

**SEMMELWEIS UNIVERSITY**

**FACULTY OF MEDICINE**

**INSTITUTE OF HUMAN MORPHOLOGY AND**

**DEVELOPMENTAL BIOLOGY**

**INFORMATION BOOKLET**

**For the academic years 2009/2010 and 2010/2011**

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**Semmelweis University**

**Faculty of Medicine**

**Department of Human Morphology  
and Developmental Biology**

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Dr. Imre Oláh, professor, pensioner  
Dr. Béla Vígh, professor, pensioner
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### **Hungarian Academy of Sciences - Semmelweis University of Medicine Joint Research Organization, Neuroendocrine Research Unit**

- Scientific Adviser:** Dr. József Kiss
- Professor Emeritus:** Dr. Béla Halász, professor, pensioner
- Researcher:** Dr. Ibolya Bodnár

## **The past and present history of the Department of Human Morphology and Developmental Biology**

The forerunner of the department was founded in the Academic Year **1875/76** as the Institute of Embryology. In that year the Faculty of Medicine of the University invited **Géza Miháلكovics** (qualified as lecturer in embryology at the University of Strassbourg) to introduce the embryology into the curriculum of the medical faculty and chair the Institute of Embryology, so the 125<sup>th</sup> Anniversary of the Department was celebrated in 2000. Still in 1875 Miháلكovics, as a lecturer, announced his course entitled "*Human and vertebrate embryology*". The course consisted of 3 lectures and 2 hours practice (embryological papers) per week. Besides this, he conducted a course with the title of „*Anatomy and histology of sensory organs*". When nominated as full professor in **1878**, Miháلكovics was entitled to teach the complete regional anatomy. According to this change, the name of the department became **2<sup>nd</sup> Department of Descriptive and Regional Anatomy** in 1880 and was considered equal to the Department of Anatomy chaired by József Lenhossék. At the first time in the history of the University, these two departments have formed two parallel teaching units.

By the foundation of the two parallel departments, both anatomy and its "supplementary" subject, the embryology became integral parts of the anatomical curriculum in both departments. The histology as "upper anatomy" belonged to the curriculum of the Department of Physiology. In 1888 Lenhossék died and Miháلكovics became the head and chairman of the 1<sup>st</sup> Department of Descriptive and Regional Anatomy. In **1890 Lajos Thanhoffer**, acting previously as professor of physiology and "upper anatomy" at the Veterinary School, Budapest, was nominated head of the 2<sup>nd</sup> Department of Descriptive and Regional Anatomy. Lajos Thanhoffer still in the Veterinary School, set up the first histology laboratory in the country, and wrote the first histology textbook in Hungarian. After the death of Jenő Jendrassik, head of Department of Physiology, Géza Miháلكovics and Lajos Thanhoffer made a joint application to the Faculty for the relocation of histology from the curriculum of physiology to that of anatomy. Since the newly nominated head of the Department of Physiology, Nándor Klug was in favor of the suggestion, the Faculty and then the Minister of Religion and Public Education approved that **histology** would belong to the curriculum of the Anatomy Departments from the Academic Year **1891/92** on. The introduction of embryology into the curriculum of medical education in 1875 and, 15 years later, the nomination of the first Hungarian histologist, Lajos Thanhoffer as head of the Department had a great impact on the scientific and teaching orientation of the Department.

After the death of Lajos Thanhoffer in **1909, Kálmán Tellyesniczky**, formerly lecturer of art and surface anatomy at the Academy of Fine Arts, became the head of this Department. He wrote the first Art Anatomy book in Hungarian. Besides anatomy and histology, his scientific interest was increasingly focused at the cellular level according to the growing biological knowledge of his time. Following the death of his young and beloved wife, he had resigned and in 1932 committed suicide. His main achievement was to introduce cytological studies into the research work of the Department.

Following Tellyesniczky's retirement, the Dean nominated a committee headed by Mihály Lenhossék to elect the new head of the Department. The committee stressed the significance of histology and embryology and suggested that even the name of the Department be changed accordingly. Therefore, in **1932** the Faculty appointed **Tivadar Huzella**, former professor of anatomy at the Faculty of Medicine in the Tisza István University, Debrecen as head of the Department which from 1933 to 1972 was called **Department of Histology and Embryology**. During this period gross and regional anatomy were taught in the former 1<sup>st</sup> Department of Descriptive and Regional Anatomy while histology and embryology in the former 2<sup>nd</sup> Department of Descriptive and Regional Anatomy. The division of the morphological subjects between the two Departments was reasonable and supported by both Mihály Lenhossék and Tivadar Huzella.

Medicine was considered by Huzella applied biology. He wrote the first biology book in Hungarian and founded an important experimental research laboratory in his own country estate, in Göd. During World War II, the laboratory was destroyed and Huzella's health has deteriorated in the post-war years. The authorities considered him politically unreliable and discharged him with pension. In **1950** his earlier student in Debrecen, Imre Törő became the head of the Department.

**Imre Törő** continued Huzella's work in emphasizing the importance of biological thinking in medicine. On his initiative, biology departments have been established in each Medical University of the country. On the basis of the Department of Histology and Embryology, an independent teaching and research group was formed in 1968 which in 1972 became gradually independent as Department of Biology. Imre Törő's histology and embryology books were the official textbooks for several generations of medical students. His research interest, the immunomorphology of the thymolymphatic system is still one of the main topics in the Department, and recently, the developmental biological aspects of the immune system has gained more emphasis. From 1966 the teaching program of the Department includes macroscopic anatomy besides of histology and embryology.

After the retirement of Imre Törő in **1971**, **Béla Halász** became the head of the Department. During his 24-year chairmanship an internationally acknowledged neuroendocrine research group has been formed whose members make a decisive proportion of the present staff. It was in the beginning of the 90-ies when a new PhD program was founded under the title „Neurosciences”. The number of PhD students is continuously increasing. The PhD students taking part in the program regularly join the graduate teaching activity of the institute. Likewise, the professors of the institute are also ready to undertake tutorships in the accredited doctoral program

In **1995** Béla Halász retired, still retaining his renowned research group. The new director of the Department, **Imre Oláh** expanded the developmental biological aspects to all fields of teaching and reasearch activity of the institute. It was under his chairmanship when the Department has adopted its new name: **Department of Human Morphology and Developmental Biology**. Besides classical embryology, the most basic developmental biologic, differentiatinal and regulational aspects appeared in the official curriculum. Simultaneously, a new, independent and ever-increasing developmental research group has been founded that perhaps represents the most dynamically developing group of the Department. The combination of the modern molecular biological and embryo-manipulation techniques with the classical embryological and morphological methods ensures the success of the research group. An independent PhD program was also founded by Imre Oláh under the title, „Embryology, theoretical, experimental and clinical developmental biology”.

Important achievements in medical teaching during this period was the appearance of two textbooks: the Textbook of Histology in two volumes (edited by Pál Röhlich), written and illustrated by the staff of the Department and the book „Clinical Anatomy” written by Ágoston Szél.

In July **2003**, the leading of the Department was taken over by **Ágoston Szél**. The new director lays special emphasis on the clinical aspects of anatomy in the medical curriculum. The scientific profile of the Department is multifaceted. Besides the developmental immunology and the neuroendocrine research groups, somewhat combining these two decisive branches and utilizing a set of other modern techniques, work two other research groups: the Laboratory of Electron Microscopy and the Laboratory of Photoneuroendocrine Functions. Both research groups, investigating the molecular and cellular basis of color vision on the one hand, and the diurnal (circadian) and circannual rhythms on the other, are among the most prominent teams of the Department and enjoy a remarkable international reputation in retinal and pineal research. The research work of the Department also includes studies on membrane biology (e.g.: endocytosis and exocytosis) and research related to addictology (relationship of the central nervous system and drugs).

Budapest, 15th August, 2007

## **Regulations of studies and provisions related to the evaluation of knowledge**

**Curriculum:** On the first class of the Academic Year the detailed weekly curriculum of the first and second semester is announced. The dates of the mid-term exams are also indicated. *The subject of the exam includes the material of the lectures, practices as well as the compulsory textbooks.*

### ***Compulsory books:***

- 1 C Rosse, P Gaddum-Rosse: Hollinshead's Textbook of Anatomy, Lippincott-Raven, 4th ed., 1997.
- 2 RMH McMinn: Last's Anatomy, Regional and Applied, Churchill Livingstone, Edinburgh 1990.
- 3 ML Barr, JA Kiernan: The Human Nervous System, Lippincott Co. Philadelphia, 5th ed., 1993.
- 4 RMH McMinn, RT Hutchings: A Color Atlas of Human Anatomy, Wolfe Medical Publications Ltd, paperback ed.
- 5 MH Ross, GI Kaye, W Pawlina,: Histology: A Text and Atlas. Lippincott William and Wilkins, 4th ed., 1995.
- 6 PR Wheater, HG Burkitt, VG Daniels: Functional Histology, Churchill Livingstone, Edinburgh, 2nd ed., 1987.
- 7 BM Carlson: Human Embryology and Developmental Biology, Mosby, 3rd ed., 2004.

