

**Semmelweis University**  
**Department of Anatomy, Histology and Embryology**

**Faculty of Dentistry**  
**1st year**

# **ANATOMY HANDBOOK**



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# Anatomy, Histology and Embryology for ED students

## TEACHING DEPARTMENT:

SEMMELWEIS UNIVERSITY

Department of Anatomy, Histology and Embryology

Budapest, Tűzoltó utca 58.

H-1094 Budapest

<http://semmelweis.hu/anatomia>

## LEARNING OBJECTIVES

**Aims of the lectures in Anatomy** - Presentation of important and/or complicated topics such as: 1<sup>st</sup> semester - the structure of the body wall (e.g. thorax, pelvis), extremities and the cranium, 2<sup>nd</sup> 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 (1<sup>st</sup> semester). In the 2<sup>nd</sup> and 3<sup>rd</sup> 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)

## GENERAL 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 13<sup>th</sup> 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 1<sup>st</sup> 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: 5<sup>th</sup> week, October 7. (extra long class on Friday starting at 8.00)

#### Test II.

Topic: Epithelial-, connective- and supporting tissues  
Date: 10<sup>th</sup> week, November 8 and 11.

#### Test III.

Topic: Joints, muscles, vessels and nerves of the extremities.  
Date: 12<sup>th</sup> week, November 25. (extra long class on Friday starting at 8.00)

#### Test IV.

Topic: Embryology  
Date: 14<sup>th</sup> week, December 13. (Friday class)

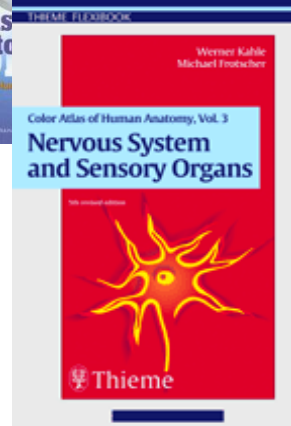
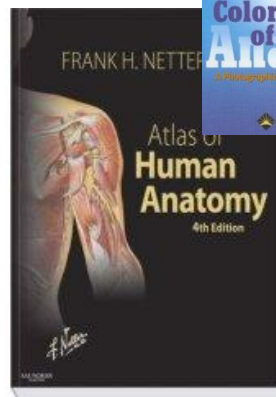
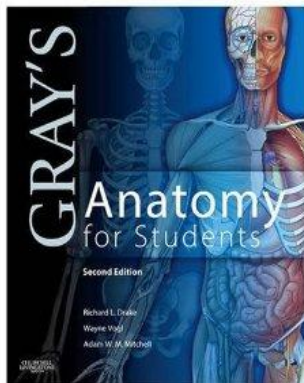
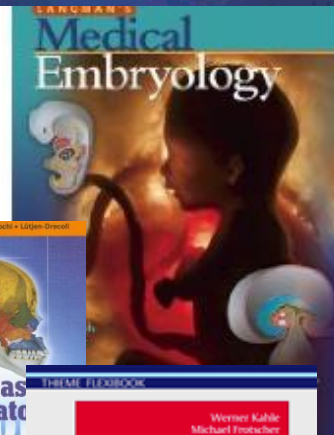
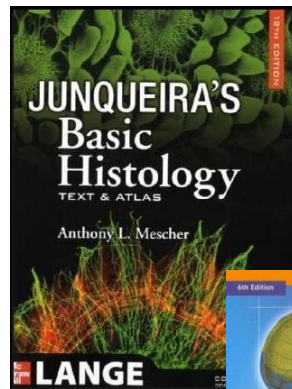
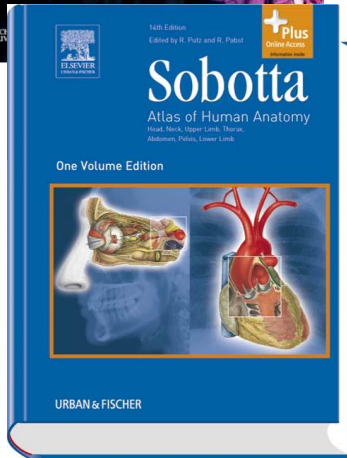
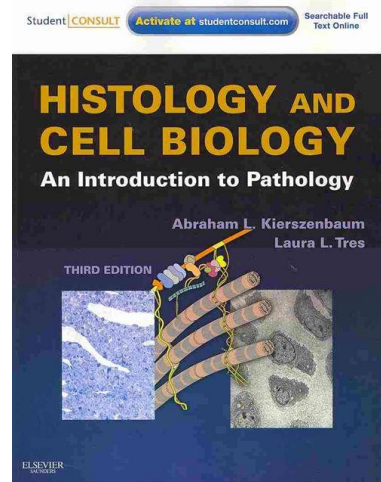
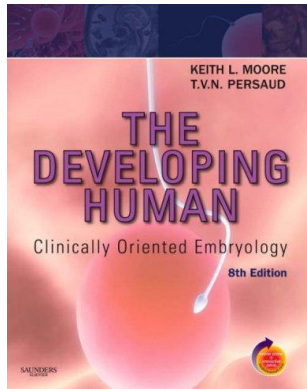
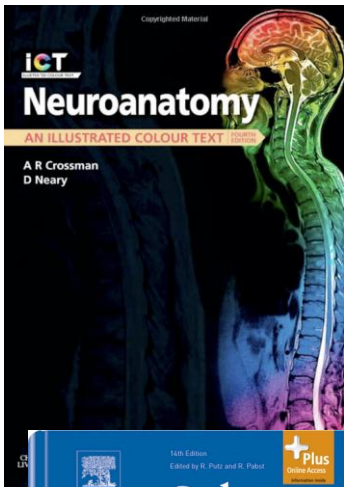
#### Semifinal examination

