **Anatomy** midterms include both identification of several structures on the specimen and theoretical questions related to the subject. **The second midterm (Microscopy of the CNS) is obligatory.** Without a valid (i.e. passing) mark gained in this midterm the semester is not accepted*. The results of all tests will appear on the personal achievement cards.

A semester practical mark is calculated from the midterm marks together with the personal achievement mark given by the group instructor. This practical mark will be counted into the semifinal examination and will be written on the personal achievement cards.

Competition – only in the 3rd semester we offer the possibility of a competition (held during the 13th study week) upon invitation to those students whose midterm marks are at least 4 (good). Registration for the competition is open in the 12th week. Topic: Material of the semester, written test, including slides of macroscopical and microscopical specimen together with relevant theoretical questions. Students who reach the required 80% at the competition are exempted from the semifinal examination with a mark 5 (excellent).

Semifinal examinations are composed of the following parts:

1. written pretest,
2. oral examination (practical and theoretical questions in Macroscopy together with the identification/description of two histological specimen.

Notebooks should be used regularly in **histology lab sessions** in order to prepare schematic drawings of the histological specimens. Students will be asked to present their histology notebooks, containing the drawings, during the semifinal exams.

Obligatory dissection work – during the **4th** semester, every student is required to produce a fully dissected specimen to be exempted from the dissection part of the final examination. The specimen will be evaluated, marked and counted in the result of the final examination.

N.B. – In case, neither the first nor the repeated takes of a semifinal exam have been successful and so the exam has to be postponed to the following, exam period (i.e. 'CV' exam), only those students will be allowed to go for a CV exam, parallel to continuing their studies whose average score of the midterm tests) is equal, or higher than 2.00

RULES AND REGULATIONS IN THE DISSECTING ROOM

IT IS STRICTLY FORBIDDEN to eat, drink, smoke, to chew gums, or to use music devices or phones.

Bags and coats should be left in the lockers before entering the dissecting room.

The lockers will have to be locked using your padlocks.

Please, remember to keep your valuables always on you, or lock them in the lockers since the department takes no responsibility for lost items.

Everybody is supposed to behave in the dissecting room conforming to the spirit of the site. Loud speech, out-of-place jokes and any kind of behaviour, disregarding the dignity of human corpses, should strictly be avoided.

Students are expected to be prepared for the practical work.

Students should take care of the furniture and equipment of the dissecting room. Do not sit on the dissection tables or stand on the tripod stools to avoid accidents. **Fire and work safety regulations** should be maintained. The dissection room is a hazard area. **Cleanliness and order** should be kept.

Working in the dissection room involves the use of **sharp and pointed tools**, injuries should be reported to the lab instructor. The technical personnel will provide first aid when necessary.

The white lab coats should be worn while in the dissection room, but should be removed before leaving the dissection room area. The purpose of wearing the lab coats is to protect one's clothing from contacting the cadaver specimen. Furthermore we advise you to wear closed toed shoes and clothing covering the legs. In the end of the class, lab coats should be emptied and left in order on the coat hangers. The department is not responsible for valuables left in the dissecting room.

Only the members of the study group can participate in the sessions, visitors may be present only with prior permission by the lab instructor. Students can leave the sessions only with the approval of the lab instructor.

Photos or videos can only be made with the agreement and in the presence of the lab instructor, but not of cadaver specimens.

Specimen preparations should be wrapped and labeled. Dissection materials of other groups or individuals should not be handled. Dissected cadaver pieces should be discarded in a designated container and discarded blades have to be collected separately.

Dissecting rooms are closed between 6:00 PM to 8:00 AM and over the weekends Students may not stay in the dissecting room without the supervision of one of the assistants of the department. In the absence of an instructor, the technical personnel should ask the students to leave the dissecting room.

**SMOKING IS STRICTLY FORBIDDEN
ON THE DEPARTMENTAL PREMISES,
INCLUDING THE GARDEN AND THE YARD!**

EM II.

