Semmelweis University
Department of Anatomy, Histology and Embryology
2025/2026

Faculty of Medicine
2nd year / 1st semester

MICROSCOPIC ANATOMY HANDBOOK

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Course Director

Microscopic Anatomy and Embryology II

TEACHING DEPARTMENT:

SEMMELWEIS UNIVERSITY
Department of Anatomy, Histology and Embryology
Budapest, Tűzoltó utca 58. (closed for reconstruction works)
H-1094 Budapest
http://semmelweis.hu/anatomia

Departmental offices are found in the City Corner Building, Üllői út 25.

Microscopic Anatomy **Lectures** are held online

Microscopic Anatomy **histology classes** are held in the City Corner Building, Üllői út 25.

LEARNING OBJECTIVES

Histology - Demonstration of the fine structure of cells and tissues composing the organs of the human body specifically to provide the future clinicians/medical doctors with a valid body of information describing the microscopical elements of clinically significant morphological structures (including cell biology, general histology and the histology of organs).
Embryology – the subject demonstrates the formation of the nervous system together with the organs of special senses and the endocrine glands, including the clinically relevant aspects of the development of organ systems. Teaching is done in the form of lectures and histology laboratory practical classe
Competences acquired by completion of the course:
Understanding the microscopical composition of the human body together with the understanding of human development in order to draw parallels with macroscopical anatomy. Clear understanding of histological structure and function. Ability to identify basic structural elements within the tissue specimen. Identification of general directions/landmarks within digitized tissue slides.

LECTURES: First semester: 2 x 45 min; second semester: 2 x 45 min.
PRACTICAL CLASSES: First semester: 4 x 45 min; second semester: 2 x 45 min.
ECTS CREDITS: Altogether 9 (first semester: 5; second semester: 4).
MIDTERM TESTS: Written (in the Moodle system)

ACCEPTENCE OF THE SEMESTER:

Active participation in laboratory sessions is obligatory for every student. 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%**. Attendance will be recorded in the classes.

TYPE OF EXAMS: oral and written
First semester: semifinal examination (oral), second semester: final exam (oral and written)
The final examination consists of written and oral (practical and theoretical) parts
1. Written pretest (e-learning module – access to SeKA account is obligatory)
2. Oral examination (identification of structures on digitized histological slides) including relevent theoretical questions from the fields of Histology and Embryology

COURSE DESCRIPTION

Microscopic Anatomy and Embryology II.
Lectures and histology classes
Subject matter: Histology of the lymphatic system, together with the histology and developmental aspects of the central and peripheral nervous systems, endocrine organs and organs of special senses, including the skin.
Credits: 4
Prerequisites: Microscopic Anatomy and Embryology I. (successful examination)
Macroscopic Anatomy and Embryology II. (successful final examination)

Academic Year 2025/2026 Faculty of Medicine

EM II. Microscopic Anatomy and Embryology II.

