



## MEDICAL SCHOOL

### BUILDING BODIES SYLLABUS

#### GENERAL INFORMATION

Academic year: 2022-2023

First year, first semester

Mandatory

Language: English

Credits: 12

Disciplines: Cytology, Histology, Embryology, Anatomy

**Faculty** Isabella Barajon (Coordinator), Paola Allavena, Diletta Di Mitri, Luca Di Tommaso

**Guest lecturer:** Marco Erreni, Fabio Grizzi

**Tutors for practical activities at the light microscope:** Paola Allavena, Fabio Grizzi, Aldo Ummarino, Diletta Di Mitri

#### GENERAL LEARNING GOALS

##### Knowledge and understanding

By the end of the course, students will have knowledge and understanding of

- how the human body and its main organ-systems develop and the most important congenital malformations (general embryology and organogenesis)
- the most relevant structural features of cells, tissues and organs in relation to their function (Cytology, Histology and Organ structure).

Knowledge acquired during this course is relevant and propaedeutics to the content of the course of Body Architecture (1<sup>st</sup> year, 2<sup>nd</sup> semester), to the course Body at Work 2 (2<sup>nd</sup> year, 2<sup>nd</sup> semester) and provides an essential foundation for many courses of the 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> year).

The importance of studying the subjects of the course in relation to their relevance for the understanding of physiology, physiopathology, and histopathology and the acquisition of knowledge of clinical importance, will be fostered by correlating the topic treated with clinical examples and the signs and symptoms of the Priority Presenting Problems Portfolio.

##### Applying knowledge and understanding

By the end of the course students will be able to

- Identify different tissue and organs and summarize their main characteristics
- Compare and contrast their morphological features
- Relate the morphological features of tissues and organs to their function



- Apply the knowledge of the development of the human body to the study of gross and regional anatomy
- Apply the knowledge acquired to simple clinical or research-related scenarios and in general to problem solving activities

### **Making judgements; Communication skills; Learning skills.**

By the end of the course students will have

- acquired some learning skills related to organization of knowledge and selection of relevant information for the purpose of revision and retention
- developed some level of communication skills related to ability to convey acquired knowledge
- developed some ability to make judgments with respect to the relevance of acquired knowledge for clinical problem solving

### **Prerequisites**

To best understand the content of the course, students should have at least a basic knowledge of biology

### **Important**

This syllabus contains all the topics that students need to prepare for the final evaluation.

Not all of them will be necessarily dealt with during the course. In this case, they need to be studied autonomously.

Slides used during the lectures and made available to students are a teaching support. They do not include everything the student needs to know and therefore they are not intended as a substitute of the syllabus or of the textbooks.

## **TEACHING METHODS**

**Lectures:** the main purpose of lectures is to transfer knowledge to students by guiding them through the most relevant subjects of the disciplines included in the course of Building Bodies.

Students are expected to participate to lectures in a proactive manner and to take notes as part of the learning process.

### **Activation of Knowledge**

Along the semester there will be six Activation of Knowledge Activities consisting in formative assessments on the topics discussed in class.

The purpose of these activities is to monitor students' learning and to provide them with an ongoing feed-back on their learning process.



Each assessment will be followed by formative feedback, consisting in explanations and clarifications on the topics of the activity.

The formative tests are considered as an integral part of the program of the course and students are expected to participate.

**Practical activity at the light microscope:** The purpose of these activities is for the student to acquire the basic professionalizing skill of how to use a simple light microscope and to apply the knowledge acquired to the description and identification of histological preparation.

### **ATTENDANCE**

Per regulation, students are expected to attend at least 75% of all scheduled learning activities (lectures and practical classes). Please note that absences due to illness or misadventure will be factored into the 25% of allowable absences.

Students that will fall short of the due attendance will have to undergo to an additional evaluation process to pass the exam. The extent and content of the additional evaluation will be established by the teaching staff based on the level of shortfall.

If the deficiency in attendance is excessive (below 50%), the situation of the student will be reported to the Teaching Council and may entail repetition of the year.

### **Specific Learning Difficulties**

Students with SLDs are welcome to make it known to the teaching staff whenever they feel the need: at the beginning of the course, during the course, or close to the exam session.

### **COURSE CONTENT and SPECIFIC LEARNING GOALS**

#### Topics

The course can be ideally divided into 5 domains: cytology, histology, general embryology, organogenesis, and organ structure. While the lectures of histology and general embryology are proposed to students in sequence, the lectures of organogenesis and organ structure are intermingled so that the organogenetic aspects always precede the explanation of the adult structural aspect. The syllabus is organized by learning outcomes specific for each lecture or for a group of lectures.