Subject matter of the 3rd^t semester

I. Central nervous system

- a) gross anatomy of brain and spinal cord, meninges
- b) nuclei and tracts of brain and spinal cord
- c) development of the brain and the spinal cord

II. Peripheral nervous system

- a) cranial nerves
- b) spinal nerves
- c) autonomic nervous system
- d) development of the peripheral nervous system

III. Organs of special senses (gross anatomy, histology and embryology)

- a) organ of vision, visual pathways
- b) organ of hearing and equilibrium, auditory pathways, vestibular system
- c) organ of smell, olfactory pathways
- d) organ of taste, gustatory pathways
- e) skin and appendages

IV. Endocrine organs (gross anatomy, histology and embryology)

V. Topographical anatomy of the head&neck together with the dorsal regions of the trunk

Midterm test I. Topic: Gross anatomy and embryology of the central nervous system.
Date: 4th week, October 5-6.

Midterm test II. Topic: Microscopy of the central nervous system, cranial nerves.
(written and obligatory)
Date: 10th week, November 13-15.

Midterm test III. Topic: Organs of special senses, topographical anatomy of the head&neck region
Date: 13th week, December 7-8.

Semifinal examination

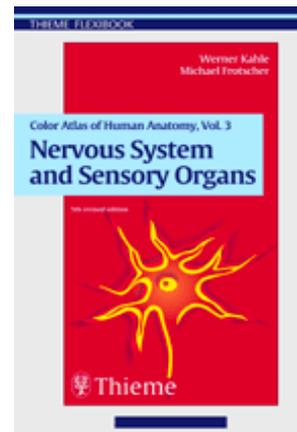
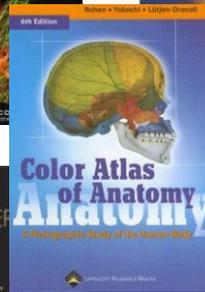
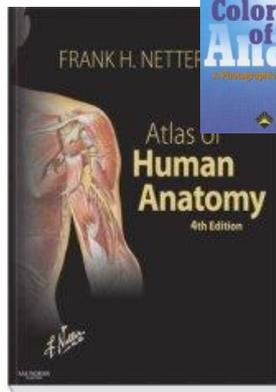
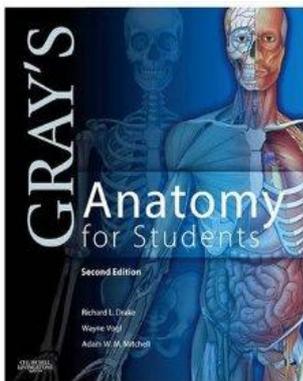
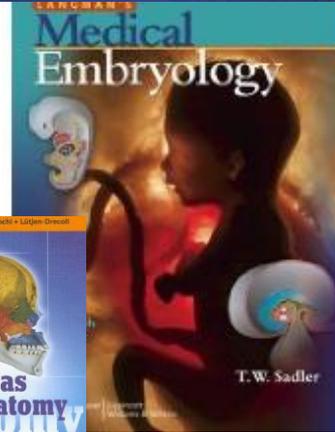
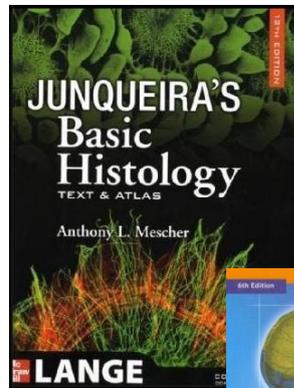
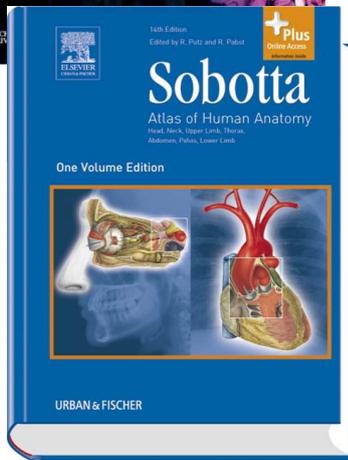
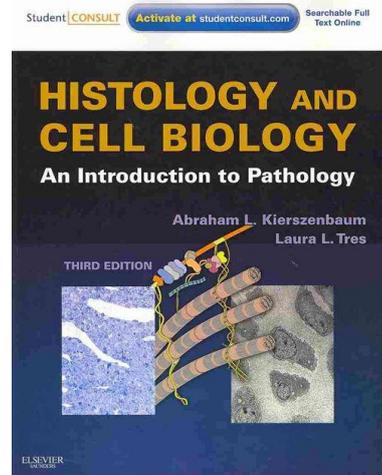
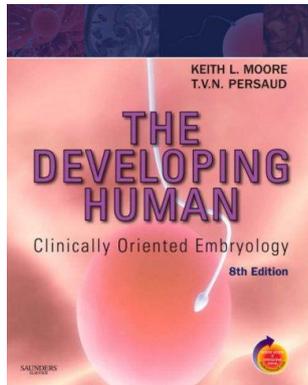
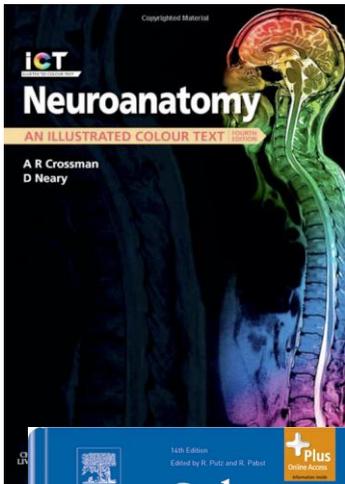
Topics: Subject matter of the semester