### ***Suggested reading:***

- 1 GJ Romanes: Cunningham's Textbook of Anatomy, Oxford Univ. Press, Oxford, 12th ed., 1991.
- 2 S Standing: Gray's Anatomy. Elsevier, Churchill Livingstone, 39th ed., 2005.
- 3 Bloom and Fawcett: A Textbook of Histology, 11th ed., W.B.Saunders Co., 1986.
- 4 KL Moore, AF Dalley: Clinically Oriented Anatomy. 4th ed., Lippincott William and Wilkins, 1999.
- 5 W Kahle, H Leonhardt, W Platzer: Color Atlas and Textbook of Human Anatomy (in 3 volumes), 3rd revised ed., Thieme Inc. New York. 1986,
- 6 AMR Agur: Grant's Atlas of Anatomy, 9th ed., Williams and Wilkins, Baltimore. 1991.
- 7 LC Junqueira, J Carneiro, RO Kelly: Basic Histology, Lange Medical Publications, Prentice-Hall International Inc., 6th ed., 1989.
- 8 KL Moore, TVN Persaud: The Developing Human - Clinically Oriented Embryology. 7th ed., Saunders, 2003.
- 9 AL Kierszenbaum: Histology and Cell Biology (Elsevier Second Edition, 2007)
- 10 JA Gosling, PF Harris, JR Humpherson, I Whitmore, PLT Willan: Human Anatomy, Color Atlas and Textbook 2008)
- 11 A Nemeskéri: Sectional Anatomy - Workbook, István Apáthy's Foundation, 2001.
- 12 A Nemeskéri, K Kocsis: Histology Manual 1-3, István Apáthy's Foundation, 2001.
- 13 A Csillag: Anatomy of the Living Human, Könnemann, 1999.
- 14 Morton, D.,A, Peterson, K.D., Albertine, K.H.: Gray's Dissection Guide for Human Anatomy, (Elsevier Second Edition, 2007)
- 15 Drake, R.L., Vogl, A.W., Mitchell, A.W.M.: Gray's Anatomy for Students, (Elsevier Second Edition, 2010)
- 16 Nolte, J.: The Human Brain (Elsevier 6th Edition 2008)

**Mid-term exam:** During the 1st through 3rd semesters both the practical and theoretical knowledge is evaluated. The anatomical and histological mid-terms are oral or written exams. The mid-term in anatomy consists of identification of a given number of structures on the body in a given period of time and theoretical questions related to the subject. The mid-term in histology consists of identification of a given number of structures on microscopic slides in a given time period as well as theoretical questions related to the subject.

**Signing of the lecture book:** Students should attend at least 75% of the practical classes. Evaluation of the semester is made on the five-grade scale (1-5). The basis of the evaluation is the scores of the mid-term examinations and the activity on the practical courses. No repetition is needed if the *semester-mark* is **unsatisfactory (1)**, however this mark is calculated into the score of the semi-final exam. Two unsatisfactory mid-terms automatically result in a *semester-mark* not better than **fair (3)**. The semester-mark is indicated on the student's registration card and is taken into account at the evaluation of the semi-final.

**Competition:** Twice during the two-year course. The first-year competition comprises the subject matter of the second semester at the end of the first year. The second-year competition is of the matter of the two years at the end of the second year. The competition is a written exam. Good performance at the first and second year competition may be taken into account at the evaluation of the score of the semi-final and final exams, respectively.

**Examination period:** At least 30 workdays (the period is determined by the Dean of the Faculty). Exams are organized once a week. The exam days are announced 4 weeks before the examination period. The way of application for exam: students sign up using the Neptun system. Modification of the exam date is possible only not later than 48 hours prior to the accepted examination date.

**Evaluation of the semi-final examination:** The student's knowledge is evaluated on the five-grade scale (1-5). The semi-final exam is composed of **practical** and **theoretical** parts. The exam starts with the oral practical part either in the dissecting room with gross anatomy or in the lecture hall with histology. The **gross anatomy** exam includes the identification of structures, the demonstration of specimens and related questions. During the **histology exam** students should recognize two microscope slides, give a detailed description of the identifiable tissues and answer theoretical questions related to the slides. Each performance is marked with *part-scores*. If the student passed both practical parts, the exam continues in the lecture hall with multiple choice questions that makes the theoretical part of the exam. The theoretical part (test) contains the embryological questions as well.

A **bad (1 or 1/2)** semester-mark automatically excludes the possibility of an **excellent (5)**. If any part-score and/or the embryological part of the test (less than 51%) are unsatisfactory (1), the student fails the semi-final examination. Each student is obliged to present him/herself on the exam day. If the student is absent, a certificate issued by an authorized physician, stating the cause of the absence is needed. If the certificate is not produced within 3 working days at the Secretariat of the Department, the designation "absent" appears on the exam report. That decreases the number of the affordable retake exams.

**Evaluation of the final examination:** Following the 4th semester, students must give an account of their knowledge gathered during the four semesters. In order to emphasize the importance of the practical skills and to motivate the preparatory activity of students, a *dissection exam* is obligatory prior to the comprehensive final exam. No mid-term examination is organized in the last semester. The *dissection exam* is organized continuously during the whole semester, and should be passed not later than in the 14th week. A preparative work must be performed in order to identify a specific structure or demonstrate a region, and related theoretical questions are asked. The list of possible preparative tasks is announced during the last semester. The actual item of the list is decided by lot. The choice on a specific day depends on the available preparations. A failure does not involve the retake of either the semester or the exam, however the score is taken into

consideration when calculating the grade of the final examination. In case of an absence the semester will not be validated by signature. No retake or improvement is allowed.

The **final exam** starts with *practical gross anatomy and histology* and followed by the *theoretical* part. No further dissection work is to be performed, however the identification and demonstration of prepared structures together with the relevant theoretical knowledge form the *gross anatomy* part of the final examination. Each student has to be able to orient herself/himself on preparations from three different fields ([1] *osteology, arthrology, myology, vessels and nerves of the trunk and limbs*, [2] *central nervous system*, [3] *internal organs*). During the *histology* part of the exam, three microscopic slides must be identified and explained. Theoretical questions in conjunction with the slides are also asked. ***The theoretical part of the exam is written*** (multiple choice questions). The score of the latter makes 50% of the final grade.

The failure of any of the part-scores (except for that of the dissection exam) leads to the failure of the complete final examination. If the grade of dissection exam is 0 or 1, the final grade will not be better than “*good*” (4). It is the task of the practical course in the 4<sup>th</sup> semester to gather the necessary practical skills. Therefore, it is highly recommended to attend each course.

**Retake examinations:** Upon the second failure or absence a ***retake permission ticket*** is to be purchased from the English Secretariat. Within one examination period, student can have a maximum of **2 *retake exams***. If once the student has started the exam, the evaluation takes place and an appropriate mark will be given (i.e., student cannot stop, suspend or postpone the exam without receiving a mark). The student is allowed to correct a poor grade with a retake exam within the same examination period.

**First Semester**

**Department of Human Morphology and Developmental Biology  
Faculty of Medicine, Semmelweis University  
English Language Course**

**Anatomy:** Osteology, arthrology. Muscles, vessels and nerves of the upper and lower limbs. (The topics of the lectures are: general osteology, arthrology. myology; clinical anatomy of the vertebral column, pelvis and foot). Skull.

**Histology:** Basic tissues (except the nerve tissue), histology of blood vessels, blood cells, cells of the bone marrow. Histology of the skin and the mammary gland.

**Embryology:** Basic principles of the human development, introduction to the clinical embryology. Spermatogenesis, oogenesis, fertilization, morula, blastula, formation of germinal layers, axes, molecular basis of right-left asymmetry, Hox genes, formation of the placenta, placenta. Factors inducing congenital anomalies. Development of the limbs, trunk and the skull.

**Credits:** 9

**Lectures:** 3 hours/week

**Laboratory:** 6 hours /week

Gross anatomy class: 4 hrs/week

Histology class: 2 hrs/week

**Detailed weekly curriculum**

LECTURE		LAB	
Weeks	Topic	Anatomy	Histology
<b>Week 1 (September 7-11)</b>			
	1. Significance of the subject in the medical training. 2. General osteology. 3. Germ cells. Structure of the spermium. Spermatogenesis.	Anatomical nomenclature, body axes, terms of orientation. Bones of the upper limb.	Microscope. Simple epithelia I.
<b>Week 2 (September 14-18)</b>			
	4. General arthrology and myology 5. Characterization and classification of the epithelial tissue. Membrane specialization of epithelial cells. 6. Oocyte, oogenesis.	Bones and joints of the upper limb.	Simple epithelia II. Stratified epithelia.
<b>Week 3 (September 21-25)</b>			
	7. Glandular epithelium. 8. Connective tissue, connective tissue cells and ground substance. 9. Fertilization.	Joints of the upper limb. Muscles of the ventral surface of the upper limb. Branches of the brachial plexus innervating the upper limb.	Glandular epithelia I.

<b>Week 4 (September 28-October 02)</b>			
	10. Connective tissue fibers. 11. Classification of connective tissue. Adipose, chordoid tissue. 12. Morula, blastula, implantation.	Muscles of the ventral and dorsal surface of the upper limb. Joints, blood vessels and nerves of the upper limb.	Glandular epithelia II.
<b>Week 5 (October 05-09)</b>			
	13. Molecules of adhesion. 14. Cartilage. 15. Molecular bases of gastrulation.	Muscles, joints, vessels and nerves on the ventral and dorsal surface of the upper limb.	Connective tissue I.
<b>Week 6 (October 12-16)</b>			
	16. Bone tissue. 17. Ossification, bone growth. 18. Axes of the body, right-left asymmetry.	Review of the upper limb <b>MID-TERM TEST.</b>	Connective tissue II.
<b>Week 7 (October 19-23)</b>			
	19. Muscle tissue, smooth muscle, cardiac muscle. 20. Striated muscle. 21. Formation of the placenta. Fetal membranes.	Bones and joints of the trunk and lower limb.	Cartilage, bone tissue.
<b>Week 8 (October 26-30)</b>			
	22. Clinical anatomy of the joints and muscles of the upper limb. 23. Vertebral column, clinical anatomy of the chest cavity. 24. Germinal layers. Neurulation.	Joints of the trunk and lower limb. Atlantooccipital joint.	Ossification.
<b>Week 9 (November 02- 06)</b>			
	25. Nervous tissue. Neurons and glial cells. 26. Structure of the neural fibers, degeneration-regeneration. 27. Formation of primary tissues. Homeobox genes	Muscles, vessels and nerves on the dorsal surface of the lower limb. Branches of the sacral plexus innervating the gluteal region and the lower limb.	Muscle tissue.

