

Semmelweis University
Department of Anatomy, Histology and Embryology

2016/2017

Faculty of Dentistry
2nd year, 1st semester

ANATOMY HANDBOOK



Dr. Andrea D. Székely
Associate Professor
Course Director of the English Language Program

Dr. Gábor Gerber
Associate Professor
Deputy Head of Department
Dean of the Faculty of Dentistry, Semmelweis University



Anatomy, Histology and Embryology for ED students

TEACHING DEPARTMENT:

SEMMELWEIS UNIVERSITY

Department of Anatomy, Histology and Embryology

Budapest, Tűzoltó utca 58.

H-1094 Budapest

www.ana.sote.hu

LEARNING OBJECTIVES

Aims of the lectures in Anatomy - Presentation of important and/or complicated topics such as: 1st semester - the structure of the body wall (e.g. thorax, pelvis), extremities and the cranium, 2nd semester - the morphology of internal organs including the cardiovascular, digestive and urogenital systems; 3rd semester - the composition of the central nervous system, together with the organs of special senses and topography of body regions, and the 4th semester is devoted entirely to maxillofacial topographical anatomy.

Aims of the lectures in Histology - Presentation of the cell, basic principles in cellular morphology, detailed description of the epithelial, connective, muscle and nervous tissues. During the 3 semesters, the lectures contribute to the gross anatomical description of organs with a detailed presentation of their fine structures, including ultrastructural details. 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 (basic embryology) as well as the development of the locomotor system (1st semester). In the 2nd and 3rd semesters, the embryology topics will complement the gross anatomy and histology lectures of the organs and systems, also mentioning the most frequent malformations.

For the deeper understanding of relatively difficult questions small group discussions may be organized during the practical dissection room classes.

Aims of the practical dissection classes - In the first three semesters, based on their weekly programs, the students will study the morphology of the human body using anatomical specimens (bones, joints, muscles, viscera, brain) as well as learning the basic principles of dissection, including the proper usage of tools (scalpel, forceps, scissors) under the supervision of their lab instructors. The anatomy of the locomotor system and the peripheral nervous system will be principally taught in the dissecting room.

Aims of the histology practical classes - Under supervision by the lab instructor, the students will learn the use of the light microscope and the individual viewing of histology slides will facilitate the understanding of the basic tissues (epithelial, connective, muscle and nervous) and the fine structure of the organs.

The knowledge of students will be tested by regular **mid-term examinations** and a Semester-end Dissection Test.

Lectures:

First semester: 3x 45 min; second semester: 3x 45 min;

third semester: 3x 45 min; fourth semester: 3x 45 min.

Topics:

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

Second semester: Morphology, histology and embryology of the heart and vessels, lymphatic organs, viscera, body cavities and serous membranes. Sectional anatomy of the thorax, abdomen and pelvis. Description of the diaphragmas.

Third semester: Morphology, histology and embryology of the central and peripheral nervous systems, the organs of special senses, as well as of the endocrine organs; topographical anatomy of the extremities.

Fourth semester: Maxillofacial anatomy - organs, cavities, nervous and vascular supply of the head and neck regions, including topographical and cross sectional anatomy. Revision of the topics of the first three semesters.

Practical course:

First semester 5x 45 min; second semester: 4x 45 min;

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

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

Second semester: Morphology, histology and embryology of the heart and vessels, lymphatic organs, viscera, body cavities and serous membranes. Sectional anatomy of the thorax, abdomen and pelvis. Description of the diaphragmas

Third semester: Morphology, histology and embryology of the central and peripheral nervous systems, the organs of special senses, as well as of the endocrine organs; topographical anatomy of the extremities.

Fourth semester: Topographical anatomy of the head and neck. Individual revision of the subjects taught and studied during the four semesters.

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

ECTS credits: four semesters together: 27 (first semester: 8; second semester: 7; third semester: 7; fourth semester: 5)

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. Absences are therefore limited in **25%**.

Midterm examinations: During the four semesters, both practical and theoretical knowledge will regularly be evaluated. The anatomy and histology mid-terms may be oral or written exams. The **anatomy** mid-terms include both identification of several structures on the specimen and theoretical questions related to the subject. The **histology** midterms include the identification of a certain number of structures in slides, as well as, theoretical questions related to the subject. (N.B. there are no histology midterms in the 3rd and 4th semesters.)

