

Semmelweis University
Department of Anatomy, Histology and Embryology

2015/2016

Faculty of Dentistry
1st year, 1st semester

ANATOMY HANDBOOK



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Anatomy, Histology and Embryology for ED students

TEACHING DEPARTMENT:

SEMMELWEIS UNIVERSITY

Department of Anatomy, Histology and Embryology

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H-1094 Budapest

<http://semmelweis.hu/anatomia>

LEARNING OBJECTIVES

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

Aims of the lectures in Histology - Presentation of the cell, basic principles in cellular morphology, detailed description of the epithelial, connective, muscle and nervous tissues. During the 3 semesters, the lectures contribute to the gross anatomical description of organs with a detailed presentation of their fine structures, including ultrastructural details. Important chapters: basic tissues, viscera, central nervous system.

Aims of the lectures in Embryology - Presentation of the early development from the differentiation of the germ cells to the formation of the human embryo (basic embryology) as well as the development of the locomotor system (1st semester). In the 2nd and 3rd semesters, the embryology topics will complement the gross anatomy and histology lectures of the organs and systems, also mentioning the most frequent malformations.

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

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

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

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

Lectures:

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

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

Topics:

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

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

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

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

Practical course:

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

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

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

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

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

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

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

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

ANNOUNCEMENTS

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

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

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

Semifinal examinations

Practical examination - exemption: Every student passing both dissection room midterms will be exempted from a semifinal practical examination. The dissection mark, calculated from the midterm marks (2.0 - 2.49: **2**; 2.5 - 3.49: **3**; 3.5 - 4.49: **4** and 4.5 - 5: **5**), will be written on the personal achievement cards. Midterm failures cannot be retaken. Students, unhappy with their dissection mark, may apply in writing for a practical examination, before the end of the 13th study week, with the Course Director. These students will start their semifinal examination in the dissection room prior to the theoretical part. ***(NB: when opting for a semifinal practical examination, you will lose the exemption and also may fail the examination during the practical part)***

Semifinal examinations are then composed of oral theoretical questions and the identification/description of one histological specimen.

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

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

RULES AND REGULATIONS IN THE DISSECTING ROOM

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

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

The lockers will have to be locked using your padlocks.

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

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

Students are expected to be prepared for the practical work.

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

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

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

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

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

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

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

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

ED I.

Subject matter of the 1st semester

I. Anatomy:

1. Locomotor system:
 - a) bones, including the skull (osteology)
 - b) joints (arthrology)
 - c) skeletal muscles (myology)
2. Vessels of the upper and lower limbs
 - a) branches of the brachial artery and tributaries of the brachial vein
 - b) branches of the femoral artery and tributaries of the femoral vein
3. Large nerves of the limbs.

II. **Basic tissues** (epithelia, connective and supporting tissues, skeletal, smooth and cardiac muscle types, elements of the peripheral nervous system)

III. Human development (embryology):

1. From germ cells to the formation of the embryo, placenta and fetal membranes
2. Development of the musculoskeletal system (head, trunk, limbs, muscles)

Test I.

Topic: Bones of the skeleton
Date: 5th week, October 9. (Friday class)

Test II.

Topic: Epithelial-, connective- and supporting tissues
Date: 10th week, November 13.

Test III.

Topic: Joints, muscles, vessels and nerves of the extremities.
Date: 12th week, November 27. (Friday class)

Test IV.

Topic: Embryology
Date: 14th week, December 13. (Friday class)

Semifinal examination

Topic: Subject matter of the semester

- 1) **Practical examination** (calculated from the results of the two dissection room tests)
For further information see the Announcements.
- 2) **Theoretical questions** (oral examination)
Gross anatomy and development of the locomotor system and the skull.
General embryology
- 3) **Histology** of the basic tissues (slide).