EM 1-20

Weeks	ONLINE lectures *(see in moodle)* *EM 1-11 Fridays 12.00-13.45* *EM 12-20 Mondays 8.00-9.45*	Lecturer 1-11 12-20	Histology laboratory ***Mondays 10.15-11.45 EM 13-17*** ***Tuesdays 13.00- 14.30 EM 7-12*** ***16.45-18.15 EM 18-20*** ***Thursdays 13.00-14.30 EM 1-6***
Week 1 09. 8-12.	1. Nerve tissue 2. Development of the neural tube. Cranio-caudal and dorso-ventral differentiation. Divisions of the CNS	1 Tóth 2 Nagy	Histology of the peripheral nervous system **40, 41, 203, 204, 205, 206, 6** (dem: 200, 201, 202, 207, 208)
Week 2 09. 15-19.	3. Formation and derivatives of the neural crest and placode ectoderm 4. Microscopy of the CNS – Fine structure of the spinal cord. Spinal reflexes, receptors and effectors	3 Nagy 4 Vereczki	**Microscopy of the CNS** **Consultation I.** - Spinal cord, reflexes **211, 209** (dem: 212 (***K*** is), 210)
Week 3 09. 22-26.	5. Brain tracts, neurotransmitters, neuronal circuits, "*connectomics*" Structure of the cerebral cortex 6. Central autonomic nervous system. Monoaminergic and cholinergic neurones and pathways. *„Ascending Reticular Activating System*" (ARAS)	5 Székely 6 Horváth	**Histology of the CNS** – Cerebral cortex **213** (***K*** is)**, 214, 215** (***K*** is), (***K***: 216, 219)
Week 4 09. 29 – 10.03.	7. Somatosensory system. Spinal and trigeminal sensory pathways. Thalamus, cortical areas 8. Viscerosensory system. Role of the reticular formation, thalamus, insula and the prefrontal cortices in visceral sensory activities	7 Katz 8 Kocsis	**Microscopy of the CNS** **Consultation II.** - Sensory systems
Week 5 10. 06 – 10.	9. Neuroanatomy of pain. Referred pain. Cerebral inhibition of pain sensation. 10. Neuroanatomy of movements/locomotion I. Motor cortical areas, planning and programming of movements. Motor pathways	9 Kozsurek 10 Ádám	**Microscopy of the CNS Consultation III. -** Motor systems
Week 6 10. 13-18.	11. Neuroanatomy of movements/locomotion II. The role of c basal ganglia in eliciting movements. 12. The role of the cerebellum in movement coordination. Gait control mechanism	11 Ádám 12 Barna	**Microscopy of the CNS . Consultation III. -** Cerebellum, **217, 218**
Week 7 10. 20-24. ***Oct. 23. is a National Holiday***	13. Visceromotor system. Control of micturition. Spinal motor reflexes 14. *External ear. Middle ear*	13 Csáki 14 Katz	**Midterm test I.** *EM 1-6 probably write the test on Monday at 18.00*
Week 8 10. 27 - 10.31.	15. *Inner ear. Bony and membranous labyrinth. Development of the organ of hearing* 16. Spiral organ of Corti. Auditory pathway. Neuroanatomy of hearing, understanding and control of speech	15 Kocsis 16 Puskár	**Organ of hearing and vestibular system** **220, 221** (dem: 32)
Week 9 11. 3-7.	17. Fine structure of the labyrinth, tracts of the vestibular system. Control of balancing and posture together with the movements of the eye and head. Awareness of spatial position 18. Fibrous and vascular coats of the eyeball. Lens, chambers of the eye, vitreous body, accommodation. Lacrimal gland, lacrimal apparatus	17 Hanics 18 Székely	**Organ of vision** (eye bulb, retina **230, 232** (dem: 231)
Week 10 11. 10-14.	19. Inner coat of the eyeball, retina. Development of the eye 20. Neuroanatomy of vision. Visual pathway, visual recognition, neuroanatomy of reading and understanding of written/text	19 Nagy 20 Ádám	**Organ of vision** (palpebra, lacrimal gland) **233, 234** (dem: 235) ***Visual pathway***
Week 11 11. 17-21.	21. Endocrine system I. Hypothalamus, the hypothalamo-hypophysial system, epiphysis 22. Endocrine system II. Thyroid, parathyroid, adrenal glands	21 Minkó 22 Barna	**Skin** **Endocrine system I.** (hypothalamus, hypophysis **240** (***K***)**, 241** (dem: 242, 243)
Week 12 11. 24-28.	23. Energy metabolism, neuroanatomy of food intake, taste sensation and olfaction. Structure and functional significance of the reward system 24. Limbic system. Amygdala, hippocampus	23 Tóth 24 Adorján	**Midterm test II.** **Endocrine system II.** Thyroid, parathyroid and adrenal, glands,pineal body, endocrine cells **210, 245, 246, 142a, 247** 181a-b (rev) (dem: 244)
Week 13 12. 1–5.	25. Circadian rythm, sleep/wake cycle; neuroanatomy of resting state and activation 26. Behaviour and motivation. Neuroanatomy of emotions, empathy, well-being, agression, fear, anxiety and depression	25 Dobolyi 26 Horváth	**Limbic system** (hippocampus) **250** (***K*** is) (***K***: 251)
Week 14 12.8-12.	27. Cognitive functions. Neuroanatomy of determination, planning, alertedness together with learning&memory, personality, consiousness and creativity 28. Histology revision	27 Horváth 28 Zsiros	**Histology revision**

