Semmelweis University
Department of Anatomy, Histology and Embryology
2022/2023

Faculty of Medicine
2nd year / 1st semester

MICROSCOPIC ANATOMY AND EMBRYOLOGY HANDBOOK

Dr. Alán Alpár
Full Professor
Head of Department

Dr. Andrea D. Székely
Associate Professor
Course Director

Microscopic Anatomy and Embryology II

TEACHING DEPARTMENT:

SEMMELWEIS UNIVERSITY
Department of Anatomy, Histology and Embryology
Budapest, Tűzoltó utca 58.
H-1094 Budapest
http://semmelweis.hu/anatomia

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: 3 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: Cell sciences, Microscopic Anatomy and Embryology I. (successful examination)
Macroscopic Anatomy and Embryology II. (successful final examination)

Academic Year 2022/2023 Faculty of Medicine

EM II. Microscopic Anatomy and Embryology II.
EM 1-12

Weeks	Lectures *EM 1-12 Mondays 14.45-16.25 Lenhossék lecture room*	Lecturer *Lenhossék*	Histology laboratory *Tuesdays EM 1-6 11.45-13.15 and EM 7-12 13.30- 15.00*
Week 1 09. 5-9.	1. Cellular components of lymphatic tissue. Thymus, tonsils, MALT 2. Structure and circulation of lymph nodes and spleen	1 Puskár 2 Puskár	Thymus, tonsils 43a, 43c, 47, 42a-b, 46, 48
Week 2 09. 12-16.	3. Nerve tissue 4. Development of the neural tube. Cranio-caudal and dorso-ventral differentiation. Divisions of the CNS	3 Pálfi 4 Nagy	Lymph node, spleen 40, 45, 1a, 1b
Week 3 09. 19-23.	5. Formation and derivatives of the neural crest and placode ectoderm 6. Microscopy of the CNS – Fine structure of the spinal cord. Spinal reflexes, receptors and effectors	5 Nagy 6 Vereczki	Histology of the peripheral nervous system 88a, 67, 53, 79, 75, 6, 151b, *(dem: 59, 151, 151c, 88b)*
Week 4 09. 26 - 30.	7. Brain tracts, neurotransmitters, neuronal circuits, "*connectomics*" Structure of the cerebral cortex 8. Central autonomic nervous system. Monoaminergic and cholinergic neurones and pathways. „*Ascending Reticular Activating System*" (ARAS)	7 Pálfi 8 Vereczki	**Microscopy of the CNS** **Consultation I.** - Spinal cord, reflexes 101, 33b (*110, K110, 102)*
Week 5 10. 3-7.	9. Somatosensory system. Spinal and trigeminal sensory pathways. Thalamus, cortical areas 10. Viscerosensory system. Role of the reticular formation, thalamus, insula and the prefrontal cortices in visceral sensory activities	9 Dobolyi 10 Kocsis	**Microscopy of the CNS** **Consultation II.** – Cerebral cortex 22 , 111, 16 (*K16, K16b, K22, K118*)
