

ORGANIC AND FUNCTIONAL SYSTEMS II (ML0057)

1. language

English.

2. course contents

Coordinator: Prof. BIANCA MARIA SCICCHITANO

Year Course: 2

Semester: 1

UFC: 18

Modules and lecturers:

- DIGESTIVE SYSTEM: ANATOMY (ML0075) - 1.6 ufc - ssd BIO/16

Prof. Claudio Sette, Maria Concetta Geloso

- DIGESTIVE SYSTEM: ANATOMY PRACTICALS (ML0078) - 0.4 ufc - ssd BIO/16

Prof. Chiara Naro

- DIGESTIVE SYSTEM: EMBRYOLOGY (ML0089) - 0.3 ufc - ssd BIO/17

Prof. Alessio D'Alessio

- DIGESTIVE SYSTEM: HISTOLOGY (ML0088) - 0.5 ufc - ssd BIO/17

Prof. Bianca Maria Scicchitano

- DIGESTIVE SYSTEM: HISTOLOGY PRACTICALS (ML0083) - 0.5 ufc - ssd BIO/17

Prof. Alessio D'Alessio, Ilaria Marrocco

- DIGESTIVE SYSTEM: PHYSIOLOGY (ML0061) - 1 ufc - ssd BIO/09

Prof. Marcello D'Ascenzo

- HEART: ANATOMY (ML0406) - 0.66 ufc - ssd BIO/16

Prof. Claudio Sette

- HEART: ANATOMY PRACTICALS (ML0407) - 0.34 ufc - ssd BIO/16

Prof. Chiara Naro

- HEART: EMBRYOLOGY (ML0411) - 0.3 ufc - ssd BIO/17

Prof. Bianca Maria Scicchitano

- HEART: HISTOLOGY PRACTICALS (ML0416) - 0.15 ufc - ssd BIO/17

Prof. Bianca Maria Scicchitano

- HEART: PHYSIOLOGY (ML0419) - 1.7 ufc - ssd BIO/09

Prof. Marcello D'Ascenzo, Guido Maria Filippi

- HEART: PHYSIOLOGY PRACTICALS (ML0415) - 0.3 ufc - ssd BIO/09

Prof. Saviana Antonella Barbati

- HEART:HISTOLOGY (ML0422) - 0.15 ufc - ssd BIO/17

Prof. Bianca Maria Scicchitano

- RESPIRATORY SYSTEM: ANATOMY (ML0076) - 0.66 ufc - ssd BIO/16

Prof. Camilla Bernardini

- RESPIRATORY SYSTEM: ANATOMY PRACTICALS (ML0077) - 0.34 ufc - ssd BIO/16

Prof. Camilla Bernardini

- RESPIRATORY SYSTEM: EMBRYOLOGY (ML0087) - 0.3 ufc - ssd BIO/17

Prof. Bianca Maria Scicchitano

- RESPIRATORY SYSTEM: HISTOLOGY (ML0086) - 0.34 ufc - ssd BIO/17

Prof. Bianca Maria Scicchitano

- RESPIRATORY SYSTEM: HISTOLOGY PRACTICALS (ML0084) - 0.16 ufc - ssd BIO/17

Prof. Bianca Maria Scicchitano, Alessio D'Alessio

- RESPIRATORY SYSTEM: PHYSIOLOGY (ML0062) - 1.84 ufc - ssd BIO/09

Prof. Salvatore Fusco

- RESPIRATORY SYSTEM: PHYSIOLOGY PRACTICALS (ML0063) - 0.16 ufc - ssd BIO/09

Prof. Francesca Natale

- URINARY SYSTEM: ANATOMY (ML0067) - 0.66 ufc - ssd BIO/16

Prof. Claudio Sette

- URINARY SYSTEM: ANATOMY PRACTICALS (ML0068) - 0.34 ufc - ssd BIO/16

Prof. Giovanni Zelano

- URINARY SYSTEM: EMBRYOLOGY (ML0081) - 0.4 ufc - ssd BIO/17

Prof. Luca Tamagnone

- URINARY SYSTEM: HISTOLOGY (ML0082) - 0.25 ufc - ssd BIO/17

Prof. Luca Tamagnone

- URINARY SYSTEM: HISTOLOGY PRACTICALS (ML0085) - 0.25 ufc - ssd BIO/17

Prof. Alessio D'Alessio

- URINARY SYSTEM: PHYSIOLOGY (ML0060) - 2 ufc - ssd BIO/09

Prof. Claudio Grassi

- VASCULAR SYSTEM: ANATOMY (ML0079) - 0.8 ufc - ssd BIO/16

Prof. Claudio Sette

- VASCULAR SYSTEM: ANATOMY PRACTICALS (ML0080) - 0.2 ufc - ssd BIO/16

Prof. Claudio Sette

- VASCULAR SYSTEM: EMBRYOLOGY (ML0074) - 0.2 ufc - ssd BIO/17

Prof. Bianca Maria Scicchitano

- VASCULAR SYSTEM: HISTOLOGY (ML0073) - 0.1 ufc - ssd BIO/17

Prof. Bianca Maria Scicchitano

- VASCULAR SYSTEM: HISTOLOGY PRACTICALS (ML0071) - 0.1 ufc - ssd BIO/17

Prof. Bianca Maria Scicchitano

- VASCULAR SYSTEM: PHYSIOLOGY (ML0064) - 0.84 ufc - ssd BIO/09

Prof. Guido Maria Filippi

- VASCULAR SYSTEM: PHYSIOLOGY PRACTICALS (ML0058) - 0.16 ufc - ssd BIO/09

Prof. Francesca Natale

3. BIBLIOGRAPHY

Anatomy:

Susan Standing: Gray's Anatomy, The Anatomical Basis of Clinical Practice, 41st Edition, Elsevier.

Frank H. Netter: Atlas of Human Anatomy, 7th Edition, Elsevier.

