a.a. 2026/2027

FUNCTIONAL ARCHITECTURE OF THE HUMAN BODY 2 (RESPIRATORY/DIGESTIVE/URINARY/REPRODUCTIVE) (A001946)

1. language

English.

2. course contents

Coordinatore/Coordinator: Prof. CRISTIAN RIPOLI
Anno di corso/Year Course: 2nd
Semestre/Semester: 1st
CFU/UFC: 15
Moduli e docenti incaricati /Modules and lecturers:
Anatomy Practicals — 0,50 CFU - SSD BIO/16 - Prof. Chiara Naro
Anatomy Practicals — 0,50 CFU - SSD BIO/16 - Prof. Consuelo Pitolli
Anatomy Practicals — 0,50 CFU - SSD BIO/16 - Prof. Consuelo Pitolli
Anatomy Practicals — 0,50 CFU - SSD BIO/16 - Prof. Consuelo Pitolli
Digestive System Anatomy — 0,75 CFU - SSD BIO/16 - Prof. Piergiorgio La Rosa
Digestive System Anatomy — 0,75 CFU – SSD BIO/16 - Prof. Claudio Sette
Digestive System Histology and Embryology — 1,00 CFU - SSD BIO/17 - Prof. Azadeh Montaseri
Digestive System Physiology — 1,00 CFU - SSD BIO/09 - Prof. Claudia Colussi
Histology Practicals (Group 1) — 0,50 CFU - SSD BIO/17 - Prof. Luigi Balasco
Histology Practicals (Group 1) — 0,50 CFU - SSD BIO/17 - Prof. Luigi Balasco
Histology Practicals (Group 2) — 0,50 CFU - SSD BIO/17 - Prof. Simone Detassis
Histology Practicals (Group 2) — 0,50 CFU - SSD BIO/17 - Prof. Simone Detassis
Physiology Practicals — 0,50 CFU - SSD BIO/09 - Prof. Martina Battistoni
Reproductive System Anatomy — 0,50 CFU - SSD BIO/16 - Prof. Chiara Naro
Reproductive System Histology and Embryology — 1,00 CFU - SSD BIO/17 - Prof. Luca Tamagnone
Reproductive System Physiology — 1,00 CFU - SSD BIO/09 - Prof. Cristian Ripoli
Respiratory Anatomy — 0,50 CFU - SSD BIO/16 - Prof. Piergiorgio La Rosa
Respiratory Histology and Embryology — 0,50 CFU - SSD BIO/17 - Prof. Azadeh Montaseri
Respiratory Physiology — 1,50 CFU - SSD BIO/09 - Prof. Salvatore Fusco
Urinary System Anatomy — 0,50 CFU - SSD BIO/16 - Prof. Piergiorgio La Rosa
Urinary System Histology and Embryology — 0,50 CFU - SSD BIO/17 - Prof. Luca Tamagnone
Urinary System Physiology — 2,00 CFU - SSD BIO/09 - Prof. Cristian Ripoli

3. BIBLIOGRAPHY

Anatomy:
Susan Standring: 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
V. De Felice, B.M. Scicchitano, G. Dobrowolny, G. Ricci, M.T. Viscomi, Foundamentals of Histology, Structure and Function of Human Body Tissues and Systems, Edizioni Scientifiche Falco. See also: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 respiratory, digestive, urinary and reproductive 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

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 respiratory, digestive, and urinary systems and the morphological and molecular bases of the principal malformations.

D2 - Applying knowledge and understanding

To demonstrate the understanding of the clinical relevance of the acquired knowledge with reference to implications in the diagnosis and treatment of 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 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 should 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; working in small groups stimulates discussions and the development of communication skills.

D1 - Knowledge and understanding

During the frontal lessons, teachers illustrate all the topics related to the 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

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

Feedback will be provided to students during classes and at the end of each lesson. In addition, teachers are available for consultation by email or in person, at preset office hours, or upon

appointment.

8. METHODS FOR VERIFYING LEARNING AND FOR EVALUATION

Students' knowledge and preparation will be assessed through a written examination consisting of separate tests in the three disciplines of the integrated course: Anatomy, Physiology, and Histology/Embryology.
Each test consists of multiple-choice questions with five answer options, only one of which is correct. Questions may be text-based or may include images that students are required to interpret, recognize, or identify.
The Anatomy and Histology/Embryology tests each comprise 32 questions. Each correct answer is worth 1 point, giving a maximum raw score of 32 points for each discipline.
The Physiology test comprises 36 questions. Each correct answer is worth 0.88 points, giving a maximum raw score of 31.68 points.
Students will have approximately one minute to answer each question.
Scores are expressed on a 30-point scale, with appropriate rounding where necessary. A minimum score of 18/30 is required to pass each discipline. Students who answer all questions correctly are awarded a grade of 30 cum laude.
To pass the integrated course examination, students must obtain a score of at least 18/30 in each of the three disciplines: Anatomy, Physiology, and Histology/Embryology.
If a student passes two of the three disciplines during an examination session, the passing grades obtained in those two disciplines will remain valid until the end of the following examination session. During either of these sessions, the student will be required to retake only the discipline that was not passed. If the student does not pass the remaining discipline by the end of the second subsequent examination session, the two previously obtained grades will expire, and the student will be required to retake all three disciplines.
If a student passes only one of the three disciplines during an examination session, no partial result will be carried forward. The student must therefore retake and pass all three disciplines at the next examination session.