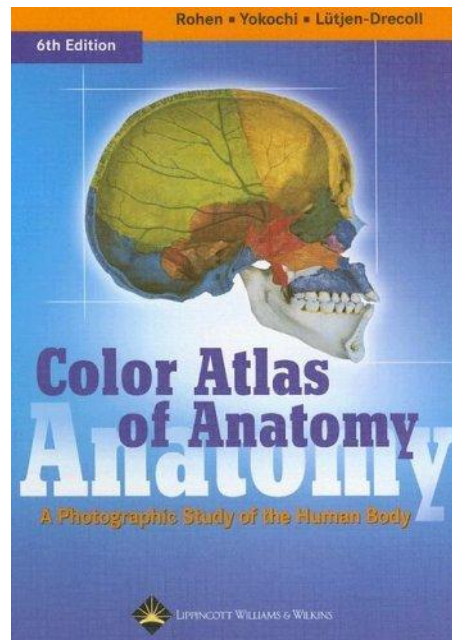
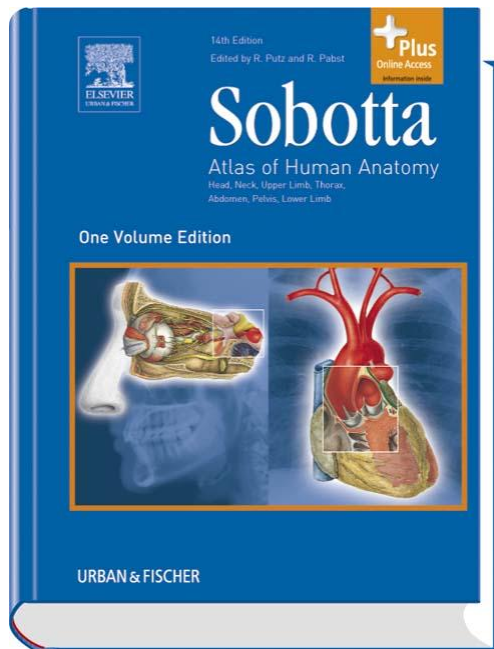
Academic year 2015/2016
Faculty of Dentistry
First Year, First Semester

Week	LECTURE <i>Tuesday 14.20 – 16.00</i> <i>Friday 11.00 - 11.45</i>	DISSECTION <i>Wednesday 15.25 – 16.55</i> <i>(ED I 1. 16.00 – 17.30.)</i> <i>Friday 10.00 – 10.45</i>	HISTOLOGY <i>Friday 12.10 – 13.40</i>
Week 1 Sept 7-11.	1. The role of anatomy, histology and embryology in the medical curriculum. Terminology 2. General osteology. Composition of the extremities. 3. Concept and types of tissues, epithelial tissue, simple epithelia	Dissection room activity, tools safety and rules. Osteology.	Introduction to histology. Rules, use of the microscope. Histological stains. Study of a compact and a hollow organs
Week 2 Sept 14 - 18.	4. Skull. Sphenoid and ethmoid bones 5. Temporal bone 6. Stratified epithelia	Osteology	Simple epithelia
Week 3 Sept 21 - 25.	7. Neurocranium, including the calvary, internal and external skull bases 8. Viscerocranium, including the orbit 9. Glandular epithelium	Osteology	Stratified epithelia
Week 4 Sept 28-Oct 2.	10. Mandible and maxilla 11. Nasal cavity, paranasal sinuses 12. Bony oral cavity, pterygopalatine and infratemporal fossae	Osteology	Glandular epithelia
Week 5 Oct 5-9.	13. Connective tissue fibres, types of the connective tissue 14. General arthrology and general myology 15. Osteology midterm	1. Osteology 2. 1st midterm test: Osteology	Connective tissue I. Fibrous elements, ground substance
Week 6 Oct 12 - 16.	16. Shoulder girdle, shoulder joint and the muscles acting upon it 17. Connective tissue cells, blood cells 18. Elbow joint and the muscles acting upon it	Dissection of the extremities (joints, muscles, vessels, nerves)	Connective tissue II. Cellular elements Blood, bone marrow.
Week 7 Oct 19 - 23.	19. Bones, joints and muscles of the hand 20. Pelvic girdle. Hip joint and the muscles acting upon it. 21. -	Dissection of the extremities (joints, muscles, vessels, nerves) NO CLASSES ON FRIDAY	NATIONAL HOLIDAY October 23.
Week 8 Oct 26 - 30.	22. <i>Introduction to human embryology. Gametogenesis, fertilization. Cleavage.</i> 23. <i>Blastulation, implantation. The bilaminar embryo. Formation of ectoderm and endoderm.</i> 24. Supporting tissue (cartilage, bone).	Dissection of the extremities (joints, muscles, vessels, nerves)	Supporting tissues : Cartilage Bone
Week 9 Nov 2 – 6.	25. Bone formation, bone remodelling 26. Knee joint and the muscles acting upon it 27. Bones, joints and muscles of the foot	Dissection of the extremities (joints, muscles, vessels, nerves)	Types of ossification Revision
Week 10 Nov 9 - 13.	28. <i>Formation and differentiation of mesoderm. Derivatives of the germinal layers.</i> 29. Temporomandibular joint, muscles of mastication 30. Muscle tissue: skeletal, smooth and cardiac muscles	Dissection of the extremities (joints, muscles, vessels, nerves)	2nd midterm test: Epithelial, connective and supporting tissues
Week 11 Nov 16 - 20.	31. <i>Neurulation. Folding of the embryo</i> 32. Muscles of facial expression 33. Muscles, fasciae and triangles of the neck	Dissection of the extremities (joints, muscles, vessels, nerves)	Smooth, skeletal and cardiac muscle tissues
Week 12 Nov. 23 - 27.	34. Nervous tissue: neurons and supporting cells 35. Nervous tissue: fibres, synapses, receptors, effectors 36. Musculoskeletal midterm	1. Dissection of the extremities (joints, muscles, vessels, nerves) 2. 3rd midterm test: Joints, muscles, vessels and nerves of the extremities	Peripheral nervous system. Spinal and autonomic ganglia, peripheral nerve, motor end plate
Week 13 Nov 30 - Dec 4.	37. <i>Fetal membranes, umbilical cord. Structure of the placenta, placental circulation, twinning, malformations</i> 38. Thoracic cage, diaphragm 39. Abdominal muscles, rectus sheath, hernia canals	Muscles of the head, neck and trunk (demonstration)	Placenta. Umbilical cord.
Week 14 Dec 9 - 13.	40. Vertebral column; movements and muscles. Actions and muscles of the atlantooccipital and atlantoaxial joints. 41. <i>Development of the vertebral column and the locomotor system</i> 42. <i>Development of the skull. Fontanelles</i>	Embryology test .	Revision