<b>Week 10 (November 09-13)</b>			
	28. Blood, stem cells biology 29. Bone marrow, hemopoiesis. 30. Granulopoiesis. Extravasatio Cells of the inflammatory processes.	Muscles, vessels and nerves on the dorsal surface of the lower limb.	Nervous tissue, neuron, and neural fibers.
<b>Week 11 (November 16-20)</b>			
	31. Pelvis, diameters of the pelvis. 32. Statics of the pelvis. 33. Development of the limbs and muscles.	Muscles, vessels and nerves on the ventral surface of the lower limb. Lumbar plexus.	Review.
<b>Week 12 (November 23-27)</b>			
	34. <b>MID-TERM TEST</b> 35. Histology of the blood vessels 36. Development of the vertebral column and the trunk.	Muscles, vessels and nerves of the lower limb, review. Skull.	Blood, red bone marrow.
<b>Week 13 (November 30-December 04)</b>			
	37. Clinical anatomy of the joints and muscles of the lower limb (hip, knee) I. 38. Structure of the skin and mammary gland. Histology and development. 39. Malformations.	Bones of the skull. Internal and external base of the skull.	Blood vessels.
<b>Week 14 (December 07-11)</b>			
	40. Subinguinal hiatus, femoral canal, adductor canal hernial canals. 41. Clinical anatomy of the joints and muscles of the lower limb II. (ankle joint, joints of the foot, structure of the foot. Mechanism of walking.) 42. Development of the skull.	Facial skeleton, mandible, orbit, nasal cavity, pterygopalatine fossa. Temporomandibular joint	Skin, mammary gland.

**Examination Period: December 14, 2009 - January 22, 2010**

## TOPICS

### First Semester

#### Anatomy

- 1 Structure and shape of bones. Periosteum. Remodelling and regeneration of the bone.
- 2 Structure and types of joints. Capsule, ligaments, bursae. Mechanism of the joint. Training, resting state, regeneration, changes with age.
- 3 Gross anatomy and types of skeletal muscles. Endo-, peri- and epimysium. Fasciae, aponeuroses, tendons. Mechanism of the muscle function. Training, atrophy.
- 4 Humerus, shoulder joint and its movements. Weak points of the joint capsule, luxation.
- 5 Muscles of the shoulder. Axillary hiatus.
- 6 Clavicula, scapula. Sternoclavicular joint, acromioclavicular joint and their movements.
- 7 Muscles and fasciae of the arm.
- 8 Elbow joint and its movements. Stability of the joint, radioulnar luxation.
- 9 Bones and joints of the forearm. Pronation, supination.
- 10 Flexor muscles and tendon sheaths of the forearm. V-phlegmone of the radial and ulnar tendon sheaths.
- 11 Extensor muscles of the forearm. Tendon sheaths on the dorsal surface of the hand. Extensor retinaculum.
- 12 Radiocarpal end distal radioulnar joints and their movements.
- 13 Carpal bones, their joints, carpal tunnel. Tunnel-syndrome.
- 14 Metacarpophalangeal and interphalangeal joints. Muscles of mesothenar and hypothenar. Insertion of the flexor digitorum muscles. Palmar aponeurosis.
- 15 Joints and muscles of the thumb. Opposition-reposition.
- 16 Ribs, sternum, costovertebral and sternocostal joints. Bony chest cavity, changes with age.
- 17 Axillary artery and its branches.
- 18 Brachial, ulnar and radial arteries and their branches (except for the blood supply of the hand).
- 19 Blood supply of the hand.
- 20 Venous drainage of the upper limb.
- 21 Branches of the brachial plexus (from the cords). Radial nerve and its branches.
- 22 Branches of the brachial plexus (from the cords). Median and ulnar nerves and their branches.
- 23 Sensory innervation of the upper limb.
- 24 Cervical, thoracic and lumbar vertebrae, variations.
- 25 Connections of vertebrae: joints and ligaments, intervertebral disc. Discus hernia.
- 26 Structure, curvatures of the vertebral column. Movements of the vertebral column. Mobile unit (segment) of the vertebral column.
- 27 Sacrum. Joints and ligaments of the pelvis.
- 28 Hip bone, symphysis, static and diameters of the pelvis.
- 29 Hip joint and its movements: neutral (0-) and resting position, luxations.
- 30 Muscles of the hip. Trendelenburg-syndrom, intramuscular injection.
- 31 Femur. Flexor and extensor muscles of the thigh, fascia lata.
- 32 Adductor muscles of the thigh, adductor canal, pes anserinus.
- 33 Knee joint. Stability, position anomalies, injuries.
- 34 Tibia, fibula. Extensor and peroneal muscles of the leg. Peroneus paralysis. Tendon sheaths, fascia cruris.
- 35 Flexor muscles and tendon sheaths of the leg.
- 36 Tarsal bones and their joints.

- 37 Subtalar and talocalcaneonavicular joints (lower spring joint) and their movements. Lines of amputation.
- 38 Talocrural joint and its movements.
- 39 Arches of the foot, their active and passive supportive elements. Lower limb during standing and walking. Hallux valgus.
- 40 Muscles of the sole and muscles on the dorsal surface of the foot.
- 41 Blood supply of the thigh and the hip.
- 42 Popliteal artery. Arterial network of the knee.
- 43 Anterior and posterior tibial arteries. Peroneal (fibular) artery.
- 44 Branches of the lumbar plexus.
- 45 Sacral plexus. Sciatic and tibial nerves.
- 46 Common peroneal (fibular) nerve. Sensory innervation of the foot.
- 47 The veins of the lower limb. Skin innervation of the thigh and leg.
- 48 Calvaria, suturae, fontanel. Trepanation.
- 49 Internal base of the skull its connections.
- 50 Bony nasal cavity and paranasal sinuses.
- 51 Walls and connections of the orbit.
- 52 External base of the skull and its connections. Lines of fracture.
- 53 Course and connections of the facial canal.
- 54 Pterygopalatine fossa and its connections.
55. Mandible, temporomandibular joint. Luxation.
56. Atlantooccipital and atlantoaxial joints.

### **Histology**

- 1 Characteristic features of the epithelial tissue. Classification of the covering epithelium.
- 2 Simple epithelia. Regeneration of the epithelial tissue.
- 3 Surface modifications of the epithelial cells. Lateral and basal surface of the epithelia.
- 4 Classification of covering epithelium. Stratified epithelia.
- 5 Molecules of adhesion.
- 6 Classification of glandular epithelium.
- 7 Connective tissue cells.
- 8 Mononuclear phagocyte system (MPS).
- 9 Connective tissue fibers: collagen, elastic and reticular fibers, fibrillin.
- 10 Intracellular and extracellular phases of the formation of connective tissue fibers.
- 11 Ground substance of the connective tissue, its components, glycoproteins of adhesion.
- 12 Classification of connective tissues.
- 13 Adipose tissue.
- 14 Histology and classification of the cartilage.
- 15 Histology of the bone.
- 16 Enchondral ossification.
- 17 Growth of long bones (epiphyseal cartilage discs, regeneration, repair and remodelling).
- 18 Intramembranous ossification.
- 19 Smooth muscle cell.
- 20 Histology of the cardiac muscle and the conducting system.
- 21 Histology of striated muscle.
- 22 Cytology of the neuron.
- 23 Neuroglia and ependyma. Microglia, the immuncells of the central nervous system.
- 24 Structure of the nerve fiber, sheath, myelination.
- 25 Histology of peripheral nerves and ganglia.
- 26 Red blood cells, erythropoiesis.

- 27 White blood cells.
- 28 Histology of the bone marrow. Leukopoiesis.
- 29 Origin of the hematopoietic stem-cells. Megakaryocyte, thrombocyte.
- 30 Histology of capillaries, extravasation of leukocytes.
- 31 Histology of veins and lymphatic vessels, valves.
- 32 Histology of arteries.
- 33 Histology of the skin and mammary gland.

### **Embryology**

- 1 Structure of the sperm. Spermatogenesis, spermiogenesis.
- 2 Oocyte, oogenesis (follicles, ovulation, atretic follicles).
- 3 Fertilization.
- 4 Morula, blastula. Formation of the trophoblast.
- 5 Implantation, formation of the placenta. Placenta.
- 6 Development of germinal layers, embryonic disc.
- 7 Derivatives of the ectoderm. Neurulation.
- 8 Differentiation of the intraembryonic mesoderm, somites.
- 9 Folding of the embryo. Formation of the external features of the embryo.
- 10 Fetal membranes, amniotic fluid. Umbilical cord. Procedures for assessing the status of the fetus. Twins, twinning.
- 11 Body axes, right-left asymmetry.
- 12 Homeotic genes.
- 13 Congenital anomalies. Factors inducing congenital anomalies.
- 14 Development and malformation of the limbs.
- 15 Development and malformation of the vertebral column and the trunk.
- 16 Development and malformation of the skull.