Week 6 10. 10-15. ***Monday schedule (10.31.) on Saturday***	11. Neuroanatomy of pain. Referred pain. Cerebral inhibition of pain sensation. 12. Neuroanatomy of movements/locomotion I. Motor cortical areas, planning and programming of movements. Motor pathways ---------- 13. Neuroanatomy of movements/locomotion II. The role of cerebellum and basal ganglia in eliciting movements. Gait control mechanism 14. Visceromotor system. Control of micturition. Spinal motor reflexes	11 Kozsurek 12 Horváth ---------- 13 Ádám 14 Csáki	**Microscopy of the CNS** **Consultation III.** - Sensory systems
Week 7 10. 17-21.	15. External ear. Middle ear 16. Inner ear. Bony and membranous labyrinth. Development of the organ of hearing	15 Katz 16 Hanics	**Microscopy of the CNS Consultation IV.-** Cerebellum, motor systems 80, 96
Week 8 10. 25-29.	17. Spiral organ of Corti. Auditory pathway. Neuroanatomy of hearing, understanding and control of speech 18. 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	17 Puskár 18 Hanics	**Midterm test I.** ***Organ of hearing and vestibular system*** *36, 4, (98)*
Week 9 10. 31 - 11. 4. ***Oct 31 and Nov. 1 National Holidays***	- **NO lectures on Monday**	-	**No classes on Tuesday**
Week 10 11. 7-11.	19. Fibrous and vascular coats of the eyeball. Lens, chambers of the eye, vitreous body, accommodation. Lacrimal gland, lacrimal apparatus 20. Inner coat of the eyeball, retina. Development of the eye	19 Katz 20 Nagy	**Organ of vision** (eye bulb, retina) 29, 30 113
Week 11 11. 14-18.	21. Neuroanatomy of vision. Visual pathway, visual recognition, neuroanatomy of reading and understanding of written/text 22. Endocrine system I. Hypothalamus, the hypothalamo-hypophysial system, epiphysis	21 Ádám 22 Tóth	**Organ of vision** (palpebra, lacrimal gland) 39, 113 (112) ***Visual pathway***
Week 12 11. 21-25.	23. Endocrine system II. Thyroid, parathyroid, adrenal glands 24. Energy metabolism, neuroanatomy of food intake, taste sensation and olfaction. Structure and functional significance of the reward system	23 Barna 24 Tóth	**Skin** 59, 113, 11 **Endocrine system I.** (hypothalamus, hypophysis) 14 (*K14*), 105a (106, 150)
Week 13 11. 28 - 12. 2.	25. Limbic system. Amygdala, hippocampus 26. Circadian rythm, sleep/wake cycle; neuroanatomy of resting state and activation	25 Adorján 26 Dobolyi	**Midterm test II.** **Endocrine system II.** Thyroid, parathyroid and adrenal glands, pineal body, endocrine cells 102, 104, 32, 70, 44 (97b, 114)
Week 14 12. 5-9.	27. Behaviour and motivation. Neuroanatomy of emotions, empathy, well-being, agression, fear, anxiety and depression 28. Cognitive functions. Neuroanatomy of determination, planning, alertedness together with learning&memory, personality, consiousness and creativity	27 Ádám 28 Horváth	**Limbic system** (hippocampus) 20 (*K20, K119*)

