I year (2nd semester) **A.Y. 2025-26**	Scientific Field	**HISTOLOGY AND EMBRYOLOGY**	TUTOR	ECTS
L. CAMPAGNOLO. **COORDINATOR**	BIOS-13/A			6
E. BIANCHI	BIOS-13/A			1
V. LACCONI	BIOS-13/A			2
			TOT	9

SPECIFIC AIMS	The aim of the *Histology and Embryology* integrated course is to provide students with comprehensive knowledge of the organization, structure, and development of cells, tissues, and organs, forming the foundation for understanding human biology and disease. The course emphasizes the dynamic nature of development from a single cell to a fully organized organism, with a focus on the structural and functional relationships at the base of normal physiology and pathological processes. Through the use of various microscopy techniques—including optic microscopy and electron microscopy—students will observe the fine details of mammalian cellular and tissue architecture, to acquire an in-depth understanding of biological organization at the microscopic level, which is essential for the subsequent study of physiology, pathological anatomy, pathophysiology, and clinical medicine. Learning Objectives Through the integrated study of Cytology, Histology, and Embryology, students will achieve the following: - Histological organization of Cells, Tissues, and Organs Students will learn to identify and describe the microscopic features of the main tissue types—epithelial, connective, muscular, and nervous—and their organization into functional organs. Emphasis will be placed on the correlation between structure and physiological function, enabling students to understand how microscopic changes can affect organ performance and health. - Use of Morphological Terminology Students will be trained to accurately describe and discuss tissue structures using proper histological and embryological terminology. This skill is essential for clear communication in medical and scientific contexts. - Cell Differentiation and Developmental Mechanisms The course will cover the molecular and cellular mechanisms underlying cell differentiation, histogenesis (tissue formation), and embryogenesis (organismal development). Students will understand how genetically programmed processes and signaling pathways drive the specialization of cells and the organization of tissues.

	- Gametogenesis, Fertilization, and Early Embryonic Development The early stages of human development—from the formation of gametes (spermatogenesis and oogenesis), through fertilization, cleavage, blastocyst formation, and implantation—will be thoroughly studied, providing insight into the origin of the embryo and the beginning of human life. - Formation of Embryonic Germ Layers and Organogenesis Students will examine the formation and significance of the three primary germ layers (ectoderm, mesoderm, and endoderm), and how these layers give rise to the various tissues and organs of the body through the complex process of organogenesis. - Principles of Morphogenesis and Dysmorphogenesis The course will introduce the principles of morphogenesis, the biological process that gives rise to the shape and structure of tissues and organs, as well as the concept of dysmorphogenesis, which refers to the abnormal development of these structures. This includes discussion of congenital anomalies, their embryological origins, and potential clinical implications.

PROGRAM	- Methods used in the study of cells and tissues. - Structural functional organization of the eukaryotic cell. - Plasma membrane. - Rough and smooth endoplasmic reticulum. - Golgi apparatus and vesicle trafficking.

CYTOLOGY	- Lysosomes and peroxisomes. - Mitochondria. - Cytoskeleton and centrioles

PROGRAM **HISTOLOGY**	- Introduction to tissues. - Cell differentiation and histogenesis of tissues. -Stem Cells; embryonic and adult stem cells, somatic cell reprogramming into pluripotent stem cells (iPS): concepts, definition and potentiality for tissue regeneration and repair. - Epithelia. - Cell surface specializations and cell polarity. - Lining epithelia. - Glands (endocrine and exocrine). - Connective tissues: General structure and function of the connective tissue; extracellular matrix, fibers, ground substance and cells. - Cartilage: Types of cartilage; chondrogenesis and cartilage growth. - Bone: Bone structure and function. Osteogenesis; bone remodeling and homeostasis. - Blood: plasma, erythrocytes, leucocytes, platelets. Hemopoiesis. - Immune system and lymphatic organs. - Muscle tissues: structure and function of the skeletal, cardiac and smooth muscle.

	- Nervous tissue: Neurons. Neuroglia. Nerve fibers. Synapses. Neuromuscular junction.

TOPICS HISTOLOGY LAB. HISTOLOGY CLINICAL PRACTICE.	- Methods for the preparation of histological sections (concepts) (2 hr). - preparation of histological sections of selected tissues (practice) (10 hr) - Seminars (16 hr) - Evaluation test (2 hr) Microscopic analysis of tissues (25 hr): - Epithelia, boundary and glandular. - Connective Tissue Proper, Adipose Tissue, Cartilage, Bone. - Blood and lymphatic organs. - Muscle tissues (skeletal, cardiac and smooth muscles) and Nervous tissue (nerve and spinal cord).