## Second Semester

### Department of Human Morphology and Developmental Biology Faculty of Medicine, Semmelweis University English Language Course

**Subject:** Muscles of the neck, chest, abdomen, diaphragm, pelvic diaphragm. Gross anatomy and development of the heart. Development of the great arteries and veins. Congenital anomalies of the heart and great vessels. Fetal circulation. Blood vessels of the thoracic and abdominal cavity. Lymphatic drainage of these regions. Gross anatomy, histology, development, clinical anatomy and congenital anomalies of the digestive, the respiratory, the urinary, and the reproductive system.

**Credits:** 9

**Lecture:** 3 hours/week

**Laboratory:** 6 hours/week (Anatomy: 4 hrs/week, Histology: 2 hrs/week)

#### Detailed weekly curriculum

LECTURE		LAB	
Weeks	Topic	Anatomy	Histology
<b>Week 1 ( February 1-5)</b>			
	1. Histology of the lymphatic organs, thymus, tonsils, mucosal lymphatic tissues 2. Histology and blood circulation of the spleen 3. Development of the face.	Muscles and vessels of the face. Muscles and fasciae of the neck. Demonstration.	Lymphatic tissue I.: tonsils and thymus.
<b>Week 2 ( February 8-12)</b>			
	4. Chest cavity, clinical anatomy of the respiratory movements. 5. Tongue, teeth. Development of the tooth. 6. Oral cavity, pharynx, oesophagus. Development of the foregut, malformations of the foregut.	Oral cavity, teeth, tongue, isthmus faucium, soft palate. Topography of the salivary glands. Dissection of the supra- and infrahyoid muscles; pectoral and abdominal muscles	Lymphatic tissue II.: lymph node, spleen.

<b>Week 3 ( February 15-19)</b>			
	<p>7. Larynx, anatomical base of the conicotomy and laryngoscopy.</p> <p>8. Trachea, lung, pleura, tracheotomy.</p> <p>9. Branchial apparatus, branchial pouches and derivatives, development of the lung.</p>	<p>Demonstration of the nasal cavity. Dissection of the pharynx, larynx. Pectoral and abdominal muscles.</p>	<p>Lip, salivary glands.</p>
<b>Week 4 ( February 22-26)</b>			
	<p>10. Histology of the respiratory system. Respiration distress syndrome.</p> <p>11. Anatomy of the heart. Cardiac wall, anulus fibrosus, cardiac valves.</p> <p>12. Pericardium, topography and clinical anatomy of the heart.</p>	<p>Surface projection of thoracic viscera. Opening of the thoracic cavity. Mediastinum. Trachea, pleura, lung, dissection of the bronchi and segments.</p>	<p>Tooth. Tooth development. Tongue</p>
<b>Week 5 (March 1-5)</b>			
	<p>13. Conducting system, innervation and blood supply of the heart. Anatomical base of the heart attack</p> <p>14. Diaphragm. Structures passing through the diaphragm. Hernia.</p> <p>15. Branchial arches and their derivatives.</p>	<p>Opening of the pericardium. Dissection of cardiac vessels and cardiac chambers.</p>	<p>Introduction to the histology of internal organs. Respiratory system I.</p>
<b>Week 6 (March 8-12)</b>			
	<p>16. Abdominal wall. Hernia canals. Inguinal canal.</p> <p>17. Gross anatomy of the stomach - parts, topography, peritoneal relations, blood supply.</p> <p>18. Development of the veins, early development of the heart.</p>	<p>Mediastinum. Heart. Demonstration of the diaphragm. Dissection of the neck and chest cavity.</p>	<p>Respiratory system II. Conducting system of the heart.</p>

<b>Week 7 (March 15-19)</b>			
	19. Small intestine – gross anatomy and histology. 20. Large intestine and rectum - gross anatomy and histology. Topography of the internal hernias. 21. Development and congenital anomalies of the heart and great blood vessels.	Cervical and thoracic organs. Muscles of the chest and abdomen  Review.	Esophagus. Stomach.
<b>Week 8 (March 22-26)</b>			
	22. Gross anatomy of the liver, peritoneal relations, portal circulation. Porto-caval anastomosis and their clinical aspects. 23. Histology of the liver and gall bladder. 24. Fetal circulation, perinatal changes in circulation.	<b>MID-TERM TEST.</b>  Surface projection and topography of abdominal viscera. Opening of the abdominal cavity. Peritoneum.	Small and large intestine. Appendix. Rectum (demonstration only).
<b>Spring Holiday: March 29-April 2</b>			
<b>Week 9 (April 5-9)</b>			
	25. Gross anatomy of the kidney (capsules, blood supply, renal hilum) and the ureter. 26. Histology of the kidney. 27. Division of the embryonic body cavity. Septum transversum.	Hepatoduodenal ligament, coeliac trunk. Liver.	Liver, gall bladder
<b>Week 10 (April 12-16)</b>			
	28. Male reproductive organs - overview. Gross anatomy of the testis and its coverings. Testicular. 29. Histology of the testis and the epididymis. 30. Development of the digestive tract, development of the foregut, hindgut, the liver and the pancreas.	Superior and inferior mesenteric artery. Porto-caval anastomoses. Opening of the stomach and duodenum. Common bile duct.	Kidney, urether, urinary bladder

<b>Week 11 (April 19-23)</b>			
	<p>31. Male urethra, penis, erection. Anatomical base of the endoscopy of the urethra.</p> <p>32. Female reproductive tract - overview, histology of the ovary and the uterus. Uterine cycle.</p> <p>33. Development of the peritoneum. Clinical anatomy of the omental bursa.</p>	<p>Retroperitoneum, abdominal aorta and its branches. Kidney, adrenal gland, ureter, urinary bladder.</p> <p>Peritoneal relations of the posterior abdominal wall.</p>	<p>Testis, epididymis, spermatic cord.</p>
<b>Week 12 (April 26-30)</b>			
	<p>34. Uterus - parts, topography, blood supply.</p> <p>35. Pelvic diaphragm. Birth canal</p> <p>36. Pronephros, mesonephros, and metanephros.</p>	<p>Retroperitoneum.</p>	<p>Seminal vesicle, prostate. Review.</p>
<b>Week 13 (May 3-7)</b>			
	<p>37. <b>MID-TERM TEST.</b></p> <p>38. Lymphatic drainage of the head, neck, chest cavity, abdomen and pelvis</p> <p>39. Development of the urinary bladder, ureter, urethra. Congenital anomalies of the kidney and urinary bladder.</p>	<p>Female reproductive organs. Pelvic organs. Blood vessels and nerves of the pelvis. Demonstration of the pelvic diaphragm.</p>	<p>Ovary, uterine tube. Uterus.</p>
<b>Week 14 (May 10-14)</b>			
	<p>40. Clinical anatomy. Image analysis I.</p> <p>41. Clinical anatomy. Image analysis II.</p> <p>42. Migration of germ cells, sex determination, development of the gonads.</p>	<p>Male reproductive organs. Pelvic organs.</p>	<p>Umbilical cord. Placenta. Vagina, labium minus.</p>

**Examination Period: May 17-June 30. and August 30 - September 3. 2010**

**TOPICS**  
**Second Semester**

**Splanchnology - Anatomy**

1. Gross anatomy, blood supply, lymphatic drainage of the oral cavity and the teeth.
2. Gross anatomy, blood supply, lymphatic drainage of the salivary glands.
3. Gross anatomy, blood supply of the soft palate and isthmus faucium. Pharyngeal lymphatic ring.
4. Gross anatomy of the tongue. Muscles, blood supply, lymphatic drainage of the tongue.
5. Nasal cavity, blood supply, lymphatic drainage.
6. Gross anatomy, blood supply and lymphatic drainage of the pharynx.
7. Gross anatomy, topography, blood supply and lymphatic drainage of the esophagus.
8. Gross anatomy and topography of the larynx (cartilages, joints, ligaments, membranes). Coniotomy.
9. Muscles of the larynx. Rima glottidis, phonation. Innervation, blood supply and lymphatic drainage of the larynx. Laryngoscopy.
10. Topography of the trachea and main bronchi. Bronchi, pulmonary segment. Tracheotomy.
11. Lung, surface projection of the lung, pulmonary hilum. Anatomical base of the percussion.
12. Pleura, surface projection of the pleura. Anatomical base of the thoracocentesis.
13. Muscles of the thorax, intercostal muscles, movements of expiration and inspiration.
14. Rectus abdominis muscle and rectus sheath. Rectus diastasis. Laparotomy.
15. Oblique and transverse abdominal muscles. Lumbar trigone, abdominal press.
16. Inguinal ligament. Hernial canals, inguinal and femoral canal.
17. Diaphragm, abdominal respiration.
18. Lesser sac (omental bursa) and dorsal reflection of the peritoneum. Clinical aspects.
19. Position, shape, parts, peritoneal relations, blood supply, innervation and lymphatic drainage of the stomach. Anatomic aspects of endoscopy.
20. Position, peritoneal relations, blood supply and lymphatic drainage of the small intestines.
21. Position, peritoneal relations, blood supply and lymphatic drainage of the large intestines.
22. Position, topography, peritoneal relations, blood supply and lymphatic drainage of the rectum. Pharmacological importance of the venous drainage.
23. Shape, position and peritoneal relations of the liver. Palpation. Lobes and segments of the liver.
24. Blood supply and lymphatic drainage of the liver. Fine structure and function of the liver. Intrahepatic bile ducts.
25. Portal circulation of the liver. Portal vein. Clinical aspect of the portocaval anastomosis.
26. Gross anatomy, peritoneal relations, blood supply and lymphatic drainage of the gall bladder. Extrahepatic bile ducts. Radiological examination.
27. Shape, parts, topography, blood supply and lymphatic drainage of the pancreas. Surgical approach of the pancreas.
28. Position, topography, peritoneal relations and blood supply of the spleen. Palpation.
29. Gross anatomy (shape, capsules, cortex, medulla, sinus) of the kidney. Anatomical base of surgery of the kidney.
30. Longitudinal section of the kidney. Blood supply of the kidney. Intrarenal circulation.
31. Renal calices, renal pelvis. Parts, course and blood supply of the ureter. Formation and operation of the kidney stone.
32. Pelvic diaphragm, muscles and fasciae, openings and their sphincter muscles.
33. Shape, position, peritoneal relations, blood supply and lymphatic drainage of the urinary bladder. Retropubical approach of the bladder.