3. Written pretest
4. Oral examination (practical and theoretical questions in Macroscopy and Embryology) and the identification/description of two histological slides.

Week	Lectures		Dissection room	Histology lab
	Tuesday 10.00 - 10.45	Thursday 8.00 - 9.40		
Week 1 Sept 11 - 15	1. Introduction to the study of the nervous system. Meninges, hemispheres, the lateral ventricles 2. Differentiation of the neural tube, development of the spinal cord. Neural crest. Craniocaudal and dorsoventral differentiation, malformations 3. Differentiation of the brain vesicles. Gross anatomy of the diencephalon, the 3rd ventricle.		Divisions of the brain, meninges, arteries and veins of the brain, surface structures of the hemispheres, basis cerebri. Specimen demonstration: dura mater, sinuses	-
Week 2 Sept 18 - 22	4. Macroscopy and development of the brain stem and cerebellum, the 4th ventricle 5. Development and derivatives of the placode ectoderm and the neural crest 6. Blood supply to the brain, CSF circulation		Lateral ventricles, third ventricle Brain stem, fourth ventricle, cerebellum	-
Week 3 Sept 25 - 29	7. Gross anatomy and blood supply of the spinal cord, spinal segment. Dermatomes. 8. Microscopical structure of the spinal cord, Rexed zones. Spinal reflexes, receptors and effectors, proprioceptive reflex arc. 9. Nociceptive (withdrawal) and autonomic reflex arcs. Spinal pathways, injuries, symptoms		Cross sections of the brain. Specimen demonstration: spinal cord together with the membranes	-
Week 4 Oct 2 - 6	10. Cells of the CNS: neurons, glia cells. Axon, dendrite, synapses, synaptic transmission, 11. Microscopy of the cerebral cortex. Cortical fields, Brodmann areas 12. Sensory systems		1. Revision 2. Midterm test 1: Anatomy and development of the brain and the spinal cord	-
Week 5 Oct 9-13	13. Motor systems and tracts, pyramidal tract 14. Structure and connections of the basal ganglia. Motor pathways arising from the brain stem 15. Microscopy of the cerebellum, pathways. Functional considerations		Dissection of the back muscles, suboccipital trigone.	Nervous system I. Peripheral nerve, motor end plate, spinal cord, brainstem
Week 6 Oct 16- 20	16. Diencephalon, thalamic nuclei 17. Introduction to cranial nerves. Classification of sensory, motor and autonomic nuclei 18. Reticular formation, monoaminergic systems		'In situ' dissection of the spinal cord. Demonstration of the spinal ganglia, spinal nerves, membranes.	Nervous system II. Cerebellar and cerebral cortices Pineal body
Week 7 Oct 23 - 27 <i>Oct 23 is national holiday</i>	19. Microscopy of the brainstem 20. Trigeminal nerve, trigeminal neuralgia 21. Cranial nerves 3, 4, 6, 7. Central and peripheral paresis		NO dissection class for Grs 9-17 on Monday 'In situ' brain dissection Demonstration of the membranes, ventricles, thalamus, brain stem, cranial nerve exits.	-