Semester-end dissection (or PIN) test: During the last two weeks of the semester, every student will have to sit for an obligatory practical test to gain **acceptance of the semester**.

Students, whose midterm tests were **passed** with at least a 2 **and have participated in every midterm test**, will be exempted from the semester-end dissection test.

Students, with **failure and/or absence** from tests, will be obliged to sit for the pin test unless the **average of the marks is at least 2.51**. Midterm failures can only be corrected taking this test and cannot be retaken during the semester or the examination period. The exact date of the tests will be announced in due course. The results of all tests will appear on the personal achievement cards.

Semifinal examinations will therefore be composed of oral theoretical questions and the identification/description of one (or, if necessary, two) histological specimen.

Obligatory dissection work – every students is required to produce a fully dissected specimen during the 2nd, 3rd or the 4th semester to be exempted from the dissection part of the final examination. The specimen will be evaluated by a departmental jury in the end of the 3rd semester.

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 or final exams.

*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, spring, exam period (i.e. 'CV' exam), only those students will be allowed to go for a **CV course** whose average score of the midterm tests is equal, or higher than 2.00.*

*In the Faculty of Dentistry, a **successful 3rd semester is necessary** for registering for ANA4 – Maxillofacial Anatomy, so there is **no parallel registration** for a CV course in ANA3 together with ANA4.*

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.

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!**

ED II.

Subject matter of the 3rd 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 limbs

Midterm test I. Topic: Gross anatomy and embryology of the central nervous system.
Date: 4th week, September 30.

Midterm test II. Topic: Microscopy of the central nervous system. (written)
Date: 8th week, October 24.

Midterm test III. Topic: Topographical anatomy of the upper and lower limbs, spinal and cranial nerves.
Date: 12th week, November 21.