Weeks	Histology laboratory *Mondays EM 13-17 10.15-11.45 Tuesdays EM 7-12 13.00- 14.30 EM 18-20 16.45-18.15 Thursdays EM 1-6 13.00-14.30*
Week 1 09. 8-12.	**Histology of the peripheral nervous system** 40. Peripheral nerve (sciatic nerve, HE) 41. Autonomic ganglion (celiac ganglion, Bielschowsky's impregnation) *DEM:* 203. Autonomic ganglion (submandibular gland, HE) *201. Median nerve (OsO4 impregnation)* 205. Motor end plate (cholinesterase enzyme histochemistry) *202. Remak fibres (fingertip neurofilament ICC)* 204. Spinal cord + dorsal root ganglion (Luxol Fast blue + cresyl violet) *207. Palm skin (HE)* 6. (Vater-)Pacinian corpuscle (plantar skin, HE) *208. Fingertip (Verhoeff)* 206 Meissnerian corpuscle (human fingertip, neurofilament ICC)
Week 2 09. 15-19.	**Microscopy of the CNS** **Consultation I.** - Spinal cord, reflexes *(K212)* 209. Muscle spindle (striated muscle, HE) *DEM 212. Spinal cord (Bielschowsky)* 211. Spinal cord (Luxol Fast blue + cresyl violet) *210 Muscle spindle (thyroid gland, HE)*
Week 3 09. 22-26.	**Histology of the CNS** – Cerebral cortex (*K 216 K 219*) 213. Cortex cerebri (pre- and postcentral gyri, Nissl) *DEM* 214. Cortex cerebri (Bodian) *215. Mesencephalon (Luxol fast blue + cresyl violet)* *219. Medulla oblongata (picrosirius green)*
Week 4 09. 29 – 10.03.	**Microscopy of the CNS** **Consultation II.** - Sensory systems *Revision 6. (Vater-)Pacinian corpuscle (plantar skin, HE) 206 Meissnerian corpuscle (human fingertip, neurofilament ICC) 208. Fingertip (Verhoeff)*
Week 5 10. 06 – 10.	**Microscopy of the CNS** **Consultation III.** - Motor systems
Week 6 10. 13-18.	**Microscopy of the CNS** **Consultation III.** - Cerebellum 217.a. Cerebellar cortex (HE) 218. Cerebellar cortex (neurofilament ICC)
Week 7 10. 20-24. ***Oct. 23. is a National Holiday***	**Midterm test I.** ***EM 1-2-3-4-5-6 to write it on Monday TBA***
Week 8 10. 27 - 10.31.	**Organ of hearing and vestibular system** 220. Cochlea / organ of Corti (semithin, toluidine blue) *DEM 32. Auricle (human, Verhoeff)* 221. Macula (semithin, toluidine blue)
Week 9 11. 3-7.	**Organ of vision** (eye bulb, retina) 230. Eye bulb (HE) 232. Retina (semithin, toluidine blue) *DEM 231 Eye bulb (canine, HE)*
Week 10 11. 10-14.	**Organ of vision** (palpebra, lacrimal gland) ***Visual pathway*** 233. Eyelid (HE) 234. Lacrimal gland (HE) *DEM 235. Optic nerve (HE)*
Week 11 11. 17-21.	**Skin** **Endocrine system I.** (hypothalamus, hypophysis) 207. Palm skin (HE) 240. Hypothalamus (Chrom haematoxylin floxin/ GÖMÖRI) *DEM 242. Pituitary gland (HE)* 64. Glomus organ, nail (HE) 241. Pituitary gland (Chrom haematoxylin floxin/GÖMÖRI) *243.Pituitary gland (ACTH ICC)* 12. Scalp skin (HE)
Week 12 11. 24-28.	**Midterm test II** **Endocrine system II.** Thyroid, parathyroid and adrenal glands, pineal body, endocrine cells 210. Thyroid gland (HE) 142.a. Endocrine pancreas/ islands of Langerhans (HE) 245. Parathyroid gland (HE) 181.ab. Corpus luteum (HE) *DEM 244.Thyroid gland (C cel ICC)* 246. Suprarenal gland (HE) 247. Pineal body (HE)
Week 13 12. 1–5.	**Limbic system** - Hippocampus *(K251)* 250. Hippocampus + choroidal plexus (Nissl) 251. Olfactory bulb (Nissl)
Week 14 12.8-12.	**Histology revision**