Week 8 Oct 30 - Nov 3 <i>Nov 1 is a national holiday</i>	22. Glossopharyngeal, vagus, accessory and hypoglossal nerves 23. Sympathetic nervous systems 24. Parasympathetic nervous systems. Autonomic innervation and reflexes of pelvic organs		Cranial nerves 5, 7 and 9. Dissection of the superficial and deep regions of the head (frontal, infraorbital, buccal, infratemporal, parotidomasseteric regions and the parapharyngeal space) NO dissection class for Grs 1-6 on Wednesday	-
Week 9 Nov 6 - 10	25. Fibrous and vascular coats of the eyeball. Lens, chambers of the eye, vitreous body, accommodation 26. Inner coat of the eyeball, retina. Morphological basis for colour vision. 27. Optic nerve, visual pathway, visual cortex, disorders. Visual reflexes		Cranial nerves 10, 11 and 12 Dissection of the submandibular, carotid, median cervical regions	-
Week 10 Nov 13 - 19	28. Extraocular muscles and eye movements, conjugated eye movements, strabism. 3D vision 29. Protective and lacrimal apparatus of the eye. Development of the eye. Malformations. 30. Skin and appendages. Mammary gland		1. Midterm test 2. (written) Microscopy of CNS, cranial nerves 2. Dissection of the eye (coats and muscles, chambers, optic nerve)	-
Week 11 Nov 20 - 24	31. The organ of hearing in general. External ear, auditory tube, tympanic cavity, tympanic membrane, auditory ossicles 32. Bony and membranous labyrinth. Vestibular system 33. Spiral organ of Corti. Auditory pathway, auditory cortex		Dissection of orbit, extraocular muscles	Organs of special senses I. Eyeball, retina, lacrimal gland
Week 12 Nov 27 - Dec 1	34. Development of the auditory and vestibular system. Clinical relevances 35. Olfactory and gustatory systems 36. Limbic system		Dissection and demonstration Tympanic cavity, inner ear, temporal bone	Organs of special senses II. Organ of Corti, palm skin, scalp skin, mammary gland
Week 13 Dec 4 - 8	37. The hypothalamo-hypophysial system. The pituitary gland 38. Endocrine organs: pineal body, thyroid, parathyroid, adrenal glands 39. Drugs of abuse, opiates, endogenous cannabinoids and receptor mediated actions in the CNS		Midterm test 3: Organs of special senses, head and neck regions	Endocrine organs Pituitary, thyroid, parathyroid, suprarenal glands; Endocrine cells in the testicle, ovary, corpus luteum and pancreas
Week 14 Dec 11 - 15	40. Patient demonstration 41. Research in the field of neuroscience 42. Research in the field of neuroscience		Revisions Brain in situ, cranial nerves	Revision

Week	Lectures		Dissection room	Histology lab
	Monday 12.00 - 13.40	Wednesday 12.45 - 13.30		
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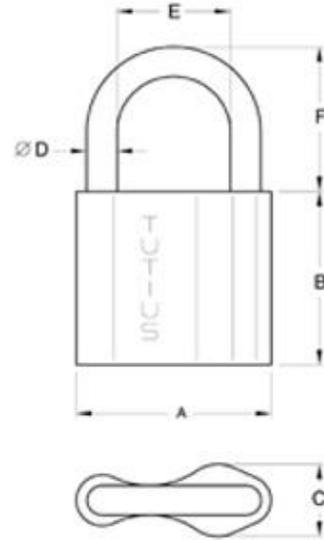
RECOMMENDED BOOKS



During dissection classes keep your belongings in the lockers and lock them with your padlock!