**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).

Week	LECTURE  Wednesdays 14.00 – 14.45 Fridays 10.00 - 11.40	DISSECTION  Wednesdays 12.00– 13.30 Fridays 8.50 – 9.35	HISTOLOGY  Fri 12.00 – 13.30 ED I 1-2 Tue 15.10-16.40 ED I 3-4
Week 1 Sept. 5-9.	1. <b>The role of anatomy, histology and embryology in the medical curriculum. Terminology</b> 2. <b>General osteology. Composition of the extremities.</b> 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. 12-16.	4. <b>Skull. Sphenoid and ethmoid bones</b> 5. <b>Temporal bone</b> 6. Stratified epithelia	Osteology	Simple epithelia
Week 3. Sept. 19-23.	7. <b>Neurocranium, including the calvary, internal and external skull bases</b> 8. Glandular epithelium 9. <b>Viscerocranium, including the orbit</b>	Osteology	Stratified epithelia
Week 4. Sept. 26-30.	10. Connective tissue fibres, types of the connective tissue 11. <b>Mandible and maxilla</b> 12. <b>Nasal cavity, paranasal sinuses</b>	Osteology	Glandular epithelia
Week 5. Oct. 3-7.	13. <b>Bony oral cavity, pterygopalatine and infratemporal fossae</b> 14. <b>General arthrology and general myology</b> 15. Connective tissue cells, blood cells	1. Osteology 2. <b>1<sup>st</sup> midterm test: Osteology</b> <b>The midterm starts at 8.00</b>	<b>Connective tissue I.</b> Fibrous elements, ground substance
Week 6. Oct. 10-14. <b>Oct. 15.</b> <b>Saturday is a „Monday„</b>	16. <b>Shoulder girdle, shoulder joint and the muscles acting upon it</b> 17. <b>Elbow joint and the muscles acting upon it</b> 18. <b>Bones, joints and muscles of the hand</b>	Dissection of the extremities (joints, muscles, vessels, nerves)	<b>Connective tissue II.</b> Cellular elements Blood, bone marrow
Week 7. Oct. 17-21.	19. <b>Pelvic girdle.</b> 20. <b>Hip joint and the muscles acting upon it.</b> 21. -	Dissection of the extremities (joints, muscles, vessels, nerves) <b>NO FRIDAY CLASS</b>	<b>Tuesday class Groups 3-4</b> <b>Supporting tissues :</b> <b>Cartilage, bone</b> <b>No Friday class for groups 1-2</b>
Week 8. Oct. 24-28.	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)	<b>Tuesday class, Groups 3-4</b> <b>Types of ossification</b> Friday class, Groups 1-2 <b>Supporting tissues :</b> Cartilage, Bone
Week 9. Oct. 31-Nov. 4. <i>Oct.31 and Nov.1 are national holidays</i>	25. Bone formation, bone remodelling 26. <b>Knee joint and the muscles acting upon it</b> 27. <b>Bones, joints and muscles of the foot</b>	Dissection of the extremities (joints, muscles, vessels, nerves)	<b>No class on Tuesday for Groups 3-4</b>  Friday class, Groups 1-2 <b>Revision</b>
Week 10. Nov. 7-11.	28. <i>Formation and differentiation of mesoderm. Derivatives of the germinal layers.</i> 29. <b>Temporomandibular joint, muscles of mastication</b> 30. Muscle tissue: skeletal, smooth and cardiac muscles	Dissection of the extremities (joints, muscles, vessels, nerves)	<b>2<sup>nd</sup> midterm test: Epithelial, connective and supporting tissues</b>
Week 11. Nov. 14-18.	31. <i>Neurulation. Folding of the embryo</i> 32. <b>Muscles of facial expression</b> 33. <b>Muscles, fasciae and triangles of the neck</b>	Dissection of the extremities (joints, muscles, vessels, nerves)	Smooth, skeletal and cardiac muscle tissues
Week 12. Nov. 21-25.	34. Nervous tissue: neurons and supporting cells 35. Nervous tissue: fibres, synapses, receptors, effectors 36. <i>Fetal membranes, umbilical cord. Structure of the placenta, placental circulation.</i>	1. Dissection of the extremities (joints, muscles, vessels, nerves) 2. <b>3<sup>rd</sup> midterm test: Joints, muscles, vessels and nerves of the extremities</b> <b>The midterm starts at 8.00</b>	Peripheral nervous system. Spinal and autonomic ganglia, peripheral nerve, motor end plate
Week 13. Nov. 28- Dec.2.	37. <i>Formation of vessels, fetal circulation, twinning, developmental malformations</i> 38. <b>Thoracic cage, diaphragm</b> 39. <b>Abdominal muscles, rectus sheath, hernia canals</b>	Muscles of the head, neck and trunk (demonstration)	Placenta. Umbilical cord.
Week 14. Dec. 5-9.	40. <b>Vertebral column; movements and muscles. Actions and muscles of the atlantooccipital and atlantoaxial joints.</b> 41. <i>Development of the vertebral column and the locomotor system</i> 42. <i>Development of the skull. Fontanelles</i>	<b>Embryology test</b> .	<b>Revision</b>