EM II. Microscopic Anatomy and Embryology II.
SUBJECT MATTER OF THE 2ND SEMESTER

I. Histology of the lymphatic organs

II. Neurohistology

a) Histology of neurons and supporting elements
b) Fine structure of peripheral nerves
c) Receptors and effectors, interneuronal synapses
d) Histology of the brain and spinal cord

III. Microscopy of the central nervous system *(aka Neuroanatomy)*

a) Microscopic anatomy of brain and spinal cord
b) Nuclei and tracts of brain and spinal cord
c) Microscopy of the autonomic nervous system, tracts

IV. Organs of special senses (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

V. Development of the nervous system and organs of special senses

a) Development and primary differentiation of the neural tube
b) Development of the peripheral nervous system (neural crest, placodes)
c) Development of the organ of vision
d) Development of the organ of hearing&equilibrium

VI. Endocrine organs (histology and embryology)

a) Hypothalamo-hypophysial system
b) Endocrine glands and cells

ANNOUNCEMENTS

Acceptence of the semester:

1. active participation in histology lab sessions is obligatory. Students should attend at least 75% of the scheduled hours, including the obligatory midterm examinations, to gain a signature proving the validity of the semester. Absences are therefore limited in **25%**.
2. Successfully passed midterm examinations (with at least a 2)

Students should present themselves **well prepared and on time to start with the practical work**. Attendance is regularly checked and students will have to sign a presence sheet once the teacher has verified their presence.

Students unfit to start with the practical class at the **starting time specified in the time table** will be recorded as „*being late*". According to the *Study policy 28. § 12.point* 3 such occasions of *being late* will add up to a **recorded absence**.

Furthermore, students **arriving later than 5 minutes past the starting time** may participate in the class but their presence will not be recorded/accepted (i.e. counts as an absence).

MID-TERM EXAMINATIONS

During the semester, both practical and theoretical knowledge will regularly be evaluated. There are two written (Moodle) midterm tests during the semester. **Attendance and a successful mark (i.e., at least a 2) from BOTH midterms is obligatory**. Students absent from, or having an unsuccessful result (i.e., fail = 1) from any of the midterms should reattend at a given timepoint and pass the exam or their semester will not be accepted. The results of all tests will appear on the personal achievement cards.

Midterm test I. Written (Moodle) Date: 7th week
Topic: Microscopy and development of the central nervous system

Midterm test II. Written (Moodle) Date: 12th week
Topic: Organs of special senses;
Histology of the hypothalamo-hypophyseal system.

FINAL EXAMINATION

Topics: Subject matter of the two semesters

Parts of the final examination

Written pretest (moodle*, unless exempted* ***)

Oral examination

1. Identification of structures and explanation of theoretical background on 2 digitized tissue slides
2. one theoretical question from *the Microscopy of the CNS*

N.B. – In case neither the first nor the repeated takes of the final examination have been successful the exam can be postponed to the following, exam period (i.e. 'CV' exam if there are possibilities left).

** Exemptions can be earned by*

- having good (4) or excellent (5) marks at the exam competition

EXAM COMPETITION

Students having an average of 4.00 from the two midterm marks are eligible to participate in the exam competition held during the last weeks (TBA). **Exemptions from the written (moodle) examination can be earned** by scoring at least 80% in the competition test (80-90% - 4; 90-100% - 5). These students need to sit for the oral part of the examination only.