- 34 Gross anatomy, topography, blood supply of the ductus deferens, prostate and seminal vesicle. Surgical approach of the prostate.
- 35 Gross anatomy, topography of the penis and urethra. Endoscopy of the urethra.
- 36 Gross anatomy, topography, coverings, of the testis, epididymis and spermatic cord. Anatomical base of varicous dilation of the left testicular vein.
- 37 Gross anatomy, topography, parts, blood supply and lymphatic drainage of the uterus.
- 38 Support of the uterus, ligaments, peritoneal relations. Gross anatomy of the vagina. Douglas puncture.
- 39 Gross anatomy, topography, peritoneal relations, blood supply and lymphatic drainage of the ovary and the uterine tube.
- 40 Gross anatomy of the female perineum and external genitalia.
- 41 Topography, surface projection, and antero-posterior X-ray image of the heart. Auscultation points, absolute and relative cardiac dullness.
- 42 Structure of the myocardium, fibrous skeleton and conducting system of the heart.
- 43 Atria and atrioventricular orifices. Bicuspidal and tricuspidal valves.
- 44 Ventricles of the heart. Pulmonary and aortic orifices. Semilunar valves.
- 45 Blood supply of the heart. Coronary arteries, cardiac veins. Right-left coronary dominance. Innervation of the heart. Anatomical base of the heart attack.
- 46 Pericardium and its reflections. Heart tamponade. Pericardiocentesis.
- 47 Topography and branches of the aortic arch. Subclavian artery and its branches. Aortography.
- 48 Topography and branches of the descending aorta. Aortography.
- 49 Internal iliac artery and its branches.
- 50 Veins of the head and neck. Carotid sheath, omohyoid muscle.
- 51 Lymphatic drainage of the head and neck.
- 52 Great lymphatic vessels.
- 53 Inferior vena cava and its tributaries (except for the external iliac vein).
- 54 Lymphatic drainage of the thoracic wall, thoracic viscera and the breast.
- 55 Lymphatic drainage of the abdominal and pelvic viscera.
- 56 Mimetic muscles. Paralysis of the facial nerve.
- 57 Muscles of mastication. Trismus.
58. Hyoid bone, suprahyoid muscles, sternocleidomastoid muscle.
59. Infrahyoid muscles, deep cervical muscles, cervical fasciae. Topography of coniotomy.
60. External carotid artery and its branches.

### **Splanchnology - Histology**

- 1 Specific and accessory cells of immun system.
- 2 Recirculation of lymphocytes.
- 3 Histology of the thymus.
- 4 Histology of the lymph node.
- 5 Histology of tonsills and mucosal lymphatic tissue.
- 6 Blood circulation of spleen.
- 7 Histology of the spleen.
- 8 Histology of the tooth, decidous and permanent teeth, dentition.
- 9 Development of the tooth. Shedding of teeth
- 10 Oral cavity: histology of the lip, bucca, gingiva, palate and tongue.
- 11 Histology of the salivary glands.
- 12 Histology of the nasal cavity and upper respiratory system.
- 13 Histology of the lung. Respiration distress syndrome (RDS).
- 14 Histology of the pharynx and oesophagus.

- 15 Histology of the stomach. Histological base of ulcer.
- 16 Histology of the small intestine. Endocrine system of the gastrointestinal tract.
- 17 Histology of the duodenum, motility and innervation of the intestine.
- 18 Histology of the large intestine and the rectum (intestinal and anal part).
- 19 Hepatic circulation, sinuses, relation of liver sinus to the hepatocytes. Stroma of the liver.
- 20 Hepatocyte, hepatic lobule, intra- and extrahepatic bile ducts. Liver segment.
- 21 Histology of the endocrine and exocrine pancreas.
- 22 Histology of the kidney (except for the blood circulation of the kidney, juxtaglomerular apparatus).
- 23 Blood circulation of the kidney, juxtaglomerular apparatus.
- 24 Histology of the urinary excretory passages (renal calyx, renal pelvis, ureter, urinary bladder).
- 25 Histology of the penis. Mechanism of erection including neural control.
- 26 Histology of the testis.
27. Histology of the epididymis, ductus deferens, seminal vesicle.
28. Histology of the prostate. Hyperplasia of the mucous and submucous glands.
29. Histology of the ovary. Ovulation.
30. Histology and cyclic changes of the endometrium of uterus. Cyclic changes of the endometrium. Myometrium.
31. Histology of the uterine tube, vaginal portion of the cervix, vagina, labium pubendi majus and labium pubendi minus.
32. Histology of the placenta and umbilical cord.

### **Splanchnology - Embryology**

- 1 Development of the face. Congenital anomalies.
- 2 Branchial (pharyngeal) apparatus. Derivatives of the branchial arches.
- 3 Development and derivatives of branchial pouches and of the pharyngeal pouches. Congenital anomalies.
- 4 Development of the tongue, thyroid gland and palate. Congenital anomalies.
- 5 Development of the respiratory system.
- 6 Development and division of the embryonic body cavity.
- 7 Foregut and its derivatives (esophagus, stomach). Development of the omental bursa.
- 8 Development of the liver, pancreas and spleen.
- 9 Development of the mid- and hindgut and their derivatives. Development of the peritoneum (except omental bursa).
- 10 Pronephros, mesonephros, metanephros. Congenital anomalies.
- 11 Differentiation of the cloaca. Development and congenital anomalies of the rectum and urinary bladder.
- 12 Development of the male reproductive tract, including the accessory glands.
- 13 Development of the female reproductive tract. Development and congenital anomalies of the vagina.
- 14 Development of the external genitalia. Hermaphroditism.
- 15 Development of the gonads. Development of the testis, descensus testis. Congenital anomalies.
- 16 Development of the gonads. Development and descent of the ovary.
- 17 Development of the heart tube, its dilatations.
- 18 Partitioning and congenital anomalies of the atria.
- 19 Partitioning and congenital anomalies of the ventricles.
- 20 Development of the bulbus and truncus arteriosus. Branchial arteries and their derivatives. Congenital anomalies.

- 21 Development of the sinus venosus and the primitive venous system. Development of great veins.
- 22 Fetal circulation. Perinatal changes in circulation.

### Third Semester

**Department of Human Morphology and Developmental Biology**  
**Faculty of Medicine, Semmelweis University**  
**English Language Course**

**Subject:** Anatomy, histology and embryology of the **central and the peripheral nervous system**. Histology and development of the **endocrine organs**. Anatomy, histology and embryology of the **sensory organs**. Visual pathway, pathway of the pupillary light reflex. Auditory and vestibular pathway. Gustatory apparatus. Olfactory apparatus.

**Credits:** 8

**Lecture:** 3 hours/week

**Laboratory:** 5 hours/week (5 hrs/week anatomy, or 2.5 hrs anatomy and 2.5 hrs histology)

#### Detailed weekly curriculum

LECTURE		LAB	
Weeks	Topic	Anatomy	Histology
<b>Week 1</b>			
	1. Introduction to neuromorphology. 2. Meninges, ventricles, liquor. 3. Interneuronal synapses, chemical neurotransmission. Morphological bases of the neurophysiological processes.	Spinal cord, its blood supply meninges. Dissection of the nuchal and back muscles.	
<b>Week 2</b>			
	4. Receptors and effector nerve endings. Reflex arch. 5. Structural organization of the spinal cord. Gray matter. Rexed zones. 6. White matter of the spinal cord. Pathways of the spinal cord.	Spinal cord, segments, spinal nerves, plexuses. Nuchal and back muscles.	
<b>Week 3</b>			
	7. Spinal cord reflexes 8. Symptomes of the injury of spinal cord pathways. Brown-Sequard syndrome. 9. Morphological and functional units of the cerebrum and brain stem. Brodman's areas.	Surface of the brain. Meninges, blood supply, cranial nerves. Brodman's areas. In situ dissection of the spinal cord, dorsal root ganglion. Epidural anaesthesia.	

<b>Week 4</b>			
	10. Internal organization of the brain stem. 11. Nuclei of cranial nerves. 12. Diencephalon. III. ventricle.	Median sagittal section of the brain. Corpus callosum. Ventricles. Brain stem, cerebellum, Tonsils of the cerebellum. Anatomical base of the inclusion.	
<b>Week 5</b>			
	13. Thalamus. 14. Hypothalamus, hypothalamo-hypophyseal system. 15. Histology of the hypophysis. Portal circulation.	Flechsigs-section. Frontal sections. Review	
<b>Week 6</b>			
	16. Adrenal gland, thyroid and parathyroid gland, pineal gland. Clinical aspects of the neuroendocrine system. 17. The dorsomedial (medial lemniscus) sensory system. Somatotopy. Somatosensory cortex. 18. The ventrolateral (spinothalamic) sensory system.	<b>MID-TERM TEST</b>  In situ dissection of the brain. Meninges, cisterna punctum. Opening of the III. and IV. ventricles. Brain stem.	Peripheral nerve. Nerve endings.
<b>Week 7</b>			
	19. Gustatory and olfactory apparatus. 20. Limbic system. 21. Histology of cerebral cortex.	Base of the skull. Cranial nerves. Trigeminal ganglion. Cavernous sinus.	Spinal cord, spinal ganglion, autonomic ganglion.
<b>Week 8</b>			
	22. Motor unit, lower and upper motoneuron, somatomotor cortex. 23. Pyramidal tract. 24. Basal ganglia and their neural connections. Clinical anatomy of the motor pathway.	Cervical and brachial plexus. Dissection of the vessels on the head and the neck. Cranial nerves.	Endocrine organs. I. Hypothalamus. Hypophysis. Pineal gland.

