HISTOLOGY AND EMBRYOLOGY

I° ANNO	Scientific Field	DISCIPLINE	TUTOR
Histology and Embriology	BIO/17	*Cytology and Histology*	**De Felici Massimo**
	BIO/17	*Embryology*	**Salustri Antonietta**
ECM 9	BIO/17	*Embryology*	**Campagnolo Luisa**
Coordinator	BIO/17	*Embryology*	**Francesca Gioia Klinger**
Massimo De Felici			

Specific aims

Through the integrated study of Cytology, Histology and Embryology, the student will learn: the microscopic anatomy of cells, tissues and organs, with an emphasis on relationships between structure and function; to describe and discuss, using a correct terminology, specific morphological organizations; the molecular mechanisms of cell differentiation, histogenesis and embryogenesis, gametogenesis, fertilization and the early stages of embryonic development; the mechanisms and processes of primitive embryonic layers formation; the development of organs and apparatus. Principles and mechanisms of morphogenesis and dysmorphogenesis.

PROGRAM COURSE

Introduction: Histological techniques: overview of methods in cytology and histology; tissue preparation for microscopic examination; optical and electronic instruments for studying cells and tissues.
Cytology: Structural organization and function of the eukaryotic cell. Cytoplasm and nucleus. Cytoplasmic organelles. Plasma membrane. Rough and smooth endoplasmic reticulum. Golgi apparatus and vesicle trafficking. Mitochondria. Cytoskeleton and centrioles. Inclusions. Cytosol. Nucleus. Nuclear envelope. Chromatin. Nucleolus. Cell death and division.
Histology: Introduction to tissues. Cell differentiation and histogenesis of tissue. Tissue engineering.
Epithelium. Specializations of cells surface and cell polarity. Lining epithelia. Glands.
Connective tissues. General structure and functions of connective tissue; extracellular matrix, fibers, ground substance and cells; Connective tissue proper.
Cartilage. Types of cartilage; chondrogenesis and cartilage growth
Bone. Bone architecture and functions. Osteogenesis; bone remodeling and homeostasis .
Blood: plasma, erythrocytes, leucocytes, platelets. Hemopoiesis.
Immune system and organs
Muscle tissues: morphology and functional characteristics of skeletal, cardiac muscle and smooth muscle. Nervous tissue. Neurons. Nerve fibers. Synapses. Neuroglia. Peripheral nerve terminals.
Embryology: Introduction. Gametogenesis and fertilization. In vitro fertilization. Embryonic and adult stem cells, somatic cell reprogramming into pluripotent stem cells (iPS): concepts, definition and potentiality for tissue regeneration and repair. Early stages of the embryo development. Segmentation. Morula. Blastocyst and implantation. The embryonic disk. Timing and 3D development of primitive layers: endoderm, ectoderm and mesoderm.

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PROGRAM

The notochord and its role in embryo development. Embryonic folding and body cavities. Ectoderm development. Endoderm development. Mesoderm development. Neural crest derivatives. Placenta. Embryo annexes. Morphogenetic mechanisms. Tissue origin and differentiation of integumentary, musculoskeletal, central and peripheral nervous, circulatory, digestive, respiratory and urogenital systems. Teratogenesis.

Subject (Cytology and Histology)

Course presentation - Overview of methods in cytology and histology
Tissue preparation for microscopic examination. Opt. & electronic Microscopy
Structural organization and function of the eukaryotic cell - Cytoplasm and nucleus.
Cytoplasmic organelles
Plasma membrane. Rough and smooth endoplasmic reticulum
Nucleus. Nuclear envelope. Chromatin
Nucleolus. Cell death and division
Golgi apparatus and vesicle trafficking. Mitochondria
Cytoskeleton and centrioles. Inclusions, Cytosol
Evaluation test 1
Introduction to tissues. Cell differentiation and histogenesis of tissue.
Tissue homeostasis
Epithelium. Specializations of cells surface and cell polarity
Lining epithelia
Lining epithelia
Glands
Glands
Histology Lab : Methods for preparation of histological sections (4 hr)
Histology Lab : Epithelia (2 hr)
Connective tissues. General structure and functions of connective tissue
Connective Tissue proper: extracellular matrix, fibers, ground substance
Connective Tissue proper: cells
Connective Tissue proper - Adipose tissue
Cartilage. Types of cartilage
Chondrogenesis and cartilage growth
Bone architecture and functions
Bone architecture and functions - Osteogenesis; bone remodeling and homeostasis
Histology Lab : Connective Tissue, Cartilage, Bone (2 hr)
Blood: plasma
erythrocytes, platelets
Leucocytes
Leucocytes