PROGRAM **EMBRYOLOGY**	- Spermatogenesis. - Hormonal control of spermatogenesis -Folliculogenesis and oogenesis - Hormonal control of folliculogenesis and oogenesis. - Ovarian & uterine cycles - Fertilization.

Commentato [LC1]: NON SO SE MANTENERE QUESTA PARTE SOPRATTUTTO SE RADDOPPIANO I NUMERI

Commentato [LC2]: NON SO SE QUESTO SI RIFERISCE ALL'ESAME O AD UN TEST DI VALUTAZIONE SULLA PARTE PRATICA, MA ORA L'ESAME E' SOLO ORALE E NON FACCI OTEST IN ITINERE

	- First week of development and implantation embryo. - Second week of development and the formation of embryonic disk. - Third week of development and the formation of primitive layers: endoderm, ectoderm and mesoderm. - The notochord and its role in embryo development. - Fourth week of development and the embryonic folding and body cavities. - Placenta and extraembryonic membranes. ORGANOGENESIS. Development of: - Intergumentary system - Head and neck - Oropharingeal apparatus - Gut - Respiratory system - Urogenital system - Skeleton and muscle system - Nervous system - Cardiovascular system

TEXTBOOKS	A choice of different textbooks (in alphabetical order): Students are strongly encouraged to choose a Histology textbook and an Embryology textbook. - HISTOLOGY (including essential Cytology): Pawlina W, Histology: a Text and Atlas, Lippincott Williams & Wilkins, IX edition 2023 Gartner & Hiatt's Atlas and Text of Histology, Wolters Kluwer Health, 2022 O'Dowd, Bell, Wright: Wheather's Functional Histology, a text and colour atlas. 7th edition 2023 - EMBRYOLOGY : Schoenwolf & Bleyl & Brauer & Francis-West. Larsen's Human Embryology, Churchill Livingston Elsevier, 2021 Moore K.L. The developing Human. Clinically oriented Embryology, Saunders Elsevier, 11th ed. Sadler T.W. Langman's Medical Embryology, Lippincott Williams & Wilkins, 15th edition. Bruce M. Carlson Human Embryology and Developmental Biology, Mosby Elsevier, 7th edition 2023 - Reference & supplementary books: Alberts and others, Molecular Biology of the Cell, Garland Science, 2022. Eroschenko VP, Atlas of Histology with Functional Correlations, Lippincott Williams and Wilkins, 2017
EXAM METHOD	The final exam consists of a practical test of microscopic identification of tissues and an oral examination on topics related to cytology, histology and embryology.

EXAM COMMISSION	The Coordinator, full Professors of the disciplines, Professors of similar disciplines, Specialists of the subject, compose the exam Commission of the Integrated Course.

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CONTACTS

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PREREQUISITES: Previous knowledge and competence in the following subjects:
Human Anatomy1, Chemistry and Introductory Biochemistry.

The specific learning outcomes of the program are coherent with the general provisions of the Bologna Process and the specific provisions of EC Directive 2005/36/EC. They lie within the European Qualifications Framework (Dublin Descriptors) as follows:

1. **Knowledge and Understanding**

- From the observation of macroscopic morphology of the human body structure, combined with observation of the microscopic structure of a variety of human cells, tissues, organs, etc., through the microscope, build the cognitive concepts for cells, tissues, and organs composing the human body system and structure and further combine structure with function.
- Recognize the structural components of the cell, their function and how this correlates with the maintenance of equilibrium at organ, tissue and systemic level.
- Understand the characteristics, function and use of STEM CELLS with regard to their exploitation in the setting of tissue and organ repair. Understand their potential present and future use in medical research.
- Analyze the stages of embryo development, focusing on the genesis of each organ.
- Demonstrate knowledge about established and evolving medicine, being aware of the usefulness of an up-dated education.

2. **Applying Knowledge and Understanding**

- Participate in the study or discussion of slides via four-headed microscope; discuss the findings of the case with the teachers responsible for the individual cases, and make important contributions to the interpretation of the findings.
- Approach to the use of microscopes, in particular the light microscope.
- Provide a proper description of a case based on specific macroscopic and microscopic examination.
- Learn the practical aspects of the pathologic diagnostic instruments, when to use them and how to perform them.
- Learn to interpret appropriate laboratory and diagnostic studies.

3. **Making Judgements**

- Recognize the importance of an in-depth knowledge of the topics consistent with proper medical education.
- Identify the fundamental role of proper theoretical knowledge of the subject in the clinical practice.

4. **Communication Skills**

- Present the topics orally in an organized and consistent manner.
- Use of proper scientific language coherent with the topic of discussion.

5. **Learning Skills**

- Identify the possible use of the acknowledged skills in the future career.
- Assess the importance of the acquired knowledge in the overall medical education process.