<b>Week 9</b>			
	<p>25. Histology of cerebellar cortex.</p> <p>26. Neural connections of the cerebellum. Anatomical bases of the cerebellar syndromes.</p> <p>27. Reticular formation and its neural connections. Chemical neuroanatomy.</p>	<p>Nerves and blood vessels of the head and the neck.</p> <p>Neuroanatomy of the skin innervation.</p> <p>Anatomical bases of the injury of plexuses and neurons.</p>	<p>Endocrine organs. II.</p> <p>Thyroid and parathyroid gland. Adrenal gland. Pancreas.</p>
<b>Week 10</b>			
	<p>28. Autonomic nervous system. I. Thoracolumbar sympathetic system.</p> <p>29. Autonomic nervous system II. Craniosacral parasympathetic system.</p> <p>30. Development of the nervous system I. Early stage of development, differentiation of the neural tube.</p>	<p>Vessels and nerves of the head and the neck. Lumbar and sacral plexuses.</p>	<p>Cerebrum, cerebellum, hippocampus, substantia nigra. Choroid plexus.</p>
<b>Week 11</b>			
	<p>31. Development of the nervous system, II. Histogenesis, craniocaudal and dorsoventral differentiation. Malformations.</p> <p>32. Development of the nervous system, III. Development of the spinal cord, brain, brain stem and cerebellum.</p> <p>33. Development of the nervous system, IV. Development of the telencephalon, basal ganglia, choroid plexus. Liquor circulation. Hydrocephalus</p>	<p>Review.</p> <p><b><i>MID-TERM TEST</i></b></p>	
<b>Week 12</b>			
	<p>34. Development of the nervous system, V. Neural crest and its derivatives.</p> <p>35. Structure of the eye. Fibrous and vascular envelopes of the eye. Refractory media of the eye.</p> <p>36. Development of the eye.</p>	<p>Dissection of eye and orbit. External muscles of the eye and their innervation.</p> <p>Morphological base of strabism.</p>	

<b>Week 13</b>			
	<p>37. Structure of the retina. Morphology of colour vision.</p> <p>38. Visual pathway, pupillary reflex. Accommodation. Symptoms of injuries.</p> <p>39. Outer eye muscles. Accessory organs of the eye. Visual center. Secretion, drainage and absorption of the tear.</p>	<p>Dissection of the eye and orbit.</p> <p>Outer ear. Tympanic cavity. Eustachian tube. Preparation of the ossicles.</p>	<p>Eye, optic nerve. Eye lid, lacrimal gland.</p>
<b>Week 14</b>			
	<p>40. Auditory apparatus, outer ear, middle ear.</p> <p>41. Inner ear. Vestibular apparatus and its neural connections. Organ of Corti. Auditory pathway.</p> <p>42. Development of the auditory apparatus. Clinical anatomy of the auditory organ.</p>	<p>Inner ear.</p> <p>Anatomical basis of auditory and equilibrium disorders.</p> <p>Nervous system - review.</p>	<p>Auricle.</p> <p>Auditory and vestibular organ.</p>

**TOPICS****Third Semester****Neuroanatomy**

- 1 Spinal cord, regional differences, meninges. Blood supply of the spinal cord.
- 2 Spinal segments. Spinal nerve, spinal ganglion.
- 3 White matter of the spinal cord, pathways.
- 4 Gray matter of the spinal cord. Laminae of Rexed.
- 5 Gross anatomy, nuclei, and blood supply of the medulla oblongata.
- 6 Gross anatomy, nuclei, and blood supply of the pons.
- 7 Gross anatomy, nuclei, and blood supply of the mesencephalon.
- 8 Fourth ventricle, rhomboid fossa.
- 9 Nuclei of the brain stem.
- 10 Parts of the diencephalon. Third ventricle. Liquor contact neurons, circumventricular organs.
- 11 Hypothalamic nuclei and their connections (except for the hypothalamo-hypophyseal system).
- 12 Topography and nuclei of the thalamus.
- 13 Gross anatomy of the cerebellum. Archi-, paleo- and neocerebellum.
- 14 Afferent and efferent connections of the cerebellum.
- 15 Cortical areas. Fibre systems of the telencephalon.
- 16 Lateral ventricle and its X-ray anatomy, liquor-brain barrier and brain-liquor barrier.
- 17 Leptomeninges, subarachnoidal space, cisternae. Cistern puncture.
- 18 Dura mater, sinuses (except cavernous sinus), veins of the brain.
- 19 Choroid plexus. Production, circulation, drainage of the cerebrospinal fluid. Blood liquor and blood-brain barrier.
- 20 Blood supply of the brain (vertebral artery).
- 21 Internal carotid artery and its branches. Circle of Willis.
- 22 The dorsomedial (medial lemniscus) system.
- 23 The ventrolateral (spinothalamic) system.
- 24 Cranial somatic afferent pathways.
- 25 Visual pathway, pathway of the pupillary light reflex.
- 26 Auditory pathway.
- 27 Vestibular system and their connections.
- 28 Taste buds, sensory fibers for taste, cortical taste area.
- 29 Olfactory system and its central connections.
- 30 Lower and upper motor neurons, motor unit, motor end plate.
- 31 Tendon stretch reflex. Gamma motoneuron, muscle spindle, gamma loop.
- 32 Ipsilateral flexor-contralateral stretch reflex, tendon spindle.
- 33 Primary and secondary motor cortex, pyramidal tract (corticospinal), corticobulbar and corticomesencephalic tracts.
- 34 Basal ganglia and their connections. Extrapyramidal pathways.
- 35 Cranio-sacral parasympathetic nervous system.
- 36 Thoraco-lumbar sympathetic nervous system.
- 37 The hypothalamo-hypophyseal system, magno- and parvocellular neurosecretory system, portal circulation.
- 38 Nuclei, branches, distribution of efferent somatic cranial nerves.
- 39 Nuclei of the trigeminal nerve. Trigeminal ganglion. Stretch reflex of the muscles of mastication.
- 40 Ophthalmic nerve: course, branches, distribution.

- 41 Maxillary nerve: course, branches, distribution.
- 42 Mandibular nerve: course, branches, distribution.
- 43 Facial nerve: nuclei, course, branches, distribution.
- 44 Glossopharyngeal and accessory nerve: nuclei, course, branches, distribution.
- 45 Vagus nerve: nuclei, course, branches, distribution.
- 46 Reticular formation, ascending reticular activating system and its neurotransmitters.
- 47 Limbic system.
- 48 Cavernous sinus, its connection and structures passing through the sinus.
- 49 Cervical plexus. Intercostal nerves. Dorsal rami of the spinal nerves.
- 50 Brachial plexus.
- 51 Lumbar plexus.
- 52 Sacral plexus.
- 53 Nuchal muscles.
- 54 Deep muscles of the back. Thoracolumbar fascia.
- 55 Superficial muscles of the back. Bandage allowing for the scapular mobility.

### **Neurohistology**

- 1 Types of neurons. Intercellular space of the nervous system, non-synaptic signal transduction.
- 2 Interneuronal synapses, classical chemical neurotransmitters.
- 3 Injury and regeneration of nerve fibers.
- 4 Peripheral afferent nerve endings.
- 5 Peripheral efferent nerve endings (myoneural synapses).
- 6 Histology of the paleo-, archi-, neo-, iso- and allocortex.
- 7 Histology of the cerebellum, termination of afferent fibers.

### **Neuroembryology**

- 1 Derivatives of ectoderm. Neurulation.
- 2 Primary nervous tissue, differentiation of the neural tube.
- 3 Formation of primary brain vesicles, primary brain flexures.
- 4 Development and congenital anomalies of the telencephalon and basal ganglia.
- 5 Development of the brain stem and the cerebellum.
- 6 Development and congenital anomalies of the spinal cord.
- 7 Development of the peripheral nervous system.
- 8 Development of the pituitary gland and the pineal gland.
- 9 Development of the adrenal gland.

### **Sensory organs**

- 1 Gross anatomy of the eye, blood supply, innervation.
- 2 External muscles of the eye; function, innervation.
- 3 Histology of the fibrous envelope of the eye, optic nerve.
- 4 Histology of the vascular envelope of the eye. Blood supply of the eye.
- 5 Structure and suspensory ligaments of the lens. Accomodation.
- 6 Chambers of the eye. Secretion, circulation, and drainage of the aqueous humor.
- 7 Fine structure of the photoreceptor cells.
- 8 Histology of the retina.
- 9 Histology of the eyelid. Lacrimal gland, secretion, drainage and absorption of the tear.
- 10 Development of the eye.

- 11 External acoustic meatus. Position, gross anatomy and histology of the tympanic membrane.
- 12 Walls and connections of the middle ear cavity.
- 13 Auditory ossicles, their joints and muscles.
- 14 Bony and membranous labyrinth. Secretion and drainage of the endolymph and perilymph.
- 15 Histology of the membranous cochlea.
- 16 Histology of the vestibular part of the membranous labyrinth.
- 17 Development of the inner ear.