#### **Module of Cytology:**

Cell morphology and structure of human cells with attention to structure-function relationships. This module will describe the main structural and morphological features of human cells.

### **Lecture 1**

**Topic: Cell membrane and inner membranes**

**Learning outcomes:**

- Understand the main structural features and functions of the cell membrane.
- Recognize and illustrate the cell membrane: structure, specialized functions, principles of transmembrane transport
- Recognize and illustrate the morphology and specific functions of the rough and the smooth endoplasmic reticulum, of ribosomes and of the Golgi apparatus
- *Clinical drop: Multidrug-resistant proteins*

### **Lecture 2**

**Topic: Vesicle trafficking in the cell and cytoplasmic organelles**

**Learning outcomes:**

- Illustrate the mechanisms of endocytosis and exocytosis and of vesicle trafficking to different cell compartments
- Understand the role, lysosomes, peroxisomes, and mitochondria
- *Clinical drop: Lysosomal storage diseases*

### **Lecture 3**

**Topic: The cellular cytoskeleton**

**Learning outcomes:**

- Illustrate the structure of microfilaments, intermediate filaments and microtubules
- Illustrate their function, with particular attention to their role in apical specializations of epithelial cells, in cell motility and in cell junction support
- *Clinical drop: pharmacological agents affecting the function of microtubules*

### **Lecture 4**

**Topic: The nucleus and the cell cycle**

**Learning outcomes:**

- Recognize and illustrate the morphology of the nucleus, chromatin arrangement, nuclear envelope, nucleolus and nuclear pores
- Describe their functional role
- Illustrate the different phases of the cell cycle during mitosis
- Understand the different types of cell death: necrosis and apoptosis
- *Clinical drop: Abnormal proliferation in cancer cells*
- *Clinical drop: Cytogenetic testing, the analysis of chromosomes*

### **Lecture 5**

**Topic: Apical and basolateral specializations of epithelial cells.**

Learning outcomes:

- Describe the morphology and function of the apical and basal domains of epithelial cells
- Illustrate the morphology and function of the specialized structures of the lateral domain: occluding, anchoring and gap junctions
- Explain the biological significance of these structural specializations in epithelial cells and other tissue cells
- *Clinical drop: Epithelial-to-mesenchymal transition*

### Module of Histology

This module will describe how cells organize into different tissues and how the characteristics tissue reflect their functional role.

#### Lecture 1

Topic: **Introduction to histological methods. From tissue sample collection to the observation at the microscope**

Learning outcomes:

- Knowledge of the main techniques used in histology
- General aspects of histological specimen processing such as: inclusion, fixation and sectioning
- Knowledge of the main commonly used histological and histochemical stainings

#### Lecture 2

Topic: **Instruments for morphological analysis and biomedical applications**

Learning outcomes:

- Knowledge of the main instruments for the morphological analysis of tissues and their application in scientific research and medical diagnosis

#### Lecture 3

Topic: **The epithelial tissue: Lining epithelia**

Learning outcomes:

- Understand the general properties and functional roles of the epithelial tissue
  - Recognize the morphological characteristics of the different types of epithelial cells
- Describe the classification and localization of the different types of lining epithelia
- Illustrate the structure of the epidermis and the morphological characteristics of the different cell types of the epidermis

*Clinical drop: epidermolysis bullosa*

#### Lecture 4

Topic: **The epithelial tissue: Exocrine glands**

Learning outcomes:

- Illustrate the general aspects and functions of the secretory epithelia
- Understand the morphological classification of the different types of exocrine glands
- Describe the main types of exocrine glands in the body and understand their functions
- Describe the structure of the exocrine portion of the pancreas and its system of excretory ducts.
- Recognize the morphological characteristics of the different types of exocrine glands and of their secretory product (serous, mucous, mixed)

### **Lecture 5 and 6**

#### **Topic: The epithelial tissue: Endocrine glands**

##### **Learning outcomes:**

- Illustrate the general aspects and functions of endocrine glands
- Understand and describe the regulatory function of the pituitary gland (hypophysis)
- Recognize the morphological characteristics and understand the functions of the endocrine glands

*Clinical drop: Diabetes*

*PPP portfolio: Altered mental status, Obesity*

### **Lecture 7**

#### **Topic: The connective tissue : Cellular components and extracellular matrix**

##### **Learning outcomes:**

- Illustrate the general organization of the connective tissue and its functions
- Classify the different types of connective tissues and their structural organization
- Describe the different cellular components of the connective tissue and
- recognize their morphological characteristics
- Illustrate the different constituents of the extracellular matrix and their function
- *Clinical drop: Extracellular matrix remodeling in tumor invasion and fibrosis*

