DESCRIPTION OF COURSE UNIT FOR DOCTORAL STUDIES
AT VILNIUS UNIVERSITY
(Interdisciplinary Course)

Scientific Area/eas, Field/ds of Science	Medical and Health Sciences (M 000): Medicine (M 001), Dentistry (M 002), Public Health (M 004) Natural Sciences (N 000): Biochemistry (N 004); Biology (N 010); Biophysics (N 011); Zoology (N 014)			
Faculty, Institute, Department/Clinic	Faculty of Medicine Institute of Biomedical Sciences Department of Anatomy, Histology and Anthropology			
Course unit title (ECTS credits, hours)	**Clinical embryology** 8 credits (212 hours)			
Study method	**Lectures**	**Seminars**	**Consultations**	**Self-study**
Number of ECTS credits	1	-	1	6
Method of the assessment (in 10 point system)	Presentation of the report: the report is presented on a chosen topic, which is coordinated with the coordinating lecturers. The doctoral student must analyze, review and present the newest scientific publications related to the relevant topic. Evaluation criteria: - novelty and relevance of the submitted material (2 points); - general structure and scope of the report, clear presentation of the knowledge, argumentation, conciseness and specificity (2 points); - summary, problematic issues, presentation and justification of conclusions (2 points); - presentation of the application of the reviewed knowledge in the dissertation (2 points); - organization of visual aids, ability to participate in discussion, control of questions, oratory skills (2 points). The minimal positive score is 5.			

PURPOSE OF THE COURSE UNIT

To provide new knowledge of human embryology, based on modern research, the regularities, peculiarities and importance of tissue, organ and system formation for normal prenatal development, developmental defects, their diversity and causes, clinical manifestations, prenatal significance for other periods of ontogenesis. To promote interest and deepening in the development and structure of the human embryo and fetal body and the application of the acquired knowledge in solving the problems of doctoral topics in various fields of science.

THE MAIN TOPICS OF COURSE UNIT

Progenesis. Detailed structure, developmental stages, viability of female and male gametes. Gametopathies, their causes, types, forms of clinical expression. Fertilization, its stages, reactions and disorders. Assisted fertilization technologies and methods. Possibilities of preimplantation genetic diagnostic. Peculiarities of different forms of asexual reproduction. Description of reproductive and therapeutic

cloning. Stem cell types, properties, use for scientific purposes, clinical application possibilities.

Blastogenesis. Segmentation, its methods, peculiarities of human segmentation, duration. Morula and blastocyst, its structure, migration, nutrition. Structure of a two-layer germ disc. Implantation, its mechanism, stages and peculiarities of human implantation. Ectopic implantation, embryological causes and consequences. Blastopathies, causes, mechanisms and clinical manifestations.

Embryogenesis. Gastrulation, its mechanism, peculiarities of human gastrulation. Fate maps of future tissues and organs in epiblast. Determination of body axis. Derivatives of germ layers. Neurulation, its stages, further development. Somitogenesis, further differentiation of somites. Folding of the embryo, formation of the outer contours of the body. Causes, mechanisms, clinical manifestations of gastrulation defects.

Histogenesis and organogenesis. Development and defects of connective and muscular tissues. Osteogenesis, peculiarities of intramembranous and endochondral osteogenesis, defects, their causes, mechanisms, clinical manifestations. Development of limb, morphogenetic zones of limb bud, causes, mechanisms, clinical manifestations of limb defects. Nervous tissue and nervous system development, causes, mechanisms, clinical manifestations of neural defects. Development of sensory organs, defects, their causes and mechanisms. Facial configuration, mechanisms, causes of facial clefts and other defects. Pharyngeal apparatus, its development and reorganization, causes, mechanisms, clinical manifestations of congenital defects. Development of the endocrine and immune systems, mechanisms and clinical manifestations of defects. Development of the cardiovascular system, causes, mechanisms, clinical manifestations of defects. Fetal blood circulation. Primitive gut, its loops and rotation. Development of the digestive and respiratory systems, causes, mechanisms, clinical manifestations of congenital defects. Development of skin and its derivatives, causes, mechanisms, clinical manifestation of defects. Development of organs of the urogenital system, causes, mechanisms, clinical manifestations of congenital defects.

Teratogenesis. Principles of teratogenesis, classification of teratogenic factors, periods of susceptibility of various organs to teratogens. Risks and perinatal outcomes of embryopathies.