WORK / ENVIRONMENTAL PROTOCOL

GENERAL RULES

1. Frequently wash your hands using soap and warm water.
2. Sanitise your hand frequently.
3. Do not touch your face or eye.
4. It is **STRICTLY FORBIDDEN** to smoke/vape, consume food, drinks or chewing gum **anywhere** on the premises of the department (including lecture halls, dissection rooms, histology laboratories or on the hallways, staircases.
5. No smoking/vaping or the consumption of alcoholic beverages is allowed in the yard.
6. Use paper tissues in case you cough or sneeze and dispose of them immediately in the designated bins.

SPECIFIC RULES CONCERNING THE HISTOLOGY LABORATORIES

1. You may clean the surfaces with sanitizing towels before you start using them.
2. Food and drinks are **strictly forbidden** on the premises of the department.

FIRE SAFETY PROTOCOL

Please make sure to adhere to the rules of fire safety regulation with full compliance, paying special attention to the following:

1. The use of naked light or smoking is **STRICTLY PROHIBITED** on the premises of the Department, including the building and the yard.
2. In case of fire, a loud fire alarm signal is to ring throughout the building. In case of a fire drill, the building must be left organized, with the guidance of the teacher/instructor of the group, using the exits as quick as possible. Escape routes are illustrated on every floor.
3. The use of elevators is STRICTLY PROHIBITED during a fire drill.
4. Every lecture room has 3 accessible entrances/exits. Students usually enter and leave through the lower single entrance under normal circumstances. When necessary, i.e. in case of fire, the upper 2 doors could also be opened using the keys kept in the fire cassettes next to the doors.
5. All fire cases or signs/ suspicion of a possible fire should be reported to the teacher of the group.
6. No electrical devices should be plugged in a connector/socket different from the designated ones. Only electrical devices in an intact and perfect condition should be used.

LIST OF TEXTBOOKS

Langmann's Medical Embryology, 13th Edition by TW Sadler, Wolters Kluwer, ISBN 9781469897806, 2014

Histology: A Text and Atlas: With Correlated Cell and Molecular Biology; 7th Edition by MH Ross and W Pawlina ; Wolters Kluwer 2015, ISBN 9781451187427

Wheater's Functional Histology, A Text and Colour Atlas, 6th Edition by B Young, G O'Dowd and P Woodford Churchill Livingstone, Edinburgh, 2013, ISBN 9780702047473

Stevens & Lowe's Human Histology, Elsevier, 4th edISBN 978-0-723435020, 2015.

Functional Anatomy, Histology and Embryology for medical and dental students by M. Réthelyi and J. Szentágothai, Medicina, 2018.

RECOMMENDED LITERATURE

The Developing Human – Clinically Oriented Embryology, 10th ed. by KL Moore, TVN Persaud and M Torchia, Saunders, 2015; ISBN 9780323313384

Histology Manual 1-3. by A. Nemeskéri and K. Kocsis: István Apáthy's Foundation, 2019.

A. L. Kierszenbaum Histology and Cell Biology: An Introduction to Pathology, 4th Edition, Paperback with STUDENT CONSULT Online Access and E-Book ISBN: 9780323085885:, 2015

Junqueira's Basic Histology: Text and Atlas; 13th Edition by Anthony Mescher, New York, McGraw-Hill Medical, 01/03/2013 ISBN13 978007178033

Further study aids:

To be downloaded from the homepage of the Department of Anatomy, Histology and Embryology (http://semmelweis.hu/anatomia) or from Knowledgebase on the Library homepage: (https://lib.semmelweis.hu/knowledge_base).