### **Lecture 8**

#### **Topic: The connective tissue: Proper connective tissue**

##### **Learning outcomes:**

- Illustrate the properties and typical locations of the different connective tissues in the body
- Describe the different types of connective tissue fibers and their different
- functional roles
- Describe the general characteristics of the white and brown adipose tissue
- and their cellular constituents

*PPP portfolio: Obesity*

### **Lecture 9**

#### **Topic: Specialized connective tissues: Cartilage**

##### **Learning outcomes:**

- Understand the general properties and functional role of the cartilage tissue
- Illustrate the cellular and extracellular components of the cartilage and

- mechanisms of growth
- Describe the classification of the different types of cartilage and their localization in the human body
- Understand the role of the cartilage tissue in the processes of bone formation during fetal life and at puberty
- *Clinical drop: Chronic arthritis*

### **Lecture 10**

#### **Topic: Specialized connective tissues: Bone and osteogenesis**

- Understand the general properties and functional role of the bone tissue
- Describe the structural characteristics of the compact and spongy bones
- Illustrate the cellular and extracellular components of the bone; understand the functional roles of osteoblasts and osteoclasts
- Understand the mechanisms of ossification, bone growth, bone remodeling and repair
- *Clinical drop: Osteoporosis*

*PPP portfolio: trauma*

### **Lecture 11**

#### **Topic: Blood, blood cells and haemopoiesis**

- Understand the general properties and functional roles of blood
- Illustrate the cellular and non-cellular components of blood
- Recognize the morphological features of erythrocytes, different types of leukocytes and platelets in a blood smear
- Memorize the life span in the circulation and the number/ ul of blood of erythrocytes, different types of leukocytes and platelets
- Understand and describe the functional roles of erythrocytes, different types of leukocytes and platelets
- Describe the main steps of haemopoiesis: the developmental precursors
- of erythrocytes, leukocytes and platelets

*PPP portfolio: Shortness of breath*

### **Lecture 12**

#### **Topic: Lymphoid organs (lymph nodes, spleen, thymus, tonsils)**

- Understand the general properties and functional roles of the lymphoid organs
- Illustrate the structure, morphology and functional organization of the different lymphoid organs: spleen, thymus, lymph nodes, tonsils and mucosal associated lymphoid tissue (MALT)
- Understand the organization of the lymphatic circulation (and lymph nodes) and their functional role
- *Clinical drop: sentinel lymph node in cancer staging*

### **Lecture 13**

#### **Topic: The muscle tissue: Skeletal and cardiac muscle tissues**

- Understand the general properties and functional roles of the muscle tissue

- Describe the general overview and function of the striated muscle tissue
- Illustrate the structure of the skeletal muscle and its components
- Illustrate the neuro-muscular junction and understand basic knowledge of striated muscle contraction
- Recognize the morphological criteria to distinguish skeletal and cardiac muscle in histological preparations
- *Clinical drop: Duchenne muscular dystrophy*

#### **Lecture 14**

##### **Topic: The muscle tissue: Smooth muscle tissue.**

- Describe the general features of smooth muscle tissues and differ with skeletal muscle
- Illustrate the main localizations of smooth muscle tissue and general principles of smooth muscle contraction
- Recognize the morphological criteria to distinguish cardiac and smooth muscle in histological preparations

#### **Lecture 15**

##### **Topic: The nervous tissue: Neurons. Nerve fibers**

- Understand the general properties and functional roles of the nerve tissue
- Describe the structure and general function of neurons
- Illustrate the morphological features of neuron body, axon, myelin sheath, and functional role of the nodes of Ranvier
- Describe the structure and general function of glial cells in the central nerve system
- *Clinical drop: Multiple sclerosis*

#### **Lecture 16**

##### **Topic: The nervous tissue: Synapses. Neuroglia. Peripheral nerve terminals**

- Illustrate the structure of the neural synapse and its role in nerve impulse transmission
- Classify the different glial cells in the peripheral nerve system: morphology, general functions
- Illustrate the functional role of Schwann cells in the process of myelination
- Understand and describe the structure and function of the blood-brain barrier

### **Module of general Embryology, Organogenesis and Organ structure**

During this module, the main events characterizing male and female gametogenesis, fertilization and implantation of the human embryo will be addressed. Following a description of the early stages of embryogenesis, some major topics in organogenesis will be discussed as to understand the main morphological events and the related molecular aspects characterizing the development of the body and its various organ systems. On this basis, the



morphological and structural features of mature organs will be described stressing functional aspects.