### **Endocrine glands**

- 1 Histology of the anterior lobe of the pituitary gland. Blood supply.
- 2 Histology of the intermediate and posterior lobe of the pituitary gland.
- 3 Histology of the thyroid and parathyroid gland.
- 4 Histology of the adrenal gland.
- 5 Histology and neural connections of the pineal gland.

### Fourth Semester

**Department of Human Morphology and Developmental Biology**  
**Faculty of Medicine, Semmelweis University**  
**English Language Course**

**Subject:** Regional anatomy of the head, neck, trunk, and body cavities. Gross anatomy of the pharynx, larynx, and peritoneum. Section anatomy.

**Credits:** 5

**Lecture:** 1 hour/week

**Laboratory:** 4 hours anatomy or 2 hours anatomy plus 2 hours histology

#### Detailed weekly curriculum

LECTURE		LAB	
Weeks	Topic	Anatomy	Histology
<i>Week 1</i>			
	1. Regional and sectional anatomy of the upper limb.	Dorsal regions of the head, neck, chest wall and limbs. Cross section of the arm and forearm. Bones and joints of the upper limb. Topography of radial nerve injury. Dorsal veins of the hand.	
<i>Week 2</i>			
	2. Regional and sectional anatomy of the lower limb.	Dorsal regions of the head, neck, chest wall and limbs. Cross section of the thigh and leg. Bones and joints of the lower limb. Medial and lateral malleolar regions. Anastomoses between deep and superficial veins. Topography of cistern puncture. <i>In situ</i> dissection of the brain.	

<b>Week 3</b>			
	3. Vertebral column and its function. Intervertebral disc.	Dorsal regions of the head, neck, chest wall and limbs. <i>In situ</i> dissection of the brain. <i>In situ</i> dissection of the orbit. Cross section of the neck.	
<b>Week 4</b>			
	4. Calvaria, face, mimetic muscles - blood supply and innervation.	Ventral regions of the head, neck, limb. Cranial nerves related to these regions. Subclavian artery, external carotid artery and their branches. Subclavian vein, internal jugular vein and their tributaries.	
<b>Week 5</b>			
	5. Orbit and pterygopalatine fossa.	Ventral regions of the neck, limbs. Surface projection of thoracic viscera. Thoracic cavity <i>in situ</i> . Pleura, pericardium, cardiac valves. Topography of thoracocentesis and cardiac puncture.	
<b>Week 6</b>			
	6. Floor of the oral cavity, topography of the salivary glands.	Ventral regions of the neck, head and limbs. Topography of the stellate ganglion. Mediastinum. Surface projection of abdominal viscera. Abdominal cavity <i>in situ</i> .	
<b>Week 7</b>			
	7. Topography of the neck.	Ventral regions of the head, neck, limbs. Lung, opening of the pericardium. Blood vessels of the heart.	

<b>Week 8</b>			
	8. Gross anatomy of the mammary gland and armpit.	Ventral regions of the head, neck, limbs. Posterior mediastinum. Removal of intestines. Retroperitoneum. Uropoietic system.	
<b>Week 9</b>			
	9. Mediastinum.	Abdominal aorta. Lumbar plexus. Retroperitoneum. Ventral regions of the head, neck, limbs. External and internal male reproductive organs.	Nervous system. Sensory organs. Endocrine glands.
<b>Week 10</b>			
	10. Posterior abdominal wall, retroperitoneum.	External and internal female reproductive organs. Perineum.	Lymphatic tissue. Blood vessels, bone marrow.
<b>Week 11</b>			
	11. Pelvis, female perineum.	External genitalia, perineum. Pelvis, internal iliac artery, sacral plexus.	Digestive tract. I.
<b>Week 12</b>			
	12. Topography and CT of the abdomen.	Topography of the rectum. Pelvis, perineum.	Digestive tract. II.
<b>Week 13</b>			
	13. Clinical anatomy. Laparoscopy. Laparoscopic surgery.	Brain, spinal cord. Review of dissected regions.	Uropoietic system. Male reproductive organs.
<b>Week 14</b>			
	14. Clinical anatomy. Endoscopy (rectoscopy, colonoscopy).	Review.	Female reproductive organs. Placenta, umbilical cord.

## TOPICS

### Fourth Semester

#### Regional Anatomy

- 1 Regional anatomy of the shoulder region. Luxation of the shoulder joint, compression of the subclavian artery. Punction of the subclavian vein.
- 2 Regional anatomy of the arm pit, regional lymph nodes. Anastomosis and variations of the axillary artery, anatomical principles of its ligation.
- 3 Topography, blood supply, innervation and lymphatic drainage of the mammary gland. Mastectomy.
- 4 Regional anatomy of the dorsal aspect of the arm. Paralysis of the radial nerve.
- 5 Regional anatomy of the ventral aspect of the arm. Possible ligations in case of arterial bleeding.
- 6 Cross section of the arm. Image diagnosis.
- 7 Regional anatomy of the cubital fossa. Palpation of arteries, measurement of the blood pressure. Collateral circulation.
- 8 Regional anatomy of the ventral aspect of the forearm. Palpation of arteries. Incision directions.
- 9 Regional anatomy of the dorsal aspect of the forearm. Typical fractures of the radius.
- 10 Cross section of the forearm. Image diagnosis.
- 11 Regional anatomy of the dorsal aspect of the wrist and of the hand. Anatomical snuff box. Extensor retinaculum, pathological forms of the dorsal tendon sheaths („sand watch” and „ganglion” forms).
- 12 Palmar aponeurosis and its insertion. Flexor retinaculum, carpal canal and its content. Phlegmone of radial and ulnar tendon sheaths. Carpal tunnel syndrome.
- 13 Palmar region. Regional anatomy of the fingers. Blood supply of the tendon sheaths, innervation of the fingers, morphological base of their local anesthesy.
- 14 Superficial venous drainage and lymphatic drainage of the upper limb. Cubital anastomoses, venous punction.
- 15 Regional anatomy of the gluteal region. Intramuscular injection, luxation-position, Roser-Nelaton’s line.
- 16 Ischiorectal fossa. Perineum. Paraproctium, anal fistula, haemorrhoides; topography of the urine infiltration (during urethral damage).
- 17 Inguinal ligament and its topography. Inguinal and femoral canal. Hernias.
- 18 Regional anatomy of the ventral aspect of the thigh. Iliopectineal fossa. Surgical anatomy of hernias and the graeter saphenus vein.
- 19 Regional anatomy of the dorsal aspect of the thigh. Approach and ligation of the femoral artery. Collateral circulation of the thigh.
- 20 Cross section of the upper third of the thigh. Image diagnosis.
- 21 Regional anatomy of the popliteal fossa. Movements following damages of the patella, ligaments and menisci. Changes of the form and resting position during inflammation.
- 22 Regional anatomy of the anterior and lateral aspect of the leg. Symptomes of the peroneus-paralysis.
- 23 Regional anatomy of the posterior aspect of the leg. Surgical anatomy of the lesser saphenus vein; ligation and collateral circulation of the popliteal artery.
- 24 Cross section of the middle third of the leg. Image diagnosis.
- 25 Dorsal region of the foot, sensory innervation. Palpation of the dorsal artery of the foot.
- 26 Structures topographically related to the medial and lateral malleolus. Approach of the greater saphenus vein for punction and transfusion.

- 27 Regional anatomy and sensory innervation of the sole. Palpation of the arteries. Static of the foot.
- 28 Superficial veins and lymphatic drainage of the lower limb. Connections of the superficial and deep veins.
- 29 Superior mediastinum and its structures. Anesthesia and biopsy through the neck.
- 30 Posterior mediastinum and its structures. Esophageal constrictions.
- 31 Cross section of the thorax (at level Th6-7). Image diagnosis.
- 32 Gross anatomy, innervation and movements of the diaphragm, structures passing through the diaphragm. Diaphragmatic hernias, diaphragmatic (abdominal) respiration.
- 33 Abdominal wall - blood supply, sensory innervation, lymphatic drainage. Palpable internal organs, abdominal pressure, muscular defence (“Défense musculaire”), hernias.
- 34 Regional anatomy and sensory innervation of the back of the neck. Suboccipital triangle. Suboccipital puncture.
- 35 Superficial structures of the back, palpable organs and bony structures. Sensory innervation of the back.
- 36 Peritoneum, peritoneal recesses and internal hernias.
- 37 Cross section of the abdominal cavity (at level Th12-L1). Image diagnosis.
- 38 Cross section of the male pelvis (at level S5). Image diagnosis.
- 39 Topography of the male pelvic organs. Constrictions of the male urethra. Surgical approach of the prostate.
- 40 Median sagittal section of the male pelvis. Palpation of the prostate.
- 41 Topographic relationship of the female pelvic organs. Palpations of the ovaries and uterine appendages (adnexes). Ovarian cysts and anatomy of the Douglas-puncture.
- 42 Median sagittal section of the female pelvis. Measurement of the conjugata diagonalis and calculation of the conjugata vera.
- 43 Gross anatomy of the female perineum and external genitalia. Topography of the Bartholin-glands.
- 44 Superficial and palpable structures and sensory innervation of the neck. Surgical anatomy of the tracheotomy.
- 45 Cross section of the neck (at level C5). Image diagnosis.
- 46 Carotid and median cervical region of the neck. Palpation of the thyroid gland and the carotid artery, surgical anatomy of the carotidotomy and thyroidectomy.
- 47 Submandibular region. Cervical fasciae and lymph nodes.
- 48 Supraclavicular region. Scaleno-tracheal fossa. Palpation and ligation of the subclavian artery. Lymph nodes (Virchow-,glands”).
- 49 Parapharyngeal and retropharyngeal space, their content and relations. Cervical fasciae.
- 50 Fasciae, blood supply and sensory innervation of the face. Infraorbital and buccal region. Trigeminal pressure points.
- 51 Parotideo-masseteric region. Topography of the parotid gland and structures piercing it. Surgical anatomy of the parotid cysts.
- 52 Temporal and infratemporal region. Surface projection of the middle meningeal artery. Sites of trepanation.
- 53 Structure of the scalp. Mechanic injury, forming of haematoma. Blood supply and innervation and lymphatic drainage of the skin of the head.
- 54 Topography of the orbit. Connection of ophthalmic vein with the facial vein and the cavernous sinus. Exophthalmus. Surgical anatomy of the external muscles of the eye.
- 55 Pterygopalatine fossa, its boundaries, connections and structures to and from the fossa. Local anesthesia of the maxillary nerv.
- 56 Bony nasal cavity, paranasal sinuses, their content and connections. Surgical approach of the paranasal sinuses and the hypophysis.
- 57 Walls and connections of the orbit.