For clinical correlates, see also: Keith L. Moore, Arthur F. Dalley and Anne M.R. Agur: Clinically Oriented Anatomy, 6th Edition: Hardcover Edition, Lippincott Williams and Wilkins.

Embryology:

Keith L. Moore, T.V.N. Persaud, Mark G. Torchia: The Developing Human- Clinically Oriented Embryology, 11th Edition, Elsevier, 2019. See also: Gary C. Schoenwolf, Steven B. Bleyl, Philip R. Brauer, Philippa H. Francis West: Larsen's Human Embryology, 6th Edition, Churchill Livingstone, Elsevier, 2020.

Histology

Wojciech Pawlina: Histology- A Text and Atlas with correlated cell and molecular biology, Eighth Edition, Wolters Kluwer, 2019.

Physiology

W. F. Boron and E. L. Boulpaep: Medical Physiology, 3rd Edition, Elsevier, 2017.

J. B. Wes: Respiratory Physiology: The essential. 10th Edition, Lippincott Williams and Wilkins, 2016.

See also: Guyton and Hall: Textbook of Medical Physiology, 13th Edition, Elsevier, 2015.

4. LEARNING OBJECTIVES

The whole course aims to give the student a sound understanding of the structure, function, and development of the heart and the vascular, respiratory, digestive, and urinary systems. In particular, the Anatomy modules focus on the gross structure, microscopic anatomy, and functional correlations of the various organs; the Histology and Embryology modules provide principles of development and illustrate the histological structure of the various systems with cell and molecular biology correlations; the Physiology modules delineate the main mechanisms underlying the system functioning with particular attention on their interaction. Great relevance is given to the clinical impact of the various disciplines. The student is encouraged to use clear and appropriate language. At the end of the course, the student must demonstrate that he/she has accomplished the following objectives:

D1 - Knowledge and understanding abilities

To have acquired the knowledge and understanding of the gross anatomy and of the functional correlations between the organs of the above-mentioned systems.

To know and understand the main mechanisms underlying the system's functioning.

To know and understand the histological structure of the various systems with cell and molecular biology correlations.

To know and understand the embryological mechanisms of the development of the heart and of the vascular, respiratory, digestive, and urinary systems and the morphological and molecular bases of the principal malformations.

D2 - Applying knowledge and understanding skills

To demonstrate the understanding of the clinical relevance of the acquired knowledge with reference to implications in diagnosis and treatment of the different diseases.

To demonstrate how to use the methods that can help to acquire a better understanding of cells, tissues, and organ functions.

To demonstrate practical skills in microscopic examination of heart and vascular, respiratory, digestive, and urinary system tissue specimens.

D3 - Personal judgment

The student must reflect on his/her learning and develop critical thinking by integrating the knowledge and the skills learned.

D4 - Communication skills

The student should be able to describe and communicate the acquired information using appropriate terminology.

D5 - Learning ability

Students should have acquired the capability of updating and expanding their

knowledge by consulting textbooks other than the suggested ones, scientific papers, and databases.

5. prerequisites

In order to achieve a better understanding of the topics of this course, and to register for the exam session, Students must have passed the exams of the first year.