Academic Year 2022/2023 Faculty of Medicine
EM II. Microscopic Anatomy and Embryology II.
EM 13-22

Weeks	Lectures ***EM 13-20 Fridays 13.00-14.40 Huzella lecture room***	Lecturer *Huzella*	Histology laboratory ***Wednesdays EM 13-17 10.00-11.30*** ***Fridays EM 18-20 8.00-9.30***
Week 1 09. 5-9.	1. Cellular components of lymphatic tissue. Thymus, tonsils, MALT 2. Structure and circulation of lymph nodes and spleen	1 Nagy 2 Nagy	Thymus, tonsils 43a, 43c, 47, 42a-b, 46, 48
Week 2 09. 12-16.	3. Nerve tissue 4. Development of the neural tube. Cranio-caudal and dorso-ventral differentiation. Divisions of the CNS	3 Tóth 4 Nagy	Lymph node, spleen 40, 45, 1a, 1b
Week 3 09. 19-23.	5. Formation and derivatives of the neural crest and placode ectoderm 6. Microscopy of the CNS – Fine structure of the spinal cord. Spinal reflexes, receptors and effectors	5 Nagy 6 Barna	Histology of the peripheral nervous system 88a, 67, 53, 79, 75, 6, 151b, *(dem: 59, 151, 151c, 88b)*
Week 4 09. 26 - 30.	7. Brain tracts, neurotransmitters, neuronal circuits, "*connectomics*" Structure of the cerebral cortex 8. Central autonomic nervous system. Monoaminergic and cholinergic neurones and pathways. *„Ascending Reticular Activating System*" (ARAS)	7 Alpár 8 Alpár	**Microscopy of the CNS** **Consultation I.** - Spinal cord, reflexes 101, 33b (*110, K110, 102)*
Week 5 10. 3-7.	9. Somatosensory system. Spinal and trigeminal sensory pathways. Thalamus, cortical areas 10. Viscerosensory system. Role of the reticular formation, thalamus, insula and the prefrontal cortices in visceral sensory activities	9 Katz 10 Kocsis	**Microscopy of the CNS** **Consultation II.** – Cerebral cortex 22 , 111, 16 (*K16, K16b, K22, K118*)
Week 6 10. 10-15. ***Saturday is workday***	11. Neuroanatomy of pain. Referred pain. Cerebral inhibition of pain sensation. 12. Neuroanatomy of movements/locomotion I. Motor cortical areas, planning and programming of movements. Motor pathways	11 Kozsurek 12 Horváth	**Microscopy of the CNS Consultation III.** - Sensory systems
Week 7 10. 17-21.	13. Neuroanatomy of movements/locomotion II. The role of cerebellum and basal ganglia in eliciting movements. Gait control mechanism 14. Visceromotor system. Control of micturition. Spinal motor reflexes	13 Ádám 14 Csáki	**Microscopy of the CNS Consultation IV.** - Cerebellum, motor systems 80, 96
Week 8 10. 25-29.	15. External ear. Middle ear 16. Inner ear. Bony and membranous labyrinth. Development of the organ of hearing	15 Székely 16 Kocsis	**Midterm test I.**
Week 9 10. 31 - 11. 4. ***Oct 31 and Nov. 1 National Holidays***	17. Spiral organ of Corti. Auditory pathway. Neuroanatomy of hearing, understanding and control of speech 18. 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	17 Puskár 18 Hanics	**Organ of hearing and vestibular system** 36, 4, (98)
Week 10 11. 7-11.	19. Fibrous and vascular coats of the eyeball. Lens, chambers of the eye, vitreous body, accommodation. Lacrimal gland, lacrimal apparatus 20. Inner coat of the eyeball, retina. Development of the eye	19 Székely 20 Nagy	**Organ of vision** (eye bulb, retina) 29, 30
Week 11 11. 14-18.	21. Neuroanatomy of vision. Visual pathway, visual recognition, neuroanatomy of reading and understanding of written/text 22. Endocrine system I. Hypothalamus, the hypothalamo-hypophysial system, epiphysis	21 Ádám 22 Minkó	**Organ of vision** (palpebra, lacrimal gland) 39, 113 (112) ***Visual pathway***
Week 12 11. 21-25.	23. Endocrine system II. Thyroid, parathyroid, adrenal glands 24. Energy metabolism, neuroanatomy of food intake, taste sensation and olfaction. Structure and functional significance of the reward system	23 Barna 24 Tóth	**Skin** 59, 113, 11 **Endocrine system I.** (hypothalamus, hypophysis) 14 (K14), 105a (106, 150)
Week 13 11. 28 - 12. 2.	25. Limbic system. Amygdala, hippocampus 26. Circadian rythm, sleep/wake cycle; neuroanatomy of resting state and activation	25 Adorján 26 Dobolyi	*Midterm test II* **Endocrine system II.** Thyroid, parathyroid and adrenal glands, pineal body, endocrine cells 102, 104, 32, 70, 44 (97b, 114)
Week 14 12. 5-9.	27. Behaviour and motivation. Neuroanatomy of emotions, empathy, well-being, agression, fear, anxiety and depression 28. Cognitive functions. Neuroanatomy of determination, planning, alertedness together with learning&memory, personality, consiousness and creativity	27 Ádám 28 Horváth	**Limbic system** (hippocampus) 20 (K20, K119)