Semifinal examination

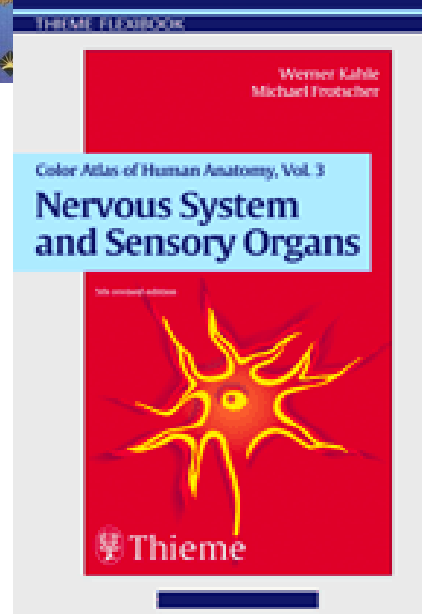
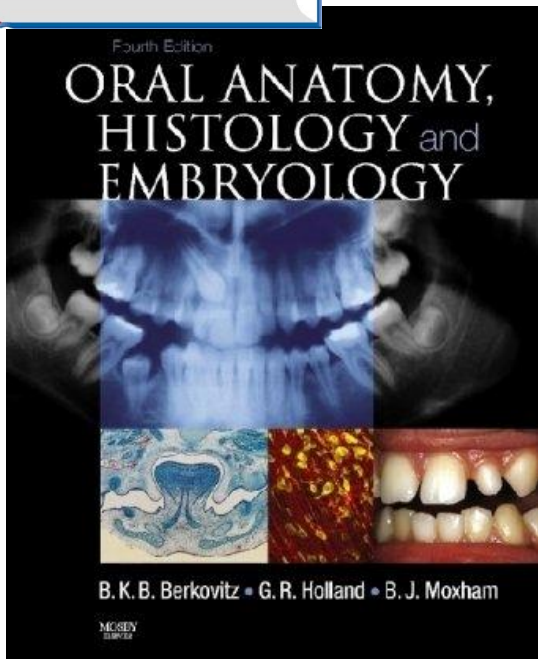
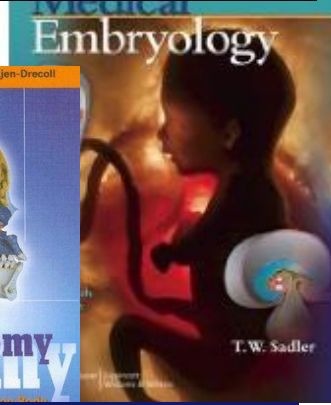
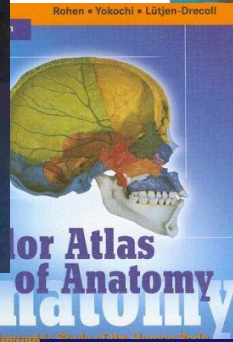
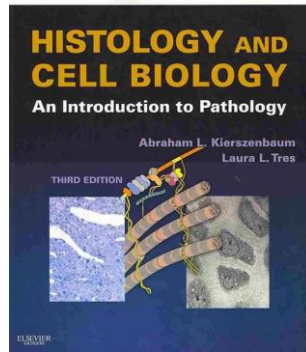
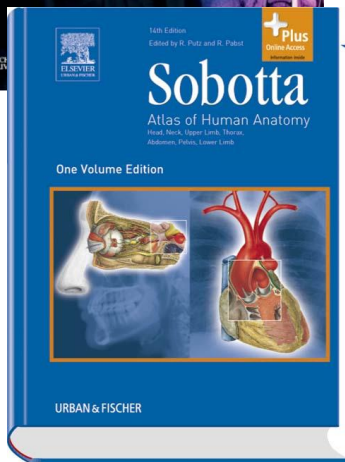
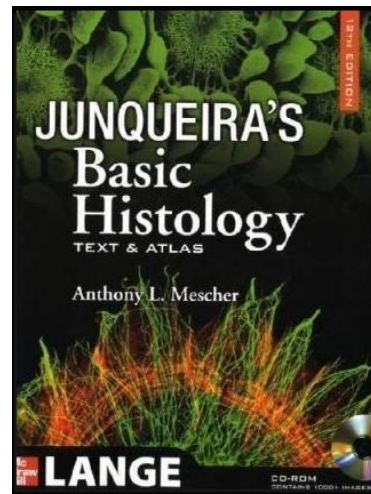
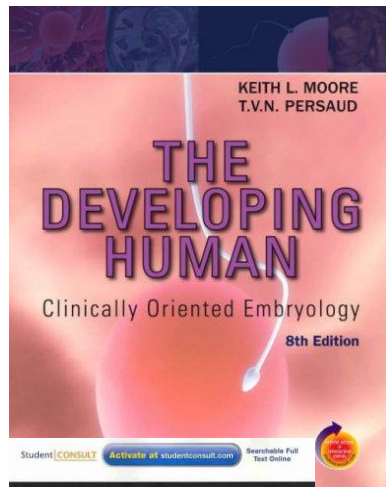
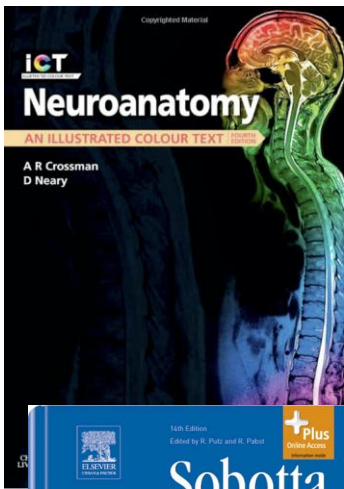
Topic: Subject matter of the semester

- 1) **Practical examination** (calculated from the results of the two dissection room tests)
For further information see the Announcements.
- 2) **Theoretical questions** (oral examination)
Gross anatomy, microscopy and development of the brain, spinal cord, organs of special senses and endocrine glands.
- 3) **Histology** of the nervous system, organs of special senses, the endocrine system (slide).