### ***General embryology and organogenesis***

#### **Lectures 1 and 2**

**Topic: Introduction to embryology and principles of male and female gametogenesis**

#### **Learning outcomes**

- Explain the importance of studying embryology
- Outline the periods and phases of human embryology
- Calculate the date of birth
- Describe the periods of susceptibility to teratogens
- List the components of male and female genital tract
- Explain the phases of gametogenesis
- Formation of primordial germ cells (PGC) and their migration
- Increase in number of PGM by mitosis
- Reduction in chromosomal number by meiosis
- Compare male and female gametogenesis and summarize their differences
- Explain the origin of teratomas
- Explain the structural and functional maturation of egg and sperm
  - steps of spermatogenesis and spermiogenesis
  - maturation and capacitation of spermatozoa
  - hormonal regulation of spermatogenesis
  - maturation of the oocyte-follicle unit
  - hormonal regulation of folliculogenesis
- *Clinical drop: male infertility*
- Compare the differences in the maturation of egg and sperm
- Explain the events taking place at ovulation
- *Clinical drop: mittelschmerz*
- Explain the formation of the corpus luteum and its role
- Correlate the ovarian cycle and the uterine cycle and their hormonal regulation

*PPP portfolio-related topic: Abdominal pain and pelvic pain*

#### **Lecture 3.**

**Topic: Fertilization and early stages of the embryo development (week-1 and week 2)**

#### **Learning outcomes**

- Outline the transport of the egg and sperm up to the site of fertilization
- Explain the different steps of fertilization
- Explain the mechanisms that prevent polyspermy
- Explain what is accomplished by the process of fertilization and the characteristics of the zygote
- Explain the process of cleavage of the zygote and its role

- Outline the formation of the blastocyst and explain the role of its different components: inner cell mass, trophoblast, zona pellucida, blastocele
- Explain the difference between developmental potency and developmental fate
- Outline the transport of the zygote and blastocyst to the uterine cavity
- Describe the characteristics of the mucosa of the uterus at the end of the endometrial cycle
- Outline the phases of implantation of the blastocyst in the endometrium (apposition, adhesion, invasion)
- Summarize the mechanisms that contribute to initial maternal tolerance
- Describe the decidual reaction
- Summarize the most important steps of the progressive embedding of the blastocyst in the uterine wall
  - formation of the cytotrophoblast and syncytiotrophoblast
  - formation of the trophoblastic lacune
  - formation of the initial uteroplacental circulation
- Explain the transformation of the inner cell mass into the embryonic shield (disc): becoming bilaminar
- Describe the first molecular and morphological events indicating that the embryo is “taking charge”
- Explain the formation of the amniotic cavity, of the primary and secondary yolk sacs and of the extraembryonic mesoderm
- Describe the initial development of the uteroplacental circulation
- List the normal and abnormal sites of implantation. Clinical drop: ectopic pregnancy
- Explain possible causes of early miscarriage

*PPP Portfolio-related topic: Abnormal vaginal bleeding, Pelvic pain (abdominal Pain)*

#### **Lecture 4.**

**Topic: Gastrulation. Becoming trilaminar.**

**Learning outcomes**

- Outline the importance of gastrulation
- Define the role of primitive streak and primitive node and the formation of the body axes
- Outline the steps that characterize gastrulation. *Clinical drop: epithelio-mesenchymal transition*
- List the derivatives of the endodermal layer
- List the different compartment of the mesodermal layer and their derivatives
- Outline the stages of formation of the notochord. *Clinical drop: chordomas*
- Describe the steps that lead to the formation of the neural plate and neural tube including secondary neurulation
- List the derivatives of the neural crest.
- *Developmental defects: sirenomyelia; ethanol as a teratogen (holoprosencephaly); Shh signaling pathways and the primary cilium*

- Explain the mechanism/s of breaking down of the symmetry of the embryo.  
*Developmental defects: situs inversus and Kartagener syndrome*
- Summarize some basic molecular events involved in the rostrocaudal and mediolateral patterning of the embryo.

### Lectures 5 and 6.

**Topic: The 4th week: establishing the body plan. Planning is everything**

#### Learning outcomes

- Define the organogenetic period
- List and highlight the importance of the major key transitions of animal evolution
- Define the concept of phylotypic stage
- Summarize the key steps of the process of segmentation (somitogenesis)
- List the derivatives of the components of the somite
- Explain the relationship between somites and neural tube development
- Describe the formation of the intraembryonic coelom
- Outline the steps of the folding of the embryo and its outcomes: formation of the primitive intestinal tube, formation of the body cavities, formation of the body wall.
- Describe the formation of the diaphragm. *Developmental defects: congenital diaphragmatic hernia*
- Outline the general organization of the embryonic circulation.
- Explain the difference between vasculogenesis and angiogenesis. *Clinical drop: angiogenesis and vasculogenic mimicry in cancer*