Weeks	**List of slides (AOK series)** ***Tuesdays EM 1-6 12.00-13.30 and EM 7-12 14.00- 15.30*** ***Wednesdays EM 13-17 10.00-11.30 Fridays EM 18-19 8.00-9.30***
Week 1 09. 6-10.	**Lymphatic system 1** 43.a Thymus (HE) — 43. c Thymus 47. Palatine tonsil (HE) — 46. Lingual tonsil (HE) 42.a Palatine tonsil (CD20 immunocytochemistry) — 42.b Palatine tonsil (CD3 immunocytochemistry) 48. Pharyngeal tonsil (HE)
Week 2 09. 13-17.	**Lymphatic system 2** 40. Lymph node (rat, semithin, toluidine blue) — 1.a Spleen (CD20 immunocytochemistry) 45. Spleen (human, HE) — 1.b Spleen (CD3 immunocytochemistry)
Week 3 09. 20-24.	**Histology of the peripheral nervous system** 88 a. Peripheral nerve (sciatic nerve, HE) — *DEM: 59. Palm skin (HE)* 67. Autonomic ganglion (celiac ganglion, Bielschowsky's impregnation) — *151. Fingertip (Verhoeff)* 53. Autonomic ganglion (submandibular gland, HE) — *151c Remak fibres (fingertip neurofilament ICC)* 75. Motor end plate (cholinesterase enzyme histochemistry) — *88b. Median nerve (OsO4 impregnation))* 79. Spinal cord + dorsal root ganglion (Luxol Fast blue + cresyl violet) 6. (Vater-)Pacinian corpuscle (plantar skin, HE) 151b Meissnerian corpuscle (human fingertip, neurofilament ICC)
Week 4 09.27 - 10. 1.	**Microscopy of the CNS** **Consultation I.** - Spinal cord, reflexes *(K110)* 33b. Muscle spindle (striated muscle, HE) — *DEM 11. Spinal cord (Bielschowsky)* 101. Spinal cord (Luxol Fast blue + cresyl violet) — *102 Muscle spindle (thyroid gland, HE)*
Week 5 10. 4-8.	**Microscopy of the CNS** **Consultation II.** – Cerebral cortex (*K16, K16b, K22, K118*) 22. Cortex cerebri (pre- and postcentral gyri, Nissl) 111. Cortex cerebri (Bodian) 16. Mesencephalon (Luxol fast blue + cresyl violet)
Week 6 10. 11-15.	**Microscopy of the CNS** **Consultation III.** - Sensory systems
Week 7 10. 18-22.	**Microscopy of the CNS** **Consultation IV.** - Cerebellum, motor systems 80. Cerebellar cortex (HE) 96. Cerebellar cortex (neurofilament ICC)
Week 8 10. 25-29.	**Midterm test I.**
Week 9 11. 1-5. ***Nov. 1 National Holiday***	**Organ of hearing and vestibular system** 36. Cochlea / organ of Corti (semithin, toluidine blue) — *DEM 98. Auricle (human, Verhoeff)* 4. Macula (semithin, toluidine blue)
Week 10 11. 8-12.	**Organ of vision** (eye bulb, retina) 29. Eye bulb (HE) 30. Retina (semithin, toluidine blue)
Week 11 11.15-19.	**Organ of vision** (palpebra, lacrimal gland) ***Visual pathway*** 39. Eyelid (HE) 113. Lacrimal gland (HE) — *DEM 112. Optic nerve (HE)*
Week 12 11. 22-26	**Skin** **+** **Endocrine system I.** (hypothalamus, hypophysis) *(K14)* 59. Palm skin (HE) — 14. Hypothalamus (Chrom haematoxylin floxin/ GÖMÖRI) 11. Scalp skin (HE) — 105a. Pituitary gland (Chrom haematoxylin floxin/GÖMÖRI) 153. Glomus organ, nail (HE) — *DEM 106. Pituitary gland (HE)* *150. Pituitary gland (ACTH ICC)*
Week 13 11.29-12.3.	**Midterm test II** **Endocrine system II.** Thyroid, parathyroid and adrenal glands, pineal body, endocrine cells 102. Thyroid gland (HE) — 70. Endocrine pancreas/ islands of Langerhans (HE) 104. Parathyroid gland (HE) — 44. Pineal body (HE) 32. Suprarenal gland (HE) — *DEM: 97b. Corpus luteum (HE)* *114.Thyroid gland (C cell ICC)*
Week 14 12. 6-10.	**Limbic system** - Hippocampus *(K20, K119)* 20. Hippocampus + choroidal plexus (Nissl)

EM II. Microscopic Anatomy and Embryology II.