Academic Year 2016/2017 Faculty of Dentistry, 3rd Semester ED II. 1 – 4

Week	LECTURE Tuesday 8.00-9.40 Wednesday 15.00-15.45	DISSECTION Mondays 8.00-9.30 Fridays 14.00-15.30	HISTOLOGY Mondays
Week 1 Sept. 5-9.	1. Introduction to the study of the nervous system Meninges, hemispheres, the lateral ventricles 2. Gross anatomy of the diencephalon, the III. ventricle 3. Gross anatomy of the brainstem and the cerebellum The IV. 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. 12-16.	4. Blood supply to the brain, CSF circulation 5. <i>Differentiation of the neural tube, development of the spinal cord. Neural crest</i> 6. <i>Differentiation of the brain vesicles</i>	Lateral ventricles, third ventricle Brain stem, fourth ventricle, cerebellum	
Week 3. Sept. 19-23.	7. Gross anatomy of the spinal cord, spinal segment Dermatomes 8. Neuronal architecture of the spinal cord: proprioceptive and nociceptive (withdrawal) reflex arcs. 9. Neuronal architecture of the spinal cord: autonomic reflex arc. Spinal pathways	Cross sections of the brain. Specimen demonstration: spinal cord together with the membranes	
Week 4. Sept. 26-30.	10. Introduction to cranial nerves. Classification of sensory, motor and autonomic nuclei 11. Microscopy of the brainstem: tracts and nuclei of the medulla oblongata 12. Microscopy of the brainstem: tracts and nuclei of the pons and midbrain. Reflex arc of mastication	Fine structure of spinal cord. Revision 1st midterm test: Anatomy and development of the brain and the spinal cord	
Week 5. Oct. 3-7.	13. Cells of the CNS: neurones (axon, dendrite, synapses) 14. Cells of the CNS: glia cells 15. Microscopy of the diencephalon	Dissection of limbs. Microscopy of the CNS	Nervous system I.
Week 6. Oct. 10-14. Oct.15. Saturday is a „Monday„	16. Microscopy of the cerebral cortex 17. Sensory systems, neuroanatomy of pain 18. Microscopy of the cerebellum, pathways	Dissection of limbs. Microscopy of the CNS ----- Dissection class on Saturday	
Week 7. Oct. 17-21.	19. Structure and connections of the basal ganglia Motor pathways 20. Trigeminal nerve, ophthalmic division 21. Trigeminal nerve, maxillary division 21. Trigeminal nerve, mandibular division	Dissection of limbs. Microscopy of the CNS No class on Friday	Nervous system II.
Week 8. Oct. 24-28.	22. Facial and glossopharyngeal nerves 23. Vagus, accessory and hypoglossal nerves 24. The hypothalamo-hypophysial system. The pituitary gland	2nd midterm test: Microscopic structure of the central nervous system (written test) Dissection of limbs. Demonstration of head and neck regions. Cranial nerves	
Week 9. Oct. 31-Nov. 4. <i>Oct.31 and Nov.1 are holidays</i>	25- National holiday 26- National holiday 27. Endocrine organs: pineal body, thyroid, parathyroid, adrenal glands	No class on Monday Dissection of limbs. Demonstration of head and neck regions. Cranial nerves	
Week 10. Nov. 7-11.	28. Skin and appendages. Mammary gland 29. The topographical anatomy of limbs 30. Fibrous and vascular coats of the eyeball.	Dissection of limbs. Demonstration of head and neck regions. Cranial nerves. Dissection of the eye	Endocrine organs
Week 11. Nov. 14-18.	31. Lens, chambers of the eye, vitreous body, accommodation 32. Inner coat of the eyeball, retina Optic nerve, visual pathway, visual cortex 33. External muscles and movements of the eye	Dissection of limbs. Demonstration of head and neck regions. Cranial nerves.	
Week 12. Nov. 21-25.	34. Protective and lacrimal apparatus of the eye. Development of the eye 35. External ear, auditory tube, tympanic cavity, tympanic membrane, auditory ossicles 36. Bony and membranous labyrinth	3rd midterm test: Topographical anatomy of the limbs, spinal nerves, cranial nerves Demonstration of head and neck regions Organs of special senses	Organs of special senses I.
Week 13. Nov. 28-Dec.2.	37. Spiral organ of Corti. Development of the auditory and vestibular system 38. Auditory pathway, auditory cortex 39. Vestibular system	Demonstration of head and neck regions Organs of special senses	Organs of special senses II. Skin and mammary gland
Week 14. Dec. 5-9.	40. Olfactory and gustatory systems 41. Limbic system 42. Parasympathetic and sympathetic nervous systems	Demonstration of head and neck regions Organs of special senses	