6. TEACHING METHODS

Learning activities include class lessons and laboratory and class practical lessons, student individual work, or work in small groups. All the lessons are supported by visual aids (slides, animated movies, etc.) that stimulate the interest of learners and help the teachers to explain the concepts easily. There are two fully equipped microscopy laboratories and each of the students has its own microscope and a box with a series of preparations so they can search through their samples thoroughly under teacher supervision, and in subsequent self-learning sessions that precede the exams. Laboratory and class practical lessons promote the student's capability of applying knowledge and understanding; work in small groups stimulates discussions and the development of communication skills.

D1 - Knowledge and understanding abilities

During the frontal lessons, teachers illustrate all the topics related to the heart and vascular, respiratory, digestive, and urinary systems included in the program. In particular, they focus on the relationships existing between the various disciplines and on their clinical relevance.

D2 - Applying knowledge and understanding skills

During the frontal lessons and practical activities, teachers encourage an open dialogue and student feedback is solicited. Students are invited to interact with the teacher to clarify specific points and achieve a deeper knowledge of the various topics. During classes, written questions can be administered to the students to facilitate learning and help them in preparing for the exam.

D3 - Personal judgments

During the Anatomy and Histology Practicals, teachers begin with a pre-practical briefing and then discuss slides. In particular, during the practical training in microscopy teachers attend to students individually for any clarification and stimulate their critical attitude to identify the characteristics of the specimens and make a differential diagnosis.

D4 - Communication skills

During lessons and Practicals, students are stimulated to ask and answer questions. If necessary, teachers suggest the appropriate terminology and the best way to give definitions and express concepts and data. The development of communication skills is promoted by working in small groups.

D5 - Learning ability

Students are invited to expand their knowledge by not only studying suggested textbooks but also consulting additional references that can be requested by the teachers.

7. OTHER INFORMATIONS

During exams, any portable electronic devices, including mobile phones, must be switched off and put over the desk inside an envelope given by the Course Coordinator. The only exception to this rule is if the Course Coordinator gives specific permission to use any device. Violations will be referred to the Disciplinary Committee.

8. METHODS FOR VERIFYING LEARNING AND FOR EVALUATION

The exam is composed of multiple-choice questions regarding Anatomy, Embryology, Histology and Physiology. For each question, a single correct answer is possible. In order to pass the written test, the student has to answer correctly at least 60% of the questions of each Discipline. The number of questions for each Discipline is proportional to the number of UFC. The score obtained in the written test will be initially calculated for each of the Disciplines for which the threshold was passed, ranging from 18 to 30/30. For Histology an oral part is included to verify the acquisition of practical abilities in the use of a light microscope to recognize, describe and discuss histological features of tissue specimens derived from heart, vascular, respiratory, digestive, and urinary systems. The score assigned after the oral exam will be averaged with the Histology/Embryology score obtained in the written test. An "intermediate test" that includes the Cardio-Vascular and Respiratory Systems (Anatomy, Histology/Embryology/ Physiology) will be carried out at the end of the lectures concerning these Systems. Students who pass the Intermediate Test will be able to keep their mark and complete the exam by taking the final test which will include the Digestive and Urinary Systems (Anatomy, Histology/Embryology/ Physiology). Students who do not pass the Intermediate Test will have to take the global exam (all the Systems) during the Ordinary Sessions.

The global and final score of the exam will be calculated by a weighted average of the partial score obtained for the various integrated Disciplines, taking into account the credits assigned to each of them. A maximum score (30 cum laude) will be obtained if the student will reach 30/30 in both the written and oral parts of the exam. All the details concerning the exam procedures will be given out by the Coordinator at the beginning of the Course.

D1 - Knowledge and understanding abilities

A multiple-choice questionnaire will allow verifying the acquired knowledge and comprehension of the development, structure, and function of the heart, and vascular, respiratory, digestive, and urinary systems. In addition, an oral exam regarding the histological organization of the organs of the above-mentioned systems will assess the acquired practical skills in the microscopic analysis of tissue specimens, and the ability to make a differential diagnosis. The oral exam will also allow the evaluation of the student's ability to communicate efficiently.

D2 - Applying knowledge and understanding skills

The questions included in the written test will allow verifying the ability of the students to choose the correct answer from a list of possible answers regarding anatomy, embryology, histology, and physiology. In addition, some of the questions, based on clinical cases, will help to verify if students are able to apply to the clinical practice what they learned.

D3 - Personal judgment

During the oral exam will be assessed the students' capability to observe and subsequently describe with a suitable language what the examination of the histological specimens has unveiled under the light microscope.