Faculty of Dentistry, First year, First semester 2015/2016.

Week	Specimens
Week 1 Sept 7-11.	Use of the microscope No. 5. Wall structure of a hollow organ (esophagus, H-E) No. 69. Structure of a parenchymal (compact) organ (liver, H-E)
Week 2 Sept 14 - 18.	No. 50. Simple squamous epithelium (endothel, elastic artery, H-E) No. 19. Simple cuboidal epithelium (umbilical cord, H-E) No. 3. Simple columnar epithelium (g, H-E) No. 4. Pseudostratified epithelium (epididymis, H-E) For demonstration: No. 1. Mesothel (peritoneum, silver impregnation) No. 2. Simple cuboidal epithelium (kidney, HE) No. 72. Pseudostratified epithelium (trachea, H-E)
Week 3 Sept 21 - 25.	No. 5. Stratified squamous nonkeratinized epithelium (esophagus, H-E) No. 6. Stratified squamous keratinized epithelium (palmar skin, H-E) No. 7. Stratified columnar epithelium (penis, H-E) No. 8. Transitional epithelium (urinary bladder, H-E)
Week 4 Sept 28-Oct 2.	No. 10. Goblet cells (large intestine, H-E) No. 11. Holocrine secretion (sebaceous gland, hairy skin, H-E) No. 12. Apocrine secretion (prostate, H-E) No. 13. Merocrine secretion (submandibular gland, H-E)
Week 5 Oct 5-9.	No. 14. Collagen fibers (tendon, H-E) No. 15. Elastic fibers (large artery, RF) No. 16. Reticular fibers (liver, silver impregnation) No. 17. Differentiation between epithelial and connective tissues (hairy skin, Azan) No. 18. Collagen and elastic fibres (hairy skin, Hornowsky)
Week 6 Oct 12 - 16.	No. 19. Embryonic connective tissue - mesenchyme (umbilical cord, H-E) No. 20. Connective tissue cells (scar tissue, H-E) No. 21. Mast cells (peritoneum, toluidine blue) No. 22. Fat cells – adipocytes (tongue, Sudan III.) For demonstration: No. 81. Cell rich connective tissue (uterus, H-E) No. 46. Reticular connective tissue (spleen, H-E) Reticular connective tissue (lymph follicle, silver impregnation) No. 6. Fat cells (palmar skin, H-E) ----- No. 52. Blood cells (blood smear – May-Grünwald-Giemsa) For demonstration: Bone marrow cells (bone marrow smear, May-Grünwald-Giemsa) No. 23. Hyalin cartilage (rib, H-E) No. 24. Elastic cartilage (epiglottis, RF) No. 25. Fibrous cartilage (meniscus, H-E)
Week 7 Oct 19 - 23.	October. 23. National holiday
Week 8 Oct 26 - 30.	No. 26. Bone – cross section (Schmorl) No. 27. Bone – longitudinal section (Schmorl)
Week 9 Nov 2 – 6.	No. 28. Endochondral ossification (phalanx, H-E) No. 29. Intramembranous ossification (calvary, H-E) Revision
Week 10 Nov 9 - 13.	MIDTERM TEST (epithelial-, connective- and supportive tissues)
Week 11 Nov 16 - 20.	No. 30. Smooth muscle – cross and longitudinal sections (Jejunum, H-E) No. 31. Skeletal muscle – longitudinal section (H-E) No. 32. Skeletal muscle – cross section (H-E) No. 34. Cardiac muscle - cross section (H-E) No. 35. Cardiac muscle - longitudinal section, Purkinje-fibers (H-E)
Week 12 Nov. 23 - 27.	No. 37. Pseudounipolar neurons (spinal ganglion, H-E) No. 38. Multipolar neurons (autonomic ganglion, silver impregnation) No. 36. Peripheral nerve - cross section (H-E) For demonstration: Nerve - cross section (osmium tetroxide impregnation) No. 43. Motor end plate (acetylcholinesterase histochemical reaction)
Week 13 Nov 30 - Dec 4.	No. 19. Umbilical cord (H-E) No. 83. Placenta (H-E)
Week 14 Dec 9 - 13.	Revision