- 58 Anterior cranial fossa and its connections, structures to and from the fossa.
- 59 Middle cranial fossa and its connections, structures to and from the fossa.
- 60 Posterior cranial fossa and its connections, structures to and from the fossa.
- 61 Base of the skull, content and connections.

**Subject of the final exam**

- A) Identification of gross anatomy structures.
- B) Identification of histological slides.
- C) Theoretical questions of the four semesters.

***Research topics of the Department of Human Morphology and Developmental Biology  
for the academic year 2009/2010 (diploma works, rector's competition)***

1. Local control of testicular functions  
*Tutor:* Dr. Ida Gerendai
2. Spinal and supraspinal neural connections of the reproductive organs  
*Tutor:* Dr. Ida Gerendai
3. Direct neural control of gonadal functions  
*Tutor:* Dr. Ida Gerendai
4. Neuroendocrine regulatory mechanisms (experimental studies in rats)  
*Tutor:* Dr. Béla Halász
5. Rhythms in neuroendocrine systems (experimental studies in rats)  
*Tutor:* Dr. Béla Halász
6. The role of caveolae in macrophages  
*Tutor:* Dr. Anna L. Kiss
7. The role of caveolin in the mechanism of action of estrogen and progesterone  
*Tutor:* Dr. Anna L. Kiss
8. Mechanisms of phosphorylation in the regulation of caveola-cycle  
*Tutor:* Dr. Anna L. Kiss
9. Secretin receptors in the central nervous system  
*Tutor:* Dr. Katalin Köves
10. The effect of PACAP on the regulation of hormonal events around ovulation in adult rat  
*Tutor:* Dr. Katalin Köves
11. Ontogenesis of PACAP immunoreactivity in the primitive gut  
*Tutor:* Dr. Katalin Köves
12. Early development of the bursa of Fabricius (pattern development)  
*Tutor:* Dr. Attila Magyar
13. Maternal immunity in birds  
*Tutor:* Dr. Attila Magyar
14. Production of monoclonal antibodies and their characterization  
*Tutor:* Dr. Attila Magyar
15. Human intestinal M-cells  
*Tutor:* Dr. Attila Magyar
16. Autocrine and paracrine control of adenohipophyseal hormone secretion  
*Tutor:* Dr. György M. Nagy

17. The effect of denervation of the posterior lobe of the pituitary and neurotoxins on neural elements of the intermediate-posterior lobe of pituitary (dopaminerg, vasopressinerg, oxytocinerg terminals)  
*Tutor:* Dr. György M. Nagy
18. The role of the intermediate-posterior lobe of the pituitary in the control of prolactin secretion  
*Tutor:* Dr. György M. Nagy
19. The new theory of molecular recognition: Construction of receptor agonists and antagonists based on the complementer DNS of the ligand-binding sites of the receptors  
*Tutor:* Dr. György M. Nagy
20. Regional, cytological and molecular biological studies on the prolactin secretion of the adenohypophysis  
*Tutor:* Dr. György M. Nagy
21. Control of cells and function of the mammary gland during lactation  
*Tutor:* Dr. György M. Nagy
22. The effect of milk- and serum-born factors on the lymphocytes  
*Tutor:* Dr. György M. Nagy
23. The role of prolactin receptors in lymphocytes  
*Tutor:* Dr. György M. Nagy
24. The effect of prenatal stress on the pre- and postnatal ontogenesis of gonadotrop and corticotrop control system  
*Tutor:* Dr. Ágnes Nemeskéri
25. The effect of menopause on the functions of the gastrointestinal system  
*Tutor:* Dr. Ágnes Nemeskéri
26. Surgical anatomy of the liver. Liver segments  
*Tutor:* Dr. Ágnes Nemeskéri
27. Exocytosis  
*Tutor:* Dr. Anna Németh
28. Development of lymphatic organs (bursa of Fabricius, spleen, lymph node)  
*Tutor:* Dr. Imre Oláh
29. The pineal gland and the lymphatic system  
*Tutor:* Dr. Imre Oláh
30. Common antigene expression in human primordial germ cells and tumours identified by a novel monoclonal antibody  
*Tutor:* Dr. Imre Oláh
31. Retinal mosaic  
*Tutor:* Dr. Pál Röhlich

32. Development and differentiation of photoreceptors  
*Tutor:* Dr. Ágoston Szél
33. Immunocytochemical studies on the non-visual photoreception in the pineal gland, the retina and the deep encephalic photoreceptors  
*Tutor:* Dr. Béla Víg
34. Comparative cytological studies of circumventricular and liquor contact neuronal systems in humans and various vertebrates  
*Tutor:* Dr. Béla Víg
35. Effects of dependence of drugs on the control of neuroendocrine processes  
*Tutor:* Dr. Tibor Wenger

### *PhD Programs*

- (1) **Embryology, theoretical, experimental and clinical developmental biology.**  
Program leader: Dr. Imre Oláh, Professor Emeritus
  - (2) **Neurosciences.**  
Program leader: Dr. Miklós Palkovits, Professor, Member of the Hungarian Academy of Sciences
- 

The Department has eight posts for "demonstrators".

**LABORATORIES AND RESEARCH TOPICS OF THE  
DEPARTMENT OF HUMAN MORPHOLOGY AND DEVELOPMENTAL BIOLOGY**

***LABORATORY OF DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY***

**Topics**

1. Immunobiology of the stromal cells of the primary lymphoid organs.
2. Developmental biology of the accessory, dendritic cells of the immunosystem.
3. Function, origin and differentiation of M-cells in the gut-associated lymphoid organs.
4. Development and its regulation of the smooth and striated muscles.
5. Notochord and its induction effects on the dorsal organs.

**Members of the research group:**

Éva Bíró  
Zoltán Hajdú  
Zsuzsa Kittner  
Katalin Kocsis  
Krisztina Minkó  
Nándor Nagy  
Imre Oláh

***PHOTONEUROENDOCRINE LABORATORY***

**Topic:** Comparative ultrastructural and immunocytochemical studies of the pineal organ.

**Members of the research group:**

Csaba Dávid  
Zsolt Fejér  
Béla Vigh

***LABORATORY OF CELL AND MOLECULAR BIOLOGY***

**Topics:**

1. Distribution and differentiation of retinal photoreceptors.
2. Endo- and exocytotic processes.

**Members of research group:**

Ágnes Ida Berta  
Erzsébet Botos  
Gergely Halász  
Anna L. Kiss  
Ákos Lukáts  
Attila Magyar  
Anna Németh  
Pál Röhlich  
Arnold Szabó  
Ágoston Szél

***LABORATORY OF CELLULAR AND MOLECULAR NEUROENDOCRINOLOGY*****Topics:**

1. Neuroendocrine and paracrine mechanisms in the control of hypophyseal hormone secretion.
2. Studies on the mechanisms of the altered sensitivity of mammothrophs due to different physiological statuses.
3. The role of prolactin in immuno-endocrine interactions.

**Members of the research group:**

Ibolya Bodnár

Béla Halász

György M. Nagy

Márk Oláh

Béla Székács

***PHARMACOLOGICAL LABORATORY***

**Topic:** Studies on the pharmacological effects of marihuana.

**Member of the research group:**

Tibor Wenger

***LABORATORY OF CLINICAL ANATOMY*****Topics:**

1. Clinical anatomy of coronary arteries
2. Abnormal arborization of coronary arteries (corrosion preparations)
3. Clinical anatomy of the cardiac venous system (corrosion preparations)
4. Corrosion preparations in the search for ischaemic heart diseases
5. Bile duct variations in the surgery of the liver (hepatectomy)
6. Surgical anatomy of the liver
7. Sectional anatomy of the female body (CT images of the cadaver sections)
8. Special conervation techniques in the teaching of anatomy and pathology
9. Surgical anatomy of the kidney

**Members of the research group:**

Ágnes Nemeskéri

András Szuák

***IMMUNOHISTOCHEMICAL LABORATORY***

**Topic:** Studies on the role and distribution of the vasoactive intestinal polypeptide (VIP) and the adenylate cyclase-activating polypeptide (PACAP) in the hypothalamus and the hypophysis.

**Members of the research group:**

Béla Halász

Andrea Heinzlmann

Mária Kausz

Katalin Köves

Judith Molnár

***LABORATORY OF NEUROENDOCRINOLOGY OF REPRODUCTION***

**Topics:**

1. Direct neural control of gonadal functions.
2. Local effects of peptides synthesized in the testis.
3. Interaction between local peptide effects and innervation of the testis.

**Members of the research group:**

Ida Gerendai

Béla Halász

***LABORATORY OF THE NEUROMORPHOLOGY***

**Topic:** Studies on the septohippocampal system in the rat

**Members of the research group:**

Ágnes Csáki

Béla Halász

József Kiss