During the oral exam, the student's capability of examining histological preparations will be assessed. In particular, their attitude to identify the most important elements of the different specimens and making a differential diagnosis will be evaluated.

D4 - Communication skills

During the oral exam, not only the capacity to use adequate terminology in describing cells, tissue, and organs but also the ability to efficiently communicate will be assessed.

D5 - Learning ability

Both the written test and the oral exam will allow the students to show the acquired knowledge and comprehension regarding all the topics included in the program.

9. program

HEART

Anatomy

Mediastinum: limits, division in the superior and inferior mediastinum, the topography of visceral structures. Overview of the cardiovascular system, systemic and pulmonary circulations, and fetal circulation. Heart: topography, position, and relations within the thoracic cavity, wall structure, fibrous skeleton, external and internal anatomy: chambers, valves, conducting system, coronary vessels, microscopic anatomy of the heart. Pericardium and pericardial sinuses, a brief introduction to congenital anatomical anomalies of the heart.

Practicals: Heart dissection; introduction to medical examination and imaging of the vascular system, radiographic anatomy of the heart.

Embryology

Establishment and patterning of the primary heart field. Progenitor heart cells. Secondary heart field. Formation and position of the heart tube. Formation of the cardiac loop. Molecular regulation of cardiac development. Development of the sinus venosus. Formation of the cardiac septa.

Histology

Cardiac muscle. Structure of the heart muscle. Differentiation, renovation, damage, and repair. Intrinsic regulation of heart rate. Systemic regulation of the heart function.

Practical training: Use a light microscope to understand the structure of cardiac muscle and correlate structure and function.

Physiology

Rhythmical excitation of the heart: the cardiac action potential. Specialized conductive system of the heart. Control of excitation and conduction in the heart. Characteristics of the normal electrocardiogram. Electrocardiographic leads. Principles of vectorial analysis of electrocardiograms.

The cardiac muscle. The cardiac cycle. Preload and afterload. Stroke volume and cardiac output. Frank-Starling mechanism. Heart pump and artery elasticity. Cardiac work. Contractility modulation. Coronary circulation. Practical: Electrocardiographic recording, auscultation of heart sounds.

VASCULAR SYSTEM

Anatomy

A basic introduction to Pulmonary circulation, Systemic circulation, and the Lymphatic system.

Blood vessels: structure and function. Arteries. Arterioles. Capillaries. Venules. Veins. Anastomoses. Vessels of the systemic circulation. Arterial System: aorta's origin, distribution, and main branches. Ascending aorta and its branches. Arch of the aorta: arteries of head and neck- arteries of the upper limb. Descending aorta: thoracic aorta; abdominal aorta and arteries of the lower limb. Venous system. Superior vena cava and its tributaries: veins of head, thorax, and upper limb. Inferior vena cava and its tributaries: veins of abdomen, pelvis and lower limb.

Practicals: Microscopic examination of the structure of the aorta, vena cava, and other main vessels. Introduction to medical examination and imaging of the vascular system.

Embryology

Vasculogenesis and angiogenesis. Formation of primitive blood vessels associated with endocardial tube. Development of lymphatic system. Development of thymus, spleen and lymph nodes. Angiomas.

Histology

Layers of the vascular wall. Vascular endothelium. Large, medium and small arteries. Classification and functional aspects of capillaries. Large and small veins. Lymphatic vessels. Lymphatic nodules. Cells of the reticular meshwork. The architecture of thymus,

spleen, and lymph nodes. Atherosclerosis. Hypertension. Ischemic heart disease.
Practical training: By studying histological sections of blood vessels, thymus, spleen and lymph nodes, students learn to recognize and analyze the different tissue and organ components.

Physiology

Hemodynamic premises. Arteries and veins. Microcirculation. Microcirculation regulation. Special circulation. Coagulation.

Practicals: Measurement of blood pressure.

RESPIRATORY SYSTEM

Anatomy

System overview. Systematic gross anatomy, topographical anatomy and anatomical relations, blood supply, and lymphatic drainage of main structures and organs: nose, pharynx, larynx. Structures of voice production. Trachea. Bronchi. Lungs.

Practicals: Introduction to examination imaging of the respiratory system: X rays, computerized tomography, bronchography, bronchoscopy.

Embryology

Respiratory primordium. Development of larynx, trachea, bronchi and lungs. Anomalies of the respiratory system. Tracheoesophageal fistula. Respiratory distress syndrome.

Histology

Histological structure of larynx, trachea, bronchi, bronchioles and alveoli. Emphysema and pneumonia. Cystic fibrosis.