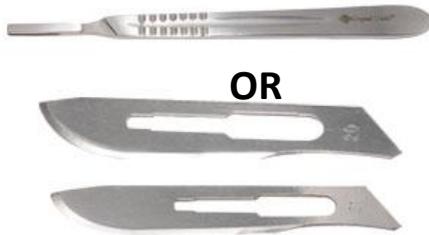
PADLOCK SIZE: 6 mm

Please, remember to keep your valuables always on you, or lock them in the lockers since the department takes no responsibility for lost items.



DISSECTION ROOM TOOLS

SCALPEL



OR



A PAIR OF ANATOMICAL FORCEPS



RUBBER GLOVES



PROTECTIVE CLOTHING (LABCOAT)

GOGGLES



TOPICS OF THE SEMIFINAL EXAM

EM II.

Third semester

Dissection room

Topics of the 1st and 3rd MIDTERM examinations

Histology exam

Description of histological specimen

Microscopical structure of the central and peripheral nervous systems, different staining techniques (cerebral and cerebellar cortices, neurons, supporting cells, ganglia, receptors and effectors, synapses)

Other relevant topics

Endocrine organs

Gross and microscopical anatomy of the pituitary gland; development of the posterior lobe
Blood supply, histology and development of the anterior and intermediate lobes of the pituitary gland

Gross and microscopical anatomy of the pineal gland

Gross and microscopical anatomy and the development of the thyroid gland

Gross and microscopical anatomy and the development of the parathyroid gland

Gross and microscopical anatomy and the development of the suprarenal gland

Histology of the Langerhans islets

Endocrine cells and function of the male and female gonads

Microscopical structure of the eyeball

Histology of the lacrimal gland

Microscopical structure of the cochlea

Microscopical structure of the skin (scalp and palm)

Histology of the mammary gland (lactating and non-lactating)

Macroscopical structure of the CNS

Gross anatomy of hemispheres

Cranial dura mater and its sinuses
Arachnoid and pia mater. Subarachnoid cisterns. Cerebrospinal fluid
Arteries, circle of Willis and veins of the brain
Gross anatomy of the lateral ventricles
Gross anatomy of the third ventricle
Gross anatomy of the fourth ventricle
Gross anatomy of the large commissural pathways
Gross anatomy of the internal capsule
Gross and microscopic anatomy of basal nuclei
Gross and microscopic anatomy of thalamus
Anatomy, blood supply and development of the diencephalon
Gross and microscopic anatomy of midbrain
Gross and microscopic anatomy of pons
Gross and microscopic anatomy of medulla oblongata
Gross and microscopic anatomy of cerebellum
Cranial nerve exits
Gross anatomy of spinal cord. Spinal segment. Spinal nerve.
Blood supply and meninges of the spinal cord

Microscopical structure and development of the central nervous system

Development and primary differentiation of the neural tube
Development of the spinal cord; neurohistogenesis
Differentiation of the prosencephalon vesicle; development of
the hemispheres and the lateral ventricle
Differentiation of the diencephalon vesicle, development of the third ventricle
Differentiation of the mesencephalon and rhombencephalon vesicles,
development of the fourth ventricle
Roots, branches and components of the spinal nerves; spinal segment
Fine structure (microscopy) of the spinal cord
Neurons and function of the spinal proprioceptive (stretch) reflex
Neurons and function of the spinal flexion (withdrawal) reflex
Neurons and functions of the visceral reflexes
Microscopical anatomy of the medulla
Microscopical anatomy of the pons
Microscopical anatomy of the midbrain
Nuclei of the cranial nerves
Microscopical anatomy of the cerebellum
Afferent and efferent cerebellar connections
Microscopical anatomy of thalamus, divisions, connections and transmitters
Hypothalamus, hypothalamo-hypophyseal systems
Microscopical anatomy of the basal ganglia, divisions, connections and transmitters
Histology of the cerebral cortex; cortical fields
Internal capsule, divisions
Tracts of the protopathic sensibility (anterolateral system)
Tracts of the epicritic sensibility (posterior funiculus/medial lemniscus)
Corticospinal tract (pyramidal tract)
Extrapyramidal system

