

HUMAN EMBRYOLOGY – MEDICINE

Presentation topics and required content – winter semester 2026/2027

Presentation topic / Lecturer	Required presentation content
GAMETOGENESIS: MEIOSIS, OOGENESIS AND SPERMATOGENESIS S. Borska	1. Gametogenesis – origin and migration of primordial germ cells; general principles of gamete formation. 2. Meiosis – stages of meiosis I and II, chromosome segregation and meiotic errors. 3. Oogenesis – development and maturation of female germ cells and ovarian follicles. 4. Spermatogenesis and spermiogenesis – stages of male germ-cell development and maturation.
1ST WEEK: OVULATION TO IMPLANTATION S. Borska	1. Ovarian cycle – follicular and luteal phases, hormonal regulation and ovulation. 2. Uterine (menstrual) cycle – menstrual, proliferative, secretory and ischaemic (premenstrual) phases; relationship between ovarian hormones and changes in the endometrium. 3. Fertilisation – capacitation, acrosome reaction, sperm-oocyte interaction, cortical reaction and formation of the zygote. 4. Cleavage, blastocyst formation and implantation – cleavage divisions, morula, blastocyst formation and hatching from the zona pellucida; stages of implantation, early trophoblast development and selected abnormalities of fertilisation and implantation.
2ND-3RD WEEK: GERM DISCS A. Piotrowska	1. Day 8 of development – partial implantation of the blastocyst; differentiation of the trophoblast into cytotrophoblast and syncytiotrophoblast; formation of the epiblast and hypoblast; appearance of the amniotic cavity. 2. Day 9 of development – deeper implantation; lacunar stage of the trophoblast; formation of the exocoelomic membrane and primary yolk sac. 3. Days 11–12 of development – completion of implantation; formation of the lacunar network; initial formation of the extraembryonic mesoderm and chorionic cavity; decidual reaction. 4. Day 13 of development – restoration of the endometrial surface; initial appearance of the connecting stalk, secondary yolk sac and primary chorionic villi. 5. Gastrulation – formation of the primitive streak, migration of epiblast cells and establishment of the trilaminar germ disc. 6. Formation of the notochord – notochordal process, notochordal plate and definitive notochord. 7. Establishment of the embryonic body axes – basic mechanisms involved in establishing the cranial–caudal, dorsal–ventral and left–right axes.
3RD-8TH WEEK: ORGANOGENESIS, EMBRYONIC PERIOD K. Jabłońska	1. Derivatives of the ectoderm 2. Neural crest cell derivatives 3. Derivatives of the mesodermal germ layer – paraxial, intermediate and lateral plate mesoderm. 4. Derivatives of the endodermal germ layer – the gut tube and formation of the body cavities.
FETAL MEMBRANES AND PLACENTA A. Gomułkiewicz	1. Fetal membranes: yolk sac and allantois – formation, development and functions of the yolk sac/umbilical vesicle; formation, development and functions of the allantois. 2. Fetal membranes: amnion, umbilical cord and amniotic fluid – formation and development of the amnion; formation and structure of the umbilical cord; significance of amniotic fluid and disorders of its volume: hydramnios/polyhydramnios and oligohydramnios. 3. Fetal membranes: chorion – formation and development of the chorion. 4. Formation and structure of the placenta – three regions of the decidua; components of the placenta; cotyledons; intervillous spaces; placental circulation; full-term placenta. 5. Functions of the placenta and placental changes at the end of pregnancy