Practical training: By studying histological sections, students learn to recognize and analyze the different tissue and organ components of the respiratory system.

Physiology

Functional organization of the respiratory system. Secondary functions of the respiratory system. Lung volumes and capacities. Respiratory muscles. Mechanics of breathing. Elastic properties of the lung: pressure-volume curve; compliance; surface tension. Role of pulmonary surfactant. Elastic properties of the chest wall. Airway resistance. Work of breathing. Gas exchange in the lungs. Transport of oxygen and carbon dioxide in the blood. Ventilation and perfusion of the lungs: the ventilation-perfusion ratio. Role of respiratory system in the regulation of acid-base equilibria. Nervous control of ventilation. Chemical control of ventilation. Practical: Spirometry.

DIGESTIVE SYSTEM

Anatomy

Overview of the system. Systematic gross anatomy, blood supply, and lymphatic drainage of main organs of the gastrointestinal tract and related accessory glands: oral cavity and salivary glands, pharynx, esophagus, stomach; small intestine, large intestine; liver and portal vein system, gallbladder and bile ducts, pancreas. Abdominal wall: muscles and fasciae. Peritoneum: general arrangement, ligaments, omenta, mesenteries, pouches and fossae, intraperitoneal and retroperitoneal organs. Topographical anatomy and organ relations in the abdominal cavity.

Practicals: Microscopic examination of the structure of liver, pancreas, gallbladder and mesenteries. Introduction to medical examination and imaging of the digestive system; clinical anatomy of selected digestive disorders.

Embryology

Development of pharyngeal apparatus, face and neck. Pharyngeal arches, pouches and grooves. Development of tongue. Development of salivary glands. Development of nasal cavities and palate. Foregut. Development of esophagus, stomach, duodenum, liver and biliary apparatus. Development of pancreas. Midgut. Herniation and rotation of midgut loop. Retraction of intestinal loops. Hindgut. Cloaca and anal canal. Anomalies of digestive system. Esophageal stenosis. Hypertrophic pyloric stenosis. Ectopic and annular pancreas. Gastroschisis. Congenital omphalocele. Umbilical hernia. Anomalies of the midgut. Reversed rotation. Ileal diverticulum. Congenital megacolon. Anorectal anomalies.

Histology

Oral cavity: structure of salivary glands and tongue. Overview of the gastrointestinal tract. Mucosa, submucosa, muscularis externa, serosa and adventitia. Histological structure of esophagus, stomach. Small and large intestine. Structural organization of liver, gallbladder and pancreas. Zollinger-Ellison syndrome. Peptic ulcer disease and gastric cancer.

Adenomatous polyps of the large intestine.

Practical training: By studying histological sections, students learn to recognize and analyze the different tissue and organ components of the digestive system.

Physiology

Functional organization of the gastrointestinal system. Gastric function: acid secretion, pepsinogen secretion control of gastric secretion; gastric motility; filling and emptying of the stomach. Pancreatic and salivary glands: composition, function and control of pancreatic secretion; composition, function and control of salivary secretion. Nutrient digestion and absorption: carbohydrate, lipid and protein digestion and absorption. Intestinal motility: tonic and rhythmic contractions of intestinal smooth muscle; peristalsis; motility of sphincters; motility of the small intestine and large intestine.

URINARY SYSTEM

Anatomy

Overview of the system. Systematic gross anatomy, blood supply, and lymphatic drainage of main structures and organs: kidneys, ureters, urinary bladder and urethra. Topographical anatomy and organ relations in the abdomino-pelvic cavity. Hints on sexual dimorphism in the urinary system.

Practicals: Basics of imaging techniques for the urinary system; congenital malformations and anatomical variants; clinical anatomy of selected urinary disorders.

Embryology

Development of urinary system. Development of kidney and ureters. Development of urinary bladder and urethra. Congenital anomalies of kidney and ureters. Urachal anomalies. Exstrophy of the bladder.

Histology

General structure of the kidney, ureter, urinary bladder and urethra. Urinalysis.

Practical training: By studying histological sections, students learn to recognize and analyze the different tissue and organ components of the urinary system.

Physiology

Functional organization of the urinary system. Glomerular filtration. Renal clearance. Control of renal blood flow and glomerular filtration. Transports in the different segments of the nephron. Transport of sodium and chloride. Transport of urea, glucose, phosphate, calcium, magnesium, and organic solutes. Transport of potassium. Transport of acids and bases. Renal handling of water: transport of water by different segments of nephron. Role of kidney in the regulation of the volume and osmolality of body fluids. Role of kidney in the control of blood pressure. Role of kidney in the control of pH.