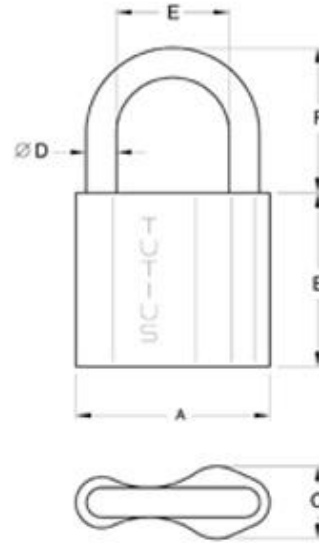
RECOMMENDED BOOKS



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

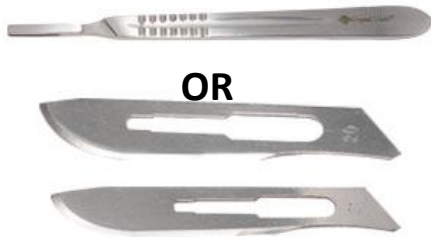
PADLOCK SIZE: 6 mm

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



DISSECTION ROOM TOO

SCALPEL



A PAIR OF ANATOMICAL FORCEPS

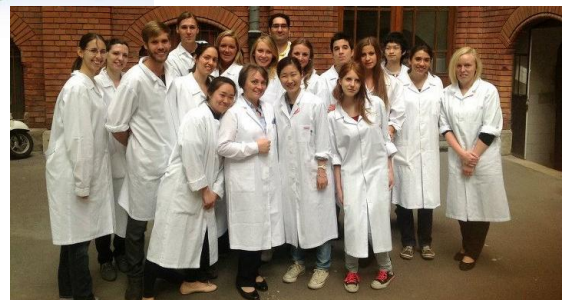


RUBBER GLOVES



**PROTECTIVE CLOTHING
(LABCOAT)**

GOGGLES



TOPICS OF THE SEMIFINAL EXAM

ED I.

First semester

Practical exam

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

Topics

Skull

- Anterior cranial fossa (composition, boundaries, connections)
- Middle cranial fossa (composition, boundaries, connections)
- Posterior cranial fossa (composition, boundaries, connections)
- Walls and connections of the orbit
- Walls and connections of the nasal cavity
- Inferior surface and connections of the base of the skull
- Bony walls of the oral cavity, the temporal and infratemporal fossa
- Walls and connections of the pterygopalatine fossa

Joints of the extremities

Muscles, vessels and nerves of the extremities (without the cutaneous innervation)

