SUBJECT CARD

Faculty of Medicine and Health Sciences
Field of studies: Medicine
Form of studies: Full-time
Degree: long-cycle Master's program
Specializations: No specialization
Academic year: 2022/2023

BIOLOGY OF PRENATAL DEVELOPMENT	
SUBJECT	**Biology of prenatal development**
NUMBER OF ECTS POINTS	5
LANGUAGE OF INSTRUCTION	English
TEACHER(S)	Professor Jadwiga Mirecka, MD, PhD Assoc. Professor Ewa Wypasek, MD, PhD Emanuel Kolanko, MD Bożena Wójcik, MSc
PERSON RESPONSIBLE	Assoc. Professor Ewa Wypasek, MD, PhD
NUMBER OF HOURS	
LECTURES	34 h
CLASSES	5 h
SEMINARS	22 h
GENERAL OBJECTIVES	
OBJECTIVE 1	To familiarize students with typical stages of human development from fertilization to birth. Causes and mechanisms underlying congenital malformations - genetic and environmental factors. Maturation of organ systems during fetal life that will be essential for extrauterine life.
OBJECTIVE 2	Understanding of key principles of genetics. The mechanisms governing inheritance and law of genetics.
LEARNING OUTCOMES	
MK1	**Knowledge:** The student has knowledge of basic genetic concepts and genetic mechanism, genetic linkage, normal human karyotype, various types of sex determination. (C.W1_EUK7_W36, C.W2_EUK_7W37, C.W3_EUK7_W38)
MK2	**Knowledge:** The student knows the structure of chromosomes and is able to characterize the molecular basis of mutagenesis. (C.W4_EUK7_W39)
MK3	**Knowledge:** The student knows the rules of nuclear and non-nuclear inheritance. (C.W5_EUK7_W40)
MK4	**Knowledge:** The student knows the genetic basis of human blood groups and serological conflict in the Rh system. (C.W6_EUK7_W41)

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MK5	**Knowledge:** The student has knowledge of the developmental stages in human embryos as well as describes the structure and function of placenta and fetal membranes. The student is able to characterize organogenesis and the consequences of the impact of disrupting factors. (A.W6; EUK7_W6)
MK6	**Knowledge:** The student describes the methods for assessing fetus development as well as knows the indications for prenatal diagnosis.
MS1	**Skills:** The student uses embryonic nomenclature in Polish and English language. (A.U5, 5EUK7_U5)
MS2	**Skills:** The student explains the necessity of prenatal diagnostic in case of the abnormal fetal development.
MS3	**Skills:** The student defines the gestational age based on significant external features and ultrasound images.
INTRODUCTORY REQUIREMENTS	
There are no specific prerequisites.	
COURSE PROGRAMME	**DETAILED DESCRIPTION OF THE TOPIC BLOCKS**
LECTURE 1	Mechanisms of cell division (mitosis and meiosis): DNA synthesis, maintenance of normal chromosome structure, centromere, kinetochore and chromosome segregation. Clinical aspects of cell division disorders.
LECTURE 2	Basic concepts of genetics: genetic definition (gene, genome, genotype, phenotype, karyotype, genetic polymorphism and mutation), gene expression and gene transmission (mechanisms of inheritance).
LECTURE 3	Mechanism of epigenetic inheritance. Genomic imprinting (Angelman, Prader-Willi and Beckwith-Wiedemann Syndrome)
LECTURE 4	The genetic and molecular basis of development: embryonic induction, morphogenetic fields and cell differentiation. Molecular signalling pathways during embryogenesis and organogenesis.
LECTURE 5	Gametogenesis (oogenesis and spermatogenesis) during the adolescent and reproductive period.
LECTURE 6	The fertilization process – capacitation and block to polyspermy. Cleavage - the divisions of zygote. Formation and implantation of blastocyst into the endometrium. Causes of infertility and spontaneous miscarriage.
LECTURE 7	Blastoderm formation and trophoblast differentiation. Gastrulation - the development of three primary germ layers. Neurulation - neural tube formation.
LECTURE 8	Histological characteristic of the placenta, fetal membranes and umbilical cord.