## RECOMMENDED BOOKS

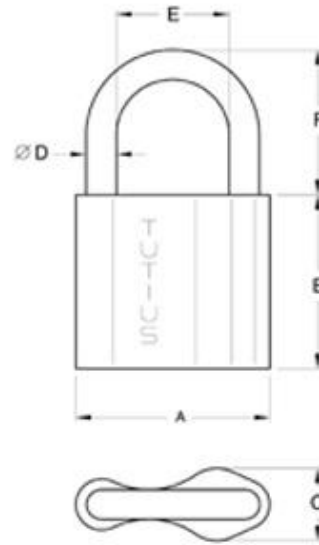




**During dissection classes keep your belongings in the lockers and lock them with your padlock!**

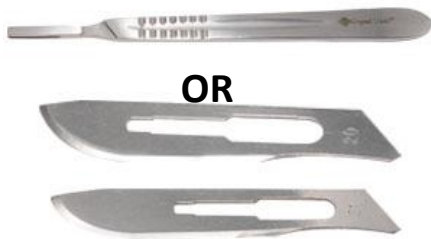
**PADLOCK SIZE: 6 mm**

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**



## Semester-end and examination announcements

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

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

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

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

**The exams will start at 13.00**

### Parts of the semifinal examination

- 1) **Practical part, if necessary**
- 2) **Histology of the basic tissues** - 1 slide (oral).
- 3) **Theory questions from each topic listed below** (oral, 20 minutes preparation time)

Please, leave your belonging in a locker (histology floor) and gather in front of the **old dissection room** (ground floor) at least 15 minutes before the examination starts. Please, remember to have your

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

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

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

## TOPICS OF THE SEMIFINAL EXAM

## ED I.

### 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 (topics of the 1<sup>st</sup> and 3<sup>rd</sup> MIDTERM examinations)***

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

### ***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

### ***MUSCULOSKELETAL SYSTEM - 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