The final grade for the integrated course is calculated as a weighted average of the grades obtained in the three disciplines, according to the number of ECTS credits assigned to each discipline: Anatomy (5 ECTS), Histology/Embryology (4 ECTS), and Physiology (6 ECTS).
The final grade is calculated according to the following formula:
Final grade = [(Anatomy grade × 5) + (Histology/Embryology grade × 4) + (Physiology grade × 6)] / 15
The resulting grade is rounded to the nearest whole number.
For example, if a student obtains 26/30 in Anatomy, 28/30 in Histology/Embryology, and 24/30 in Physiology, the final grade is calculated as follows:
[(26 × 5) + (28 × 4) + (24 × 6)] / 15 = 25.73
The final grade is therefore 26/30. In addition to the written multiple-choice test, the Histology/Embryology assessment includes an oral practical examination based on the microscopic observation, recognition, and analysis of tissue specimens. The practical examination is held at the end of the Histology laboratory course and before the first examination session.
The practical examination accounts for one-third of the final Histology/Embryology grade, while the written multiple-choice test accounts for the remaining two-thirds. Students who do not achieve a satisfactory result in the practical examination may repeat it before a subsequent examination session.

9. program

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. Practicals: 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 abdominopelvic 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 the 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

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

Practical training: Students study histological sections 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 the nephron. Role of the kidney in the regulation of the volume and osmolality of body fluids. Role of the kidney in the control of blood pressure. Role of the kidney in the control of pH.

REPRODUCTIVE SYSTEM:

Anatomy

Female genital tract. Internal genitalia. Ovary: ovarian fossa, topography, anatomical relations, ovarian ligaments; gross anatomy and structure, blood supply, lymphatic drainage. Fallopian tube: topography, anatomical relations, mesosalpinx; gross anatomy and structure, blood supply, lymphatic drainage. Uterus: topography, anatomical relations, ligaments, gross anatomy, structure, blood supply, lymphatic drainage. Vagina: topography, anatomical relations; gross anatomy, structure, blood supply, lymphatic drainage. External genitalia: vulva; mons pubis, clitoris, labia majora and labia minora. Structural modifications during pregnancy and delivery. Male genital tract. Testes: gross anatomy, structure and coverings; testis descent. The epididymis: blood supply, lymphatic drainage. Spermatic cord, vas deferens: structure, layers and anatomical relations. Seminal vesicles and ejaculatory ducts: structure, position, anatomical relations. Prostate gland: topography, anatomical relations, gross anatomy, structure, blood supply, lymphatic drainage. Penis: gross anatomy, corpora cavernosa and corpus spongiosum, blood supply, lymphatic drainage. Bulbourethral glands. Pelvic floor anatomy: endopelvic fascia, pelvic diaphragm, urogenital diaphragm. Perineum. Clinical correlates: anatomical variants of uterine positions and morphology, ovarian torsion, testicular torsion, varicocele and hydrocele.

Practical training: Interactive learning lessons on topographic anatomy of the reproductive system

Embryology

Development of genital system. Development of gonads. Development of male and female genital ducts and glands. Development of vagina. Development of male and female external genitalia. Testicular and ovarian descent. Androgen insensitivity syndrome. Mixed gonadal dysgenesis. Hypospadias. Epispadias. Anomalies of uterine tubes, uterus, and vagina. Ectopic testis.

Histology

Structure of the testis. Spermatogenesis. Seminiferous tubules. Intratesticular ducts. Excurrent duct system. Accessory glands. Semen. Factors affecting spermatogenesis. Benign prostate hypertrophy and cancer of the prostate. Ovarian structure. Ovarian cycle. Hormonal regulation of the ovarian cycle. Ovulation. Uterine tubes. Uterus. Menstrual cycle. Mammary glands. Polycystic ovarian disease. Cytologic Pap smears. Papilloma virus infections. Lactation and Infertility.

Practical Training: By studying histological sections of the organs of the Reproductive system, the students will learn how to recognize and analyze the different tissue components and their organization and to make a differential diagnosis.

Physiology

Functional organization of the male reproductive system; the male hypothalamic-pituitary-gonadal axis. Physiological events of male puberty. Physiological adult male gonad function. Functional organization of the female reproductive system. Physiological events of female puberty. The female hypothalamic-pituitary-gonadal axis. Female menstrual cycle in ovary, tube, uterus; hormonal control of the cycle and correlation between hormonal levels and organ cyclical changes; menopause.