HISTOLOGY

Description of a histological specimen with the help of a microscope

Further questions related to the inspected slide

- | | |
|------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Concept of basic tissues | Histology of cartilage |
| Definition and classification of epithelial tissue | Histology of the osteoid tissue |
| Simple epithelia | Intramembranous ossification |
| Stratified epithelia | Endochondral ossification |
| Membrane specializations of epithelia | Growth and remodeling of bone |
| Glandular epithelia | Smooth muscle and myoepithelial cells |
| Cells of connective tissue | Skeletal muscle tissue |
| Ground substance and fibres of connective tissue | Cardiac muscle tissue |
| Types of connective tissue | Histology of the peripheral nervous system (sensory and autonomic ganglia) |
| Umbilical cord and placenta | Supporting cells in the peripheral nervous system |
| Blood and the formed elements of blood | Nerve fibers, myelin sheath |
| Histology of the bone marrow, maturation of erythrocytes and platelets | Motor end-plate |
| Differentiation of granulocytes, lymphocytes and monocytes | |

LOCOMOTOR SYSTEM 1 - description of a joint (surfaces, capsule, ligaments, type, axes, movements) and the muscles acting upon the joint

Fibrous and cartilaginous joints

Components of the synovial joints

Classification of synovial joints; movements and mechanisms

Structure of the vertebral column, the gross anatomy of the muscles acting upon it

Movements and muscles of the head (atlantooccipital and atlantoaxial joints)

Joints of the shoulder girdle, the gross anatomy of the muscles acting upon them

The shoulder joint, the gross anatomy of the muscles acting upon it

The elbow joint, the gross anatomy of the muscles acting upon it

Structure and movements of the wrist (radiocarpal) joint,

the gross anatomy of the muscles acting upon it

Metacarpophalangeal and interphalangeal joints, the gross anatomy of the muscles concerned with the movements

Carpometacarpal, metacarpophalangeal and interphalangeal joints of the thumb, the gross anatomy of the muscles concerned with the movements

The hip joint and the gross anatomy of the muscles concerned with the movements

The knee joint and the gross anatomy of the muscles concerned with the movements

The ankle joint together with the gross anatomy of the muscles acting upon it

The subtalar and talocalcaneonavicular joints, the muscles acting upon them

The temporomandibular joint and the gross anatomy of the muscles acting on it

LOCOMOTOR SYSTEM 2 - a topic unrelated to joints

Architecture and classification of bones

Bones and spaces of the skull, including the description of the individual bones (see above at the ***Practical examination*** part)

Structure and actions of somatic muscles

Osteofibrous structure of the thoracic cage (bones, joints, ligaments, movements)

Muscles and movements of the thorax

Muscles of the back and nape (occipital region)

The axilla, the quadrangular and triangular spaces

The cubital fossa

Muscles and cross section of the arm

Muscles and cross section of the forearm

Osteofibrous spaces and muscle compartments of the hand, tendinous sheaths

Composition of the pelvis (bones, ligaments and membranes)

Muscles of the buttock, the posterior abdominal wall and the pelvis (external and internal muscles of the hip)

Osteofibrous compartments, muscles and cross section of the thigh

Popliteal fossa

Subinguinal hiatus, vascular and muscular compartments; adductor canal

Osteofibrous compartments, muscles and the cross section of the leg

Structure of the foot, arches of the foot

Osteofibrous compartments of the foot, tendinous sheaths

Muscles of mastication

Diaphragm

Lateral abdominal muscles and fasciae
Rectus abdominis muscle and the rectus sheath
Inguinal canal
Femoral canal
Superficial muscles of the neck and the muscle triangles
Deep muscles of the neck and the laminae of the cervical fascia
Muscles of facial expression

EMBRYOLOGY

Spermatogenesis
Oogenesis
Fertilization, cleavage of the zygote
Blastocyst formation; the bilaminar embryonic disc
Implantation
Formation of the intraembryonic mesoderm; the notochord
Neurulation (neural tube and neural crest)
Differentiation of the intraembryonic mesoderm; formation and derivatives of the somites
Derivatives of the intermediate mesoderm
Lateral plate mesoderm and its derivatives
Folding of the embryo
Development of the primitive cardiovascular system, the fetal circulation
The structure and function of the placenta
Development of the fetal membranes (chorion and amnion) and the umbilical cord
Periods embryonic and fetal life
Twin formation
Development of the limbs
Development of the vertebral column
Development of the skull
Development of the musculoskeletal system