### Lecture 7.

**Topic: Embryonic adnexa and maternal-fetal relationship.**

#### Learning outcomes

- Illustrate the exacting requirements of the relationship between the embryo and the mother
- List the derivatives of the trophoblast and of the inner cell mass
- Outline the role of the amniotic sac and amniotic fluid. *Clinical drops: use of amniotic membranes and fluid; disorders of amniotic fluid; and amniotic bands*
- Summarize the destiny of the vitelline sac and duct.
- Outline the steps that lead to the formation of the placenta and placental circulation
  - Formation of villi and interaction with the decidua
  - Formation of the utero-placental circulation
  - Formation of the placental barrier*Clinical drop: transmission of pathogens to the fetus*
- Outline the role of the placenta as an endocrine organ
- Outline the different region of the decidua
- Describe the formation of the umbilical cord  
*Clinical drops: Placental pathological conditions, Choriocarcinoma, Hydatiform mole*
- Describe the mechanisms that lead to twinning  
*PPP Portfolio-related topic: Abnormal vaginal bleeding*

## Lecture 8 and 9.

**Topic: Development of the digestive system. A place for everything and everything in the right place**

### Learning outcomes

- List the different components of the adult digestive system
- Outline the formation of the primitive intestinal tube and its subdivisions
- Describe the embryological origin of the components of the intestinal wall
- Classify abdominal organs with respect to the peritoneum
- List the derivatives of the three subdivisions of the intestinal tube and their associated vessels
- Illustrate the principles of intestinal tube innervation by the autonomic nervous system
- Describe the formation of the esophagus. *Developmental defects: esophageal stenosis, atresia, and tracheoesophageal fistula*
- Describe the formation the stomach, its rotation and associated organization of the dorsal and ventral mesentery. *Developmental defects: heterotopic gastric mucosa, pyloric stenosis*
- Describe the development of the duodenum. *Developmental defects: duodenal stenosis and atresia*
- Describe the development of the pancreas. *Developmental defects: annular pancreas, ectopic pancreas*
- Describe the development of the liver: *Developmental defects: Biliary atresia*
- Describe the growth of the liver in the ventral mesogastrium and the associated formation of ligaments
- List the derivatives of the midgut and hindgut
- Describe the formation of the midgut loop, its physiological herniation and the position of intestinal organs derived from the loop in the abdominal cavity. Describe the relationship of the intestinal organs derived from the midgut loop with the peritoneum. *Developmental defects: malrotation and abnormal fixation, Meckel diverticulum. Herniation through the anterior abdominal wall: congenital omphalocele, Umbilical hernia, gastroschisis*
- Describe the partitioning of the cloaca and of the cloacal membrane
- Describe the formation of the anal canal. *Developmental defects: anorectal anomalies*
- Illustrate the formation of the Enteric Nervous System. *Developmental defect: Hirschsprung disease*
- List the events of the histogenesis of the digestive tract
- Compare the developmental defects of the different region of the digestive system and explain their origin.
- Describe the position of the organs of the gastrointestinal tract in the abdominal cavity and their relationship with the peritoneum

*PPP Portfolio-related topic: Gastrointestinal bleeding, Abdominal pain, Jaundice*

## Lecture 10.

**Topic: The primordial pharynx and the pharyngeal apparatus. Once there was a fish...**

### Learning outcomes

- describe the pharyngeal apparatus and its relation to the primordial pharynx
- list the components of a pharyngeal arch
- outline the contribution of the pharyngeal apparatus to the formation of the face
- illustrate the formation of the palate – *Developmental defect: cleft palate*
- list the bones, cartilages and muscles originating from the pharyngeal arches
- describe the development of the thyroid gland – *Developmental defects: cysts of the thyroglossal duct, ectopic thyroid tissue*
- list the derivatives of the pharyngeal pouches, clefts and membranes
- *developmental defects: Treacher Collins syndrome, DiGeorge syndrome, abnormal position of glands, ectopic thyroid tissue, lateral cysts, sinuses and fistulae.*

### Lecture 11.

**Topic: Development of the lower respiratory tract. Shall we breathe?**

#### Learning outcomes

- Describe the origin of the respiratory bud and its relationship to the dorsal mesocardium and pericardio-peritoneal canals
  - Outline the steps that lead to the formation of the laryngeal inlet, larynx, and tracheobronchial tree from the respiratory bud - *Developmental defects: tracheoesophageal fistula and others.*
  - Describe the pulmonary segment.
  - Illustrate the main features of each stage of the maturation of the lung parenchyma in relation to the development of the gas-exchange barrier -*Clinical drops: Respiratory Distress Syndrome, Germinal matrix hemorrhage*
  - *Developmental defects: Congenital bronchogenic cysts, Congenital Pulmonary Airways Malformation, Congenital Lobar Emphysema, Bronchiectasis, Pulmonary*
- PPP Portfolio-related topic: Shortness of breath, Fever, Cough*

