

**Name of the module: Human Embryology 1<sup>st</sup> year Medicine**

**Number of module: 471-8-3004**

BGU Credits: 2.5

ECTS credits:

Academic year: 1<sup>st</sup> year Medicine

Semester: first semester

Hours of instruction: 2 hours per week frontal lecture + nine 2-hour tutorials.

Location of instruction: Weekly lectures, tutorials and laboratories will take place in the Deichmann Building for Health Professions.

Specific classroom numbers are indicated in the schedule.

Language of instruction: Lectures will be given in English.

Cycle: B.Med.Sc

Position: Obligatory module intended for the 1<sup>st</sup> year medical students, as part of their preclinical teaching.

Field of Education: Embryology.

Responsible department: Physiology & Cell Biology

General prerequisites: None.

Grading scale: Successful passing of the exam (multiple choice questions) with a score of 65 or higher.

Course Description: This course provides a comprehensive study of basic Human Embryology and associated birth defects.

Aims of the module: The goal of the Embryology course is to equip the students with knowledge of tissue development and organ formation during embryogenesis, which serves as a basis for understanding Human Anatomy and diagnosis of congenital defects.

Objectives of the module: Embryology course is designed to teach medical students (1) the key events of embryonic and fetal development that generate the adult organism, (2) the origins of both normal anatomical structures in the adult and the developmental causes of their malformations, and (3) that development is a genetic program, affected by environmental stimuli and gene mutations, (4) the integration of classical embryology and modern medicine.

Learning outcomes of the module: On successful completion of the course, the student should be able to:

1. Identify spatio-temporal processes involved in tissue and organ formation during embryogenesis.
2. Recognize the developmental causes of genetic disorders and develop problem-solving and critical-thinking skills.
3. Critically assess and integrate the diverse symptoms of multifaceted congenital syndromes.

Attendance regulation: Attendance of the frontal lectures and tutorials are obligatory.

Teaching arrangement and method of instruction: Instruction in the module is based on frontal lectures, homework assignments – Teaching Units, and tutorials.

Lecturer: Dr. Inna Gitelman

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Module evaluation: at the end of the semester the students will evaluate the module, in order to draw conclusions, and for the university's internal needs.

Confirmation: the syllabus was confirmed by the faculty academic advisory committee.

Last update: October 2015

Assessment:

Students' knowledge will be assessed by means of:

- 1) end of the term exam – 88% of the final mark.
- 2) quizzes during tutorials [using an electronic Question & Answer system] – 12% of the final mark.

Work and assignments: Attending and preparing for the tutorials and doing homework assignments that are given throughout the semester for each topic studied.

Time required for individual work: In addition to attendance in class, tutorials and laboratory sessions, the students are expected to study on their own: review the lecture material, do homework exercises, read and understand material from the assigned course textbook (before lecture as a preparation, and after it as a review). Time required for independent work is about 2 hours per hour of lecture, and additional 1½ hours per homework assignment - these numbers were provided by the students who have previously taken the course.

Module Content\ schedule and outlines:

1. Embryogenesis - a Genetic Program
  - 1) Terminology - the Language of Science
  - 2) The Cycle Of Life and Overview of Embryogenesis
  - 3) Timeline of Pregnancy, Growth and Development
  - 4) Human Development – From Egg to Organism - Creating a New Body
  - 5) Generation of Cell Diversity through Differential Gene Expression
  - 6) Embryogenesis - a Genetic Program
  - 7) Control of Embryogenesis - Both Environmental and Genetic Factors
2. From Fertilization to Bilaminar Embryo
  - 1) Male and Female Gametes (Sperm and Egg Cells)
  - 2) The process of Fertilization
  - 3) Early Cell Division and Differentiation
  - 4) Compaction
  - 5) From Zygote To Blastula
  - 6) Formation of the Bilaminar Disc
3. Stem Cells and Gametogenesis
  - 1) Oogenesis: Where & How?
  - 2) Spermatogenesis: Where & How?
  - 3) Stem Cells – Concepts:
    - a. Potency
    - b. Progressive Differentiation
    - c. Self-Renewal
    - d. Regulation - Stem Cell Niche
  - 4) Cancer – Cell Division & Differentiation Out Of Control
4. Gastrulation – Establishment of the Three Germ Layers
  - 1) EMT: Epithelial to Mesenchymal Transformation
  - 2) Gastrulation – Formation of Trilaminar Embryo
  - 3) Rostro-Caudal Gradient of Embryonic Development
  - 4) Primitive Streak (Gastrulation) Defects
5. Ectoderm: Formation of Epidermis and the Nervous System
  - 1) Ectoderm derivatives
  - 2) Development of the Central Nervous System: 1<sup>o</sup> and 2<sup>o</sup> Neurulation
  - 3) Neural Tube Closure
  - 4) Neural Tube Defects
  - 5) Neural Crest – “the 4<sup>th</sup> Germ Layer”
  - 6) Development of the Peripheral Nervous System
6. Embryonic Folding and Morphogenesis
  - 1) The Three Germ Layers - Embryonic and Extra-embryonic regions
  - 2) Mesoderm - Creation of the body cavity through splitting of the **Lateral Plate Mesoderm (LPM)**
  - 3) Endoderm - Formation of the primitive gut /primitive digestive tube
  - 4) Embryonic Lateral and Cephalo-Caudal Folding - creation of a 3-dimensional organism
7. Development of the Endoderm
  - 1) Endoderm derivatives during organogenesis: the primitive gut - from the buccopharyngeal to cloacal membrane
  - 2) Primitive gut components: Foregut, Midgut, Hindgut
  - 3) Primitive gut formation the role of: cephalo-caudal and lateral foldings, re-canalization, visceral mesoderm
  - 4) Adult derivatives of the primitive gut: Digestive, Respiratory and Urogenital systems
8. Development of Mesoderm
  - 1) Mesoderm Subdivisions
  - 2) Paraxial Mesoderm: Establishing the Segmented Pattern of Head and Body
  - 3) Main Subdivisions Of The Somites: Sclerotome, Myotome And Dermatome
  - 4) Axial Skeleton Formation
  - 5) The Process Of Myogenesis
  - 6) Multiple Congenital Malformation of the Musculo-Skeletal System
9. Development of the Fetal-Maternal Circulation
  - 1) Implantation into the uterine wall
  - 2) Fetal-Maternal circulation: chorionic villi, placenta
  - 3) Extra-embryonic envelopes: amnion, chorion
  - 4) Twinning
  - 5) Human mosaics
10. Experimental Embryology

Required reading: Moore, Persaud and Torchia. 2012. The Developing Human: Clinically Oriented Embryology. 9th edition, (Elsevier-Saunders).

Additional literature: S.F. Gilbert. Developmental Biology. 2012. 9th edition Sunderland Sinauer Associates.

\*The learning material is available to students through Lecture Handouts/Moodle/ library/ electronic documents available to BGU students.