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LECTURE 9	Folding of embryo. Amnion, yolk sac, chorion and allantois formation. Body cavities, mesentery and diaphragm. Periods of prenatal development: germinal, embryonic and fetal. Determination of embryonic age according to its morphological features.
LECTURE 10	Organogenesis: pharyngeal apparatus, face, and neck formation. The examples of anomalies.
LECTURE 11	Organogenesis: nervous system and sense organs development. Congenital abnormalities.
LECTURE 12	Organogenesis: cardiovascular system development. Heart and blood vessels disorders. Hematopoiesis and its dysfunction. The genetic basis of human blood groups and serological conflict in the Rh system.
LECTURE 13	Organogenesis: respiratory and alimentary systems development, clinical aspects.
LECTURE 14	Organogenesis: musculoskeletal system development. Examples of the malformation of skull, spine and limbs.
LECTURE 15	Organogenesis: integumentary system and clinical aspects.
LECTURE 16	Organogenesis: urogenital system development. Disorders in sex differentiation, hypospadias and cryptorchidism.
LECTURE 17	Teratology - fetal birth defects caused by environmental and genetic factors.
CLASS 1	Histological characteristic of the placenta, fetal membranes and umbilical cord.
CLASS 2	Patterns of inheritance genetically determined diseases based on pedigree analysis. Principles of genetic tree construction. Drawing a pedigree tree based on a case report. Determining the risk of disease in offspring.
SEMINAR 1	Organization of seminars and rules of examination credit. Pregnancy trimesters - general characteristics. Periods of prenatal development, embryo development stages according to the Carnegie Institution. First and second week of development (stages of fertilization, results of fertilization, formation of blastocysts, amniotic cavity, embryonic disc and umbilical vesicle).
SEMINAR 2	Inheritance of the nuclear and mitochondrial genome. Structure of nuclear DNA vs. mitochondrial DNA. Mitochondrial diseases - examples, clinical picture. Expression of genetic information, different levels and mechanisms of regulation.
SEMINAR 3	Epigenetic control of fetal gene expression. Inheritance and epi-genetic programming. Modulation of the epigenome by nutrition and xenobiotics during early life.
SEMINAR 4	Influence of environmental factors on spermatogenesis, oogenesis, pregnancy and fetal development.
SEMINAR 5	Infertility: symptoms, causes, diagnosis, management and prevention. In vitro fertilization, scientific, ethical and legal aspects.

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SEMINAR 6	The period of embryonic development - the development of systems and organs (the most important facts). Transport of substrates, metabolites and pathogens between mother and fetus.
SEMINAR 7	Fetal development, functional maturation of systems and organs. Maternal changes during pregnancy, labor, and birth. Hormonal changes. Determination of the date of delivery, periods of delivery and assessment of postnatal status of the newborn (Apgar scale).
SEMINAR 8	Critical periods in human prenatal development. Factors harmful to the development of the embryo /fetus. Developmental defects - how to prevent them?
SEMINAR 9	Prenatal diagnosis - indications for testing, non-invasive and invasive methods for assessing the condition of the fetus. Types of multifetal pregnancies, mechanisms of formation, risk to fetal development.
SEMINAR 10	Summary and systematization of the most important topics presented during the course, summary tasks.
SEMINAR 11	Final test.
DIDACTIC METHODS (APPLIED)	
M16	Lectures
M5	Discussion
M8	Work in groups
M10	Multimedia presentations
STUDENTS WORKLOAD	
NUMBER OF HOURS UNDER SUPERVISION	60 hours
NUMBER OF PREPARATION HOURS	Preparation for classes: 30 hours Preparation of presentation: 10 hours Preparation for the exam: 20 hours
TOTAL NUMBER OF HOURS FOR THE COURSE	120 hours
CONDITIONS FOR COURSE COMPLETION	
LECTURES	Attendance is obligatory.
CLASSES	Attendance is obligatory at all exercises. In exceptional and justified cases, attending in seminars/exercises with another group is possible only after prior consent of the person conducting the classes.

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SEMINARS	One absence is allowed, the other absence must be justified by sick leave (at the latest at the first classes in which the student participates after a period of absence). Three or more absences (regardless of the reason) result in the failure to pass the seminars, which means that it is not possible to proceed with the written credit.
METHODS OF ASSESMENT	
IN TERMS OF KNOWLEDGE	A written test containing open questions
IN TERMS OF SKILLS	Multimedia presentations
IN TERMS OF SOCIAL COMPETENCY	Active participation in classes
FORMATIVE	A written test containing open questions Active participation in classes
CLASSES	Active participation in classes and compile pedigree tree based on own family or case report. If the pedigree is not passed, the student is obliged to prepare it again no later than one week before the exam. Passing classes is necessary for admission to the exam.
SEMINARS	Active participation in seminars (preparation of the presentation) and passing the final seminar test. The test will consist of 10 descriptive tasks, for each question a maximum of 4 points can be received, a maximum of 40 points can be obtained. Positive assessment of this test (to obtain a minimum of 55%, 22 points) is the basis for admission to the final written test. A student who does not obtain the required minimum from the tests should proceed to the written amendment (20 descriptive questions) within the time limit set by the teacher.
SUMMATIVE (I&II terms)	**I term (EXAM):** The written exam lasts 120 minutes and containing 20 open questions covering material from seminars and lectures, requiring a longer written statement (problem solution). The student can receive a maximum of 4 points for each question, a maximum of 80 points can be obtained. The condition of passing the exam will be obtaining min. 55% (44 points) of the entire pool of points possible to obtain. The final grade will include the following: points obtained from passing the seminar test (min. 22, max. 40 points) and points obtained from the final written test (min. 44 points, max. 80 points). **II term (RETAKE EXAM):** The written exam on the same conditions as above (with 20 other questions).

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GRADING SCALE	
3.0 (Satisfactory)	**66-79 pkt**
3.5 (Satisfactory plus)	**80-86 pkt**
4.0 (Good)	**87-99 pkt**
4.5 (Good plus)	**100-108 pkt**
5.0 (Very good)	**109-120 pkt**
BASIC LITERATURE	
[1] Keith L. Moore, T.V.N. Persaud, Mark G. Torchia, Before We Are Born: Essentials of Embryology and Birth Defects, USA, 2016, Elsevier.	
SUPPLEMENTARY LITERATURE	
[1] T.W. Sadler, Langman's Medical Embryology, 13e, 2014, Wolters Kluwer.	