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Hemopoiesis
Immune system and organs
Histology Lab : Blood and Hemopoiesis (2hr)
Muscle tissues: morphology and functional characteristics of skeletal, cardiac muscle and smooth muscle
Skeletal muscle
Cardiac muscle
Smooth muscle
Nervous tissue. Neurons
Nerve fibers. Synapses. Neuroglia. Peripheral nerve terminals
Histology Lab :Muscle and Nervous Tissues (2 hr)
Seminars and Evaluation test 2

Subject (Embryology)
Spermatogenesis
Hormonal control of spermatogenesis
Folliculogenesis and oogenesis
Hormonal control of folliculogenesis and oogenesis. Ovarian & uterine cycles
Fertilization.
Fertilization. In vitro fertilization
Early stages of the embryo development. Segmentation. Morula
Blastocyst and implantation
Embryology Lab (4 hr)
Embryonic and adult stem cells
Somatic cell reprogr. into pluripotent stem cells (iPS): concepts, definition and potentiality for tissue regen. and repair
II week of embryonic development
III week of embryonic development: gastrulation, trilaminar germ disc
III week of embryonic development: notochord, somites; evolution of trophoblast
IV week- Embryonic foldings and definition of body cavities
Ectoderm and neurulation
Completing the CNS development - neural crests derivatives - role of HOX genes
Embryology Lab (4 hr)
Intermediate mesoderm-Development of the urinary system
Development of the genital system
Lateral mesoderm –Heart and Circulatory system
Endoderm development - Pharyngeal gut
Digestive and respiratory system
Placenta
Seminars and Evaluation test 3

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TEST Books

A choice of different textbooks is proposed (in alphabetical order). The indicated textbooks are all of high quality and complete. The students are encouraged to choose freely. Both a Histology textbook and an Embryology textbook are necessary.

Study books

- Histology (including essential Cytology)
  - Ross MH & Pawlina W, Histology: a Text and Atlas, Lippincott Williams & Wilkins, 2010.
  - Gartner LP & Hiatt JL, Color Textbook of Histology, Lippincott Williams & Wilkins, 2009.
  - Young B & Others, Wheather's Functional Histology. Churchill Livingstone Elsevier, 2006.

- Embryology
  - Shoenwolf G.C. Larsen's Human Embryology, Churchill Livingston Elsevier, 2009
  - Moore K.L. The developing Human. Clinically oriented Embryology, Saunders Elsevier, 9th ed.
  - Sadler T.W. Langman's Medical Embryology, Lippincott Williams & Wilkins, 2010.

Reference & supplementary books

- Alberts and others, Molecular Biology of the Cell, Garland Science, 2008.
- Ross MH, Pawlina W & Barnash TA, Atlas of descriptive Histology, Sinauer Associates, 2009
- Eroschenko VP, Di Fiore's Atlas of Histol. with funct. correl., Lippincott Williams & Wilkins, 2007
- Gartner LP & Hiatt JL, Color Atlas of Histology, Lippincott Williams & Wilkins, 2009.

Histology and Embryology Link

- Atlas of Human Embryology http://www.chronolab.com/embryo/index.htm
- Dynamic Development http://people.ucalgary.ca/~browder/virtualembryo/dev_biol.html
- Embryo Images On-line http://syllabus.med.unc.edu/courseware/embryo_images/
- Embryology-CH http://www.embryology.ch/indexen.html
- e-Mouse Atlas Project http://www.emouseatlas.org/emap/home.html
- The Multi-dimensional Human Embryo http://embryo.soad.umich.edu/index.html
- UNSW Embryology http://embryology.med.unsw.edu.au/
- University of Toronto Human Development http://www.utm.utoronto.ca/~w3bio380/index.html
- Virtual Embryo http://people.ucalgary.ca/~browder/virtualembryo/index.htm
- Histology-World http://www.histology-world.com/articles/article4.htm

METHOD of TEST

Evaluations tests will be performed during the course. The final voting will be given on the basis of these tests. In addition, in June, September and February on dates to be agreed with the students, oral examinations will be held by students who have not passed the tests or who wish to improve their voting.

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TEST COMMISSION

Massimo De Felici *(President)*	
Antonietta Salustri	
Antonio Mario Russo	
Donatella Farini	
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Francesca Gioia Klinger	
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