SUBJECT MATTER OF THE PRESENT 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

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

Signing of the lecture book: 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%**.

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 at these midterms is obligatory or the semester is not accepted. Students absent from the test should reattend at a given timepoint or their semester will not be accepted. The results of all tests will appear on the personal achievement cards.

Midterm test I. Written midterm (Moodle) Date: 8th week ***(unless exempted*)***
Topic: Microscopy and development of the central nervous system
1st retake date: Week 9 (during class), 2nd retake date: Week 14 (during class)

Midterm test II. Written (Moodle) Date: 13th week
Topic: Histology of the organs of special senses;
Histology of the hypothalamo-hypophyseal system.
1st retake date: Week 14 (during class), 2nd retake date: Week 14 (TBA)

FINAL EXAMINATION

Topics: Subject matter of the two semesters

Parts of the final examination

Written pretest (moodle)

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 (unless exempted *)*

Students may request an oral examination to replace the written theoretical part for the 2nd or 3rd retakes of the semifinal examination. The request will have to be submitted in writing with the Course Director ***48 hours prior to the date of the examination. This request has to be resubmitted (again) in case students would like to ask for a further occasion.***

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).

* HOW TO EARN EXEMPTIONS

There will be 4 consultational classes during weeks 4-7, preceding the 1st midterm, when the Microscopy of the CNS will be discussed during the laboratory classes.

Topics for the weekly tests:

week 4	lectures No 4-5-6.	week6	lectures No 9-10.
week5	lectures No 7-8.	week7	lectures No 11-12.

The consultational classes may only then be useful if the Students well prepared. To facilitate the preparatory procedure, every such class will start with a 10 question moodle test. Please make sure you arrive on time to participate in the test.

Altogether 40 points may be earned writing these tests. **It is worth to prepare well for the tests -**

- BECAUSE

1. Students earning at least **90% of the points (i.e., 36 points or more**) will be exempted from the **1st midterm AND from the CNS topic** of the final examination with a **mark 5**.

2. Students earning at least **80% of the points (i.e., between 32 and 35.9 points**) will be exempted from the **1st midterm AND from the CNS topic** of the final examination with a **mark 4**.

3. Students earning between **60-79.90% of the points (i.e., 24-31.9 points**) will be exempted from the **1st midterm** (**BUT NOT from the CNS topic at the final examination**) with a **mark 2 or 3 according to their scores**. HOWEVER, they may sit for the midterm in an attempt to upgrade their mark. In case they score at least 80% percent at the midterm test they will be exempted from the CNS topic of the final examination.

4. Students earning **less than 60%** from the consultation tests **MUST write the midterm**. In case they score at least 80% percent at the midterm test they will be exempted from the CNS topic of the final examination.

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).

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.

ANNOUNCEMENTS CONCERNING THE FINAL EXAMINATIONS IN MICROSCOPIC ANATOMY AND EMBRYOLOGY

Final examinations are held on Tuesdays and Thursdays during the entire examination period starting at 13.00 or as it appears in Neptun
(the starting time of the exam may change according to the total number of students registered)

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 not reaching 60% percent in the written part cannot continue (i.e. fail) the examination and should leave.
- Students failing the examination in a 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 an 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*.
- Students may request in writing to sit for an oral theory exam to replace the written part in case of a 2nd or 3rd retake examination. A request will have to be sent to the Course Director 48 hours before the examination day.
- **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 is open until 6.00 on the day of the examination. You may deregister from the examination before midnight on the preceding day.

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 (<u>you may not start the examination **without** it</u>**)**
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