### Lecture 12 and 13.

**Topic: Development of the urogenital system. Questions of water**

#### Learning outcomes

- Give a brief outline of the components of the urinary system and genital system in males and female
- Briefly describe the formation of the pronephros and mesonephros
- Describe in detail the formation of the metanephros: definitive kidney
- Developmental defects: defects in migration and rotation of the kidney, defects in the formation and course of the ureters, dysplasia and renal agenesis, congenital polycystic kidney disease, congenital hydronephrosis, Wilms tumor
- To describe the formation of the bladder and urethra
- Developmental defects: exstrophy of the bladder, epispadia and ipospadia
- Describe the development of the urogenital crest, the formation of the primitive gonad and its relationship with the mesonephros and mesonephric duct
- Outline the basic steps of the formation of the male and female gonad
- Describe the formation of the Fallopian tubes, uterus and vagina – *Developmental defects: Uterine anomalies*

- Describe the formation of the inguinal canal and the migration of the male gonad – *clinical drop: inguinal hernia- developmental defects: cryptorchidism*
- describe the formation of the adrenal gland – developmental defects: neuroblastoma, congenital adrenal hyperplasia/adrenogenital syndrome

*PPP Portfolio-related topic: Abdominal pain, Fever*

## Lecture 14 and 15.

**Topic: Development of the cardiovascular system, fetal circulation, neonatal circulation.**

### The declaration of independence

#### Learning outcomes

- Illustrate the contribution of the heart fields and other sources to the heart formation
- describe the formation of the heart tube and its looping
- Describe the basic events leading to the formation of the heart chambers and outflow tract
- Outline the main events leading to septation of the heart chambers and outflow tract
- Describe the general organization of the embryonic circulation and how it evolves into the fetal circulation
- Describe how the fetal circulation changes at birth
- *Developmental defects: introduction to the main congenital malformation of the heart and outflow tract.*

*PPP Portfolio-related topic: shortness of breath*

## Organ structure

### Introductory lecture

**Topic: Principles of organ architecture**

#### Learning outcomes

- Define the concept of organ and organ system/apparatus
- Classify organs
- Describe the architectural characteristics of solid/paranchimal organs and hollow organs
- Define a body membrane
- Describe the characteristics of the different body membranes
- List the characteristics of an organ in relation to its response to trauma

*PPP Portfolio-related topic: Trauma*

## Lecture 1

**Topic: Structure of blood vessels and lymphatic vessels. Coming and going**

#### Learning outcomes

- Describe the histology of a typical blood vessel
- Classify arteries morphologically and functionally, based on the characteristics of their wall - *Clinical drops: atherosclerosis; endothelial cells and COVID 19*
- Describe the components of the microvascular bed and their function

- List the different type of capillaries in relation to their structural and functional features - *Clinical drop: edema*
- Classify veins morphologically and functionally, based on the characteristics of their wall.
- Describe the structure of lymphatic vessels and their function
- Apply the knowledge acquired to simple clinical scenarios or research questions  
*PPP Portfolio-related topic: shock*

### Lecture 2 and 3

**Topic: Macroscopic aspects, functional architecture and structure of the esophagus and gastrointestinal tract. Through stormy seas and acid rains..... strange landscapes and narrow passageways...**

#### Learning outcomes

- Illustrate the general structural organization of the digestive system in relation to the functions of digestion and absorption
- Identify the architectural features of each organ of the digestive tract at the macroscopic and microscopic level (esophagus, stomach, duodenum, jejunum, ileum, colon, rectum, and anal canal)
- Associate the histological features and cellular features of each organ to its specific function/s
- Compare the structural and functional features of the different organs of the digestive tract
- *Clinical drops: esophageal varices, reflux esophagitis, hiatal hernia, pernicious anemia, peptic ulcer disease, diarrhea, Inflammatory bowel disease, the Microbial Self and the others, diverticulosis, polyps, the epithelial transformation zone, hemorrhoids*
- Apply the knowledge acquired to simple clinical scenarios or research questions  
*PPP Portfolio-related topic: Gastrointestinal Bleeding, Chest Pain, Abdominal Pain, Diarrhea*