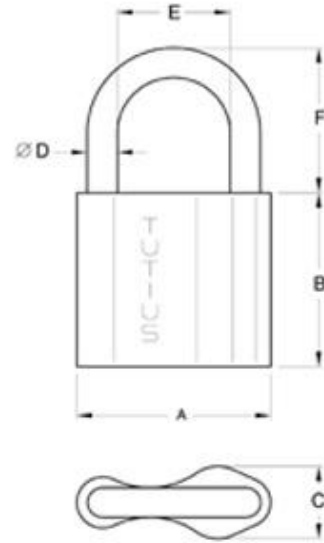
RECOMMENDED BOOKS



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

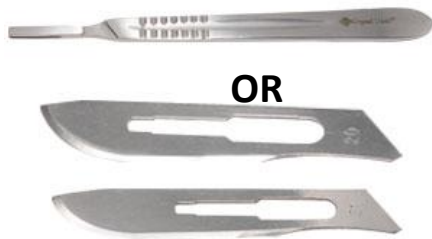
PADLOCK SIZE: 6 mm

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

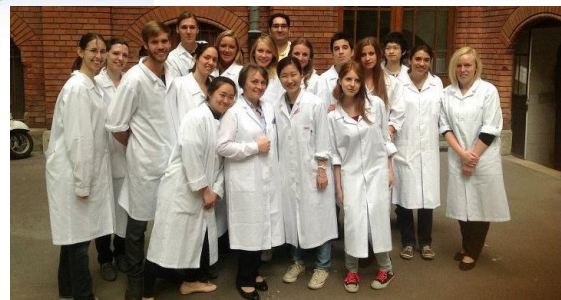


RUBBER GLOVES



PROTECTIVE CLOTHING (LABCOAT)

GOGGLES



Semester-end and examination announcements

During the last week of the semester all our students will be informed of their **practical mark** (if applies) and whether they have gained a **signature** for the present semester. The **signature** will be written in the index on a preselected day. Please, collect the indexes of the group open with the relevant page and leave them in Dr Gerber's office in the Anatomy department. Please note, that only those students may register for a semifinal examination whose semester is accepted (i.e., have not been refused the signature).

All midterm marks, together with the calculated practical exam mark (if applies) will be written on the personal achievement card. The practical exam mark will be counted in the result of the semifinal examination.

Semifinal examinations will be held only Tuesdays, Wednesdays and Thursdays during the 7 weeks of the examination period. EM I students will be examined only on Tuesdays and Thursdays, ED I students will be examined on all three examination days, whereas **ED II examinations** and CV EM II and CV ED II final examinations **will be held on Wednesdays only**.

N.B. The last changes concerning **registration/deregistration** from a date maybe done via the NEPTUN system **48 hours prior** to the selected day.

The exams start at 13.00

Please, leave your belonging in a locker and gather in front of the "old" Dissection Room (ground floor) at 12.50.

Please, remember to have your

- black study book (index)*
- histology note book
- pair of forceps on you.

In case of a **second repeated exam** you will need to present a digital or written proof* (e.g. yellow slip from the Student Secretariat) of the payment of examination fees prior to the examination.

*Items marked by * are obligatory prerequisites, the exam must not start without them.*

Parts of the exam

1. Practical part in the dissecting room (oral) except for those with a valid practical mark calculated from the successfully passed midterm marks:

2. Theoretical part

3. One histology specimen (from the slide collection studied during the semester)

In case of an unsuccessful examination, the 1st retake will be free of charge, while for a **second repeated exam** you will need to pay a fee ahead of the retake examination and present a proof of it upon entering the examination room.

*In case neither the first, nor the repeated, takes of a semifinal exam have been successful, the exam may be postponed to the following exam period (as a 'CV' exam), in case the **average score of the midterm tests is equal, or higher than 2.00**. However, these students cannot register for the 2nd semester with their groups.*

TOPICS OF THE SEMIFINAL EXAM

Practical exam

Dissection room

Topics of the 1st and 3rd MIDTERM examinations

A dissection mark will be calculated from the results of the two successfully passed dissection midterms. On the day of the semifinal examination, students may sit for a practical exam in case they would like to go for a higher dissection mark. (Prerequisite: written application before the end of week 13)

Histology exam (office)

Description of a histological specimen **with the help of a microscope**

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

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)

Theory questions (office)

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)
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