Limbic system (nuclei and tracts)

Gross anatomy and development of the peripheral nervous system

Development, fate and differentiation of the cells in the neural crest

Development of the peripheral nervous system

Nuclei and branches of the IIIrd, IVth and VIth cranial nerves

Nuclei of the trigeminal nerve; course and fiber composition of the branches of the ophthalmic (V/1) nerve

Course and fiber composition of the branches of the maxillary nerve (V/2)

Course and fiber composition of the branches of the mandibular nerve (V/3)

Nuclei, course and fiber composition of the branches of the facial nerve (VII)

Nuclei, course and fiber composition of the branches of the glossopharyngeal nerve (IX)

Nuclei, course and fiber composition of the branches of the vagus nerve (X)

Nuclei, course and fiber composition of the branches of the accessory (XI) and hypoglossal nerves (XII)

Cervical plexus and its branches

Brachial plexus and its branches (including the short branches to the neck and shoulder girdle)

Lumbar plexus and its branches

Sacral plexus and its branches

General organization of the autonomic nervous system

The sympathetic trunk

Cranial part of the parasympathetic nervous system

Sacral part of the parasympathetic nervous system

Gross anatomy, histology and embryology of the organs of special senses

Gross anatomy and microscopic structure of the fibrous coat of the eye ball (cornea, sclera)

Gross anatomy and microscopic structure of the vascular coat of the eye ball (choroid, ciliary body, iris)

Gross anatomy, microscopic structure and development of the nervous coat of the eye ball (retina)

Neurons of the visual pathways; localization and microscopic structure of the visual cortex

Gross anatomy, microscopic structure and development of the lens, accommodation

Gross anatomy and content of the chambers of the eye, circulation of the aqueous humor; gross anatomy of the vitreous body

Gross anatomy and function of the external ocular muscles.

Visual reflexes

Gross anatomy, microscopic structure of the eye lids; conjunctiva, Tenon's capsule and periorbit

Gross anatomy, microscopic structure and development of the lacrimal apparatus

Gross anatomy and development of the external ear and the tympanic membrane

Gross anatomy and development of the tympanic cavity and the auditory tube

Gross anatomy and development of the auditory ossicles; joints, muscles, and the mucous membrane of the tympanic cavity

Sensory innervation and blood supply of the tympanic cavity

Internal acoustic meatus

Gross anatomy of the bony labyrinth

Gross anatomy and development of the labyrinth
Morphology, development and divisions of the vestibular apparatus
Receptors and neuronal connections of the vestibular system
Gross anatomy, microscopic structure and development of the cochlear duct and the organ of Corti
Neurons of the auditory pathways
Organ and pathways of olfaction
Organ and pathways of taste
Gross anatomy and microscopic structure of the fibrous coat of the eye ball (cornea, sclera)
Gross anatomy and microscopic structure of the vascular coat of the eye ball (choroid, ciliary body, iris)
Gross anatomy, microscopic structure and development of the nervous coat of the eye ball (retina)
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Gross anatomy and function of the external ocular muscles.
Visual reflexes
Gross anatomy, microscopic structure of the eye lids; conjunctiva, Tenon's capsule and periorbit
Gross anatomy, microscopic structure and development of the lacrimal apparatus
Gross anatomy and development of the external ear and the tympanic membrane
Gross anatomy and development of the tympanic cavity and the auditory tube
Gross anatomy and development of the auditory ossicles; joints, muscles, and the mucous membrane of the tympanic cavity
Sensory innervation and blood supply of the tympanic cavity
Internal acoustic meatus
Gross anatomy of the bony labyrinth
Gross anatomy and development of the labyrinth
Morphology, development and divisions of the vestibular apparatus
Receptors and neuronal connections of the vestibular system
Gross anatomy, microscopic structure and development of the cochlear duct and the organ of Corti
Neurons of the auditory pathways
Organ and pathways of olfaction
Organ and pathways of taste