### Lecture 4

**Topic: Macroscopic aspects, functional architecture and structure of the liver**

#### Learning outcomes

- List the main functions of the liver
- Localize the liver and explain its relationship with the peritoneum
- Describe the outer aspect of the organ and its surfaces
- Explain the organization of the blood supply of the organ with respect to its function
- Explain the morpho-functional organization of the liver parenchyma with respect to the classic lobule, portal lobule and liver acinus.
- List the type of cells present in the liver parenchyma and explain their function
- Explain the organization of the space of Disse and its role - *Clinical drop: liver fibrosis*
- Outline the organization of the biliary system (intrahepatic and extrahepatic) and describe its histological characteristics – *Clinical drop: Jaundice*
- Locate the gallbladder and describe its macroscopic aspects – *Clinical drop: gallstones*
- Describe the hepatopancreatic ampulla and its sphincteric device
- Outline the visceral innervation of the liver and biliary system
- Apply the knowledge acquired to simple clinical scenarios or research questions

*PPP portfolio-related topic: Jaundice, Abdominal pain, Back pain*

## Lecture 5

**Topic: Macroscopic aspects, functional architecture and structure of the lower respiratory tract. Every breath you take**

### Learning outcomes

- Outline the subdivisions of the tracheobronchial tree
- Outline the functional and nutritional circulation of the lung
- Give a general overview of how the histological features of the lungs change from proximal to distal
- Identify, at the macroscopic and microscopic level, the salient morphological features of each segment of the conductive portion and respiratory portion of the tracheobronchial tree - *Clinical drops: mucociliary transport, cough, and cystic fibrosis*
- Associate the histological features and cellular features of each segment of the tracheobronchial tree to the function/s of the latter.
- Compare the structural and functional features of the different segment of the tracheobronchial tree - *Clinical drop: asthma*
- Describe and compare the pulmonary lobule and pulmonary acinus
- Describe at the structural and ultrastructural level the alveoli and gas-exchange barrier  
*Clinical drops: Emphysema, Chronic bronchitis, Acute Respiratory Distress Syndrome (ARDS)*
- Outline the lobar subdivision of the lungs and list the structure entering into the hilum of the lung.
- Describe the histological features of the visceral and parietal pleura
- Give a basic outline of the innervation of the tracheobronchial tree and pleurae

*PPP Portfolio-related topic: shortness of breath, chest pain, cough.*

## Lecture 6 and 7

**Topic: Macroscopic aspects, functional architecture and structure of the kidney, ureters and lower urinary tract. The cathedral of water**

### Learning outcomes

- Describe the macroscopic aspect of the kidney
- Describe the structural organization of the kidney parenchyma and its vascular architecture.
- Localize the different portions of the nephrons to the regions of the kidney
- Outline the histological features of the nephron: renal corpuscle and tubular system
- Outline the histological features of the collecting tubules and ducts
- Describe the macroscopic aspect and the histological features of the excretory pathways: calyces, pelvis, ureters and bladder. *Clinical drops: urolithiasis, renal colic*
- Describe and compare the macroscopic and histological features of the male and female urethra

*PPP Portfolio-related topic: dysuria, back pain, pelvic pain, abdominal pain*



## Lectures 8 and 9

**Topic: Macroscopic aspects, functional architecture and structure of the male and female reproductive system. Procreation and recreation**

### Learning outcomes

- List the different components of the female reproductive system
- Describe the macroscopic features of the ovary, uterine tubes, uterus and vagina
- Describe the histological and functional features of these organs and their cyclic changes
- *Clinical drops: Polycystic ovarian syndrome, retroflexion, retroversion and prolapse of the uterus, the transformation zone of the uterine cervix and cancer, endometriosis, leiomyomas or fibroma, sexually transmitted diseases*
- To describe the different components of the male reproductive system
- To describe the morphology of the testicle, epididymus, spermatic pathways and accessory glands
- To describe the main structural aspects of the epididymis, spermatic pathways and accessory glands
- To describe the different portions of the male urethra and the penis
- To describe the innervation of the male and female reproductive system
- *Clinical drops: Prostate hyperplasia and cancer*

*PPP Portfolio-related topic: dysuria, back pain, abnormal vaginal discharge, abnormal vaginal bleeding, abdominal pain, pelvic pain*

## Lectures 10 and 11

**Topic: Heart and pericardium. At the heart of it all.**

### Learning outcomes

- Describe the external morphology of the heart and its surfaces
- Describe the internal cavities of the heart
- Describe the organization of the heart skeleton
- Describe the morphology of cardiac valves
- describe the histological characteristics of the heart wall and the organization of the myocardium
- *Clinical drops: heart valves diseases*
- Outline the organization of the conduction system of the heart and describe its histological features
- Outline the vascularization of the heart
- *Clinical drops: ischemic heart disease*
- Describe the morphology and structure of the pericardium
- Give a brief outline of the innervation of the heart and pericardium

*PPP Portfolio-related topic: shortness of breath, chest pain*

## From normality to pathology

1<sup>st</sup> lesson: METAPLASIA: GOOD OR BAD?