ANNOUNCEMENTS CONCERNING THE FINAL EXAMINATIONS IN MICROSCOPIC ANATOMY AND EMBRYOLOGY

Final examinations are held on days specified in Neptun
starting as it appears in Neptun

PARTS OF THE FINAL EXAMINATION

WRITTEN PART **(Students may not leave the room during the test)**

The test is composed of 40 simple / multiple choice questions
(Histology, Microscopy of CNS, Embryology – organs of special senses, endocrine glands, CNS)
Writing time: 40 minutes
Passing rate: 60% (0-23.99 points=fail, 24-27.99=satisfactory, 28-31.99=average, 32-35.99=good, 36-40=excellent)

- Following the completion of the test Students may view their results, however, neither questions may be asked nor notes may be taken during this time. Students may not leave the room before the inspection time expires.
- Students irrespective of reaching 60% percent in the written part can continue with the oral examination.
- Students failing the examination in the subsequent practical part may be exempted from the written test during the retake examination if they gained a good (4) or excellent (5) result from the written test.

ORAL / PRACTICAL PART

This part is also held in the Histology Laboratory. The oral examination consists of

- 2 digitized tissue slides (one from each semester)
- 1 CNS topic (see the Topic list)

Further questions, other than the identification of the presented specimens, may arise, e.g. discussing the histological or developmental relevances. Students may be asked to produce schematic drawings as part of the examination (e.g. reflexes, cross sections of the brain stem or schematic drawings of histological entities).

MARKING SYSTEM

The examination finishes in the Histology room, where Students are given a mark calculated from all the marks they earned during the examination.

- If one part of the practical part of the examination results in fail (1), the entire examination is terminated with a fail (1).
- In case the result of one of the parts is **1/2**, the overall result of the examination CANNOT be better than a pass (2). This mark can only be earned once during the examination.
- **Students failing the examination, may repeat the exam once „free", every further attempt will be charged for.** The total number of examination seats is set (200% of the number of students in a given course), therefore the number of examination seats will not be increased*.
- **Retake of a successful examination -** students unhappy with the result of the examination may apply in writing with the Course Director, to retry the examination. They will be registered by the Course Director in neptun. ***Please note, that such a retake examination does not necessarily result in a better mark.***
- **Technical problems** concerning registration or deregistration via the neptun system are beyond the scope of the Department, Students should seek help from the neptun group of the Secretariat.
- The Registrar of the English Secretariat is not entitled to register or deregister students with the only exception of using the 4th chance upon getting the Dean's permission.

REGISTRATION ISSUES

Registration has to be done in neptun according to the Study and Examination Policy. Registration in neptun closes 24/23 hours before the actual starting time of the examination

Absences – no-show at the semifinal examination reduces the remaining examination possibilities and Students will have to pay a missed examination fee via neptun.
In case of health problems, students will have to present a **doctor's note within 3 working days** to be evaluated by the Head of Department. If accepted, the number of the student's examination possibilities will not be reduced.

On the day of the examination, leave your bags in a locker and gather in front of the Histology lab 10 minutes before starting time. Please make sure you have the following items on you:

ID card/student card (you may not start the examination **without** it**)**
SeKA login details *(*memorize or write them down on a small piece of paper*)* *
a pen or pencil to aid you with the explanation of the slides and the oral question
in case of a retake exam – proof of payment *(except for the 1st retake)*

*Students who cannot login /forgot their password will be considered as „absent" (see above) and have to sit for the examination on a different day

Phones and smart watches have to be stored elsewhere during examinations. Neither pens+papers may be with you during the written part. You cannot take notes or talk to your peers during the examination. Students found to use such items or breaking the aforementioned rules will be immediately suspended, the case recorded and the examination is terminated with a fail (1).

For safety reasons you may keep your valuables (money, cards, IDs, etc) on you, however „large" items, such as phones (switched off), tablets (switched off) and pencil cases will be collected upon entering the examination room.