Fetogenesis. Changes in fetal body mass, height, body contours, proportions. Composition and importance of *vernix caseosa*. Changes in the position of internal organs. Maturity of nervous system and lungs. Fetopathies, their causes, clinical manifestations.

Fetal membranes and adnexa. Structure, development and functions of chorion, amnion, yolk sac, allantois. Composition, metabolism and significance of amniotic fluid. Causes, mechanisms, clinical manifestations of *molla hydatidosa*, amniotic bands, defects of urachus and vitelline duct. Umbilical cord, its structure, development, functions. Umbilical knots, variation in length and attachment to the placenta. Decidua, its parts, structure. Placenta, its parts, structure, functions. Barrier between maternal and fetal blood, its change during pregnancy. Causes, mechanisms, clinical manifestations of placental defects.

Twins: mechanisms of heterozygous and homozygous twin formation, development of their membranes, significance and consequences of placental circulatory balance and imbalance. Conjoined (Siamese) twins, their classification, changes in internal organs, and survival opportunities.

Prenatal diagnostics. Non-invasive and invasive methods of fetal examination, their purposes, possible complications and risks for fetus.

RECOMMENDED LITERATURE SOURCES

1. Moore K.L., Persaud T.V.N., Torchia M.G. The Developing Human: Clinically Oriented Embryology. 11th edition, 2020: *https://www.amazon.com/Developing-Human-Clinically-Oriented-Embryology-dp-0323611540/dp/0323611540/ref=dp_ob_image_bk*
2. Moore K.L., Persaud T.V.N., Torchia M.G. Before we are Born. Essentials of Embryology and Birth Defects. Elsevier, 10th edition, 2020: *https://www.amazon.com/Before-Are-Born-Essentials-Embryology/dp/0323608493/ref=zg_mw_689712011_4/141-6975556-1539465?pd_rd_i=0323608493&psc=1&asin=0323608493&revisionId=&format=4&depth=1*
3. Torchia M.G., Persaud T.V.N. Concise Clinical Embryology: an Integrated, Case-Based Approach. Elsevier, 1st edition, 2020: *https://www.elsevier.com/books/concise-clinical-embryology-an-integrated-case-based-approach/978-0-323-69615-9*
4. Sadler T.W. Langman's Medical Embryology. Wolters Kluwer, 14th edition, 2019: *https://www.amazon.com/Langmans-Medical-Embryology-T-W-Sadler/dp/1496383907/ref=zg_mw_689712011_12/141-6975556-1539465?pd_rd_i=1496383907&psc=1*
5. Richardson S.S., The Maternal Imprint: The Contested Science of Maternal-Fetal Effects. The University of Chicago Press, 2021: *https://www.amazon.com/Maternal-Imprint-Contested-Science-Maternal-Fetal/dp/022654480X*
6. Coward K., Wells D. Textbook of Clinical Embryology. Cambridge University Press, 1st Edition, 2013: *https://www.amazon.com/Textbook-Clinical-Embryology-Kevin-Coward/dp/0521166403/ref=zg_mw_689712011_50/141-6975556-1539465?pd_rd_i=0521166403&psc=1*

ONLINE:

7. Schoenwolf G.C., Bleyl S.B., Brauer P.R., Francis-West P.H. Larsen's Human Embryology. Churchill Livingstone, 6th edition, 2021: *https://www.clinicalkey.com/#!/browse/book/3-s2.0-C20180032296*
8. Carlson B.M. Human Embryology and Developmental Biology. Elsevier, 6th edition, 2019: *https://www.clinicalkey.com/#!/browse/book/3-s2.0-C20160004588?indexOverride=GLOBAL*
9. Jones C.V., Penzkover D., Pollard R., Kuhlmann R.S. First-Trimester Embryology: An Overview, 2016: https://link.springer.com/chapter/10.1007/978-3-319-20203-7_4
10. Cochard, L.R. Netter's Atlas of Human Embryology. Elsevier, 2012: https://www.clinicalkey.com/#!/browse/book/3-s2.0-C20110081504?indexOverride=GLOBAL

CONSULTING LECTURERS

1. Coordinating lecturer: Renata Šimkūnaitė - Rizgelienė (Prof. dr.)
2. Violeta Žalgevičienė (Prof. dr.)
3. Eglė Marija Jakimavičienė (Assoc. prof. dr.)

APPROVED:

By Council of Doctoral School of Medicine and Health Sciences at Vilnius University 15th of June, 2022

Chairperson of the Board: Prof. Janina Tutkuvienė