2<sup>nd</sup> lesson: FROM METAPLASIA TO PATHOLOGY.

### Learning outcomes

At the end of these lessons, students should know the definition and morphological features of metaplasia; they should also know the differences with hyperplastic conditions and dysplastic lesions.

Students must be able to apply their knowledge to understand the sequence metaplasia-dysplasia-in situ carcinoma in human organs, such as esophagus, stomach, colon and lung.

### **Histology/Microscopic anatomy practical activity**

During these activities at the light microscope and with virtual images, students will learn how to examine and diagnose exemplifying histological preparations of some of the most important inner organs.

Learning outcomes:

- To use at a basic level a simple light microscope
- To recognize the tissues composing an organ
- To describe the histological architecture of an organ
- To identify an organ

### Organization

Guidelines for specimen observation on virtual images.

- 1:** The digestive tract: esophagus, stomach, duodenum, ileum, colon
- 2:** Liver, pancreas, salivary glands; respiratory tract
- 3:** Urinary tract ; genital system
- 4:** Lymphoid organs; endocrine glands

**Hands-on at the light microscope:** 4 hours of activity at the light microscope

### **ASSESSMENT OF LEARNING**

*The final evaluation will consist in:*

- A written exam (End of Semester Exam written, ESEw)
- An oral exam (End of semester Exam oral (ESEo))
- A description and identification of a histological preparation

Students will have access to ESEo only if they have passed ESEw.



The results of ESEw will be kept valid only within the exam session in which it was passed. (winter, summer, fall)

*The final grade will be determined as follows:*

Starting from the result of the written test (see below), the examiner will determine the final grade based on the performance of the oral exam. On average, the outcome of the oral exam will modify the grade of the written test of + or – 3 points. However, the examiner may decide that the abilities shown in the oral exam (see below) are so very poor, that even if the written test was passed the student needs to repeat the exam.

The participation and performance of the students to the formative activities of the semester will also be taken into account in the final evaluation.

### **End of Semester Exam written (ESEw) content and grading**

**The purpose of the written exam is to evaluate** the level of knowledge and understanding of the topics presented during the course through questions related to the abilities of the student to:

recall, select, identify, order, match, recognize, compare, apply, and associate information.

The test will be delivered through the LMS. Students are required to come to the exam with their own computer (no tablets). Upon previous request to IT support, a computer can be provided by the university.

Duration: 90 minutes. To prevent distraction and disturbances, students are allowed to leave the class only at the end of the test when everybody has made the submission.

Content: 62 questions, cytology, histology (18q), general embryology, organogenesis, organ structure (44 q)

Questions may include: Multiple choice questions, True and False questions, Drag and drop onto a background image, Drag and drop into text, Matching, Select missing words, Short answers, or other type of questions.

Evaluation: each question, 0.5 points.

A question that has more than one correct answer will be considered valid only if all the correct answers have been identified.

To pass the test you need to answer to at least 36 questions correctly (grade, 18)

60 correct answers: grade 30

From 61 to 62 correct answers: grade 30 lode



A minimum of 50% correct answers in histology (9 q) and a minimum of 50% correct answers in the rest of the program (22 q) is required

### **End of Semester Exam oral (ESEo) content and grading**

**The purpose of the oral exam is to evaluate the ability of the student to:**

- show understanding of the relevance and meaning of the information and concepts recalled by answering in an organized, complete, specific, and clearly understandable manner
- show depth and soundness of knowledge and understanding of the subject of the questions by being able to make relevant connections and/or comparisons with other topics and to apply such knowledge to the clinical context and/or problem solving.

### **Description and diagnosis of histological preparations**

Students' ability to describe and diagnose histological preparations will be evaluated on virtual images at the end of the written exam (ESEw). Selected images will be available through the LMS. Students must provide a short written description of the histological images and the recognition of the organ.

Duration: 20 minutes.

The evaluation of the practical exam is: passed or failed. This part of the assessment will be kept valid up to the winter session of the next academic year.

### **Textbooks**

Pawlina

Histology A Text And Atlas - With Correlated Cell And Molecular Biology,  
Wolter Kluwer, latest edition

Bruce M. Carlson

Human Embryology and Developmental Biology,  
Elsevier, latest edition

Gary C. Schoenwolf et al.

Larsen's Human Embryology,  
Elsevier, latest edition

Kevin L. Moore, T.V.N Persaud, Mark G.Torchia

The developing human. Clinically oriented embryology,



Elsevier, latest edition