No chewing gum, no food, no drinks are allowed while on the premises

TOPIC LIST OF THE FINAL EXAMINATION

General Histology

Concept of basic tissues
Definition and classification of epithelial tissue
Simple and stratified epithelia
Membrane specializations of epithelia
Glandular epithelia
Pigment epithelium, sensory neuroepithelium
Cells of connective tissue
Ground substance and fibres of connective tissue
Types of connective tissue
Blood and the corpuscular elements of blood
Histology of the bone marrow, maturation of erythrocytes and platelets
Differentiation of granulocytes, lymphocytes and monocytes
Histology of cartilage
Histology of the bone tissue
Intramembranous ossification
Endochondral ossification
Growth and remodeling of bone
Smooth muscle and myoepithelial cells
Skeletal muscle tissue
Cardiac muscle tissue
Nervous tissue

Histology of organs

Histological structure of arteries and arterioles
Composition of capillaries and veins
Wall structure of hollow organs
Histology of the lip, tongue and teeth
Structure of the esophagus
Histology of the airways (epiglottis, larynx, trachea, lung)
Histology of the stomach, the small and large intestines
Histology of the liver and biliary passages including the gall bladder
Histology of the pancreas
Histology of the kidney and the urinary passages (ureter, urinary bladder)
Histology of the testicles, epididymis, prostate, seminal vesicle, spermatic cord
Histology of the penis
Histology of the ovary, uterine tube; corpus luteum
Histology of the uterus and vagina
Placenta, umbilical cord

Lymphatic organs

Lymphatic tissues in general, cellular components
Histological structure of lymph nodes
Spleen (fine structure and circulation)
Thymus
Tonsils, MALT

Development of the nervous system and organs of special senses

Development and primary differentiation of the neural tube
Development of brain vesicles
Development of the peripheral nervous system (neural crest, placodes)
Development of the organ of vision
Development of the organ of hearing&equilibrium

Neurohistology

Histology of the neurons developing from the neural tube
Glial cells
Histology of the neurons and supporting cells developing from the neural crest
Fine structure of peripheral nerves
Receptors and effectors
Interneuronal synapses

Microscopy of the central nervous system

Fine structure (microscopy) of the spinal cord
Proprioceptive reflexes
Nociceptive reflexes

Brain tracts, neurotransmitters, neuronal circuits, "*connectomics*"
Central autonomic nervous system.
Monoaminergic and cholinergic neurones and pathways.
„*Ascending Reticular Activating System*" (ARAS)
Somatosensory system.
Spinal and trigeminal sensory pathways.
Thalamus, sensory cortical areas.
Viscerosensory system.
Role of the reticular formation, thalamus, insula and the prefrontal cortices in visceral sensory activities.
Neuroanatomy of pain. Referred pain. Cerebral inhibition of pain sensation.
Motor cortical areas, planning and programming of movements.
Motor pathways.
The role of cerebellum and basal ganglia in eliciting movements. Gait control mechanism.
Visceromotor system. Control of micturition.
Spinal motor reflexes. Autonomic reflexes
Energy metabolism, neuroanatomy of food intake, taste sensation and olfaction.
Structure and functional significance of the reward system.
Limbic system. Amygdala, hippocampus.
Circadian rythm, sleep/wake cycle; neuroanatomy of resting state and activation.
Behaviour and motivation. Neuroanatomy of emotions, empathy, well-being, agression, fear, anxiety and depression.
Cognitive functions. Neuroanatomy of determination, planning, alertedness together with learning&memory, personality, consiousness and creativity.

Endocrine organs
Microscopical anatomy and development of the pituitary gland. Portal circulation
Microscopical anatomy and development of the pineal gland
Microscopical anatomy and development of the thyroid gland
Microscopical anatomy and development of the parathyroid gland
Microscopical anatomy and development of the suprarenal gland
Histology of the islands of Langerhans

Organs of special senses
Microscopical structure of the skinand skin appendages
Coats of the eyeball
Chambers of the eye, vitreous body
Lens, accomodation
Neuroanatomy of vision. Visual pathway, visual recognition, neuroanatomy of reading and understanding of written/text.
External ear, tympanic membrane. Middle ear, auditory tube, hearing ossicles.
Spiral organ of Corti. Auditory pathway.
Neuroanatomy of hearing, understanding and control of speech.
Vestibular system; Bony and membranous labyrinth; Cochlea and cochlear duct
Fine structure of the labyrinth, tracts of the vestibular system. Control of balancing and posture together with the movements of the eye and head. Awareness of spatial position.
Organs of taste and olfaction.