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HEAD AND NECK S. Borska	1. Neural crest cells in craniofacial development – migration and major derivatives in the head and neck. 2. Pharyngeal arches, pouches, clefts and membranes – development and derivatives. 3. Development of the face – facial prominences and intermaxillary segment. 4. Development of the palate and oral cavity – primary and secondary palate. 5. Development of the tongue and thyroid gland – major stages. 6. Development of the nasal cavities and ear – brief overview only. 7. Developmental abnormalities of the head and neck – selected clinically important craniofacial and pharyngeal apparatus abnormalities, including cleft lip and cleft palate, Treacher Collins syndrome, Pierre Robin sequence, DiGeorge syndrome, thyroglossal duct cyst and ectopic thyroid tissue.
RESPIRATORY AND DIGESTIVE SYSTEMS S. Borska	1. Formation of the primitive gut tube – embryonic folding and formation of the foregut, midgut and hindgut; basic molecular mechanisms of gut patterning, including the role of retinoic acid signalling. 2. Development of the respiratory system – formation of the respiratory diverticulum; formation of the larynx and trachea; development of the bronchial tree and lungs; four periods of lung maturation; formation of alveoli and surfactant production. 3. Developmental abnormalities of the respiratory system – including oesophageal atresia and tracheo-oesophageal fistula, neonatal respiratory distress syndrome (RDS; hyaline membrane disease). 4. Foregut development and derivatives – including oesophagus, stomach, proximal part of the duodenum, liver, biliary system and pancreas. 5. Midgut development and derivatives – physiological herniation, rotation, return to the abdominal cavity and fixation. 6. Hindgut development and derivatives – including division of the cloaca and dual embryonic origin of the anal canal. 7. Selected developmental abnormalities of the foregut, midgut and hindgut. 8. Final position and peritoneal relationships of the digestive organs – intraperitoneal, retroperitoneal and secondarily retroperitoneal organs.
NERVOUS SYSTEM U. Ciesielska	1. Spinal cord development. 2. Brain development. 3. Birth defects of the neural tube. 4. Autonomic nervous system development.
CARDIOVASCULAR SYSTEM S. Borska	1. Formation of the cardiogenic fields and early blood vessels. 2. Formation of the endocardial tubes and primitive heart tube – including cardiac looping. 3. Development and septation of the atria. 4. Development and septation of the ventricles – atrioventricular canal and valves. 5. Development of the outflow tract – contribution of neural crest cells. 6. Fetal circulation and circulatory changes at birth – detailed course of the fetal circulation, including the ductus venosus, foramen ovale and ductus arteriosus; changes occurring after birth and closure of the fetal shunts. 7. Congenital heart defects – developmental basis of selected abnormalities resulting from disturbances in cardiac septation, outflow tract development and remodelling of the great vessels, including ASD, VSD, atrioventricular septal defects, tetralogy of Fallot, transposition of the great arteries, persistent truncus arteriosus, coarctation of the aorta and patent ductus arteriosus.
MUSCULAR AND SKELETAL SYSTEMS U. Ciesielska	1. Origin and development of the skeletal system – somites, somitomeres, dermomyotome, sclerotome. 2. Development of the axial skeleton – vertebrae and vertebral column, vertebral defects, ribs and sternum and their defects; skull development: neurocranium, intramembranous ossification, viscerocranium and defects of skull development. 3. Limb growth and development – endochondral ossification; molecular regulation of limb development; disorders of limb development. 4. Muscular system development – origins and development of skeletal, smooth and cardiac muscle; molecular regulation of muscle development; disorders of muscle development.

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UROGENITAL SYSTEM S. Borska	1. Development of the urinary system: three renal systems and the definitive kidney – pronephros, mesonephros and metanephros; origin of the ureteric bud and metanephric mesenchyme and their reciprocal interaction. 2. Nephron development. 3. Development of the collecting system – collecting tubules and ducts, minor and major calyces, renal pelvis and ureter. 4. Further development and abnormalities of the urinary system – including ascent, rotation and changes in renal vascular supply; development of the urinary bladder and urethra. 5. Indifferent stage and differentiation of the gonads – migration of primordial germ cells; sex determination and basic mechanisms of testicular and ovarian development. 6. Development of the male reproductive system – testis, mesonephric ducts and male internal genital organs; external genitalia and descent of the testes. 7. Development of the female reproductive system – ovary, paramesonephric ducts, uterine tubes, uterus and upper vagina; external genitalia and descent of the ovaries. 8. Developmental abnormalities of the female and male reproductive systems.
BIRTH DEFECTS S. Borska	1. Basic concepts and classification of developmental abnormalities – malformations, disruptions, deformations; syndromes, sequences and associations. 2. Critical periods of human development and principles of teratology – susceptibility of the embryo and fetus to teratogenic factors at different stages of prenatal development. 3. Genetic factors as causes of congenital defects – brief overview of chromosomal abnormalities and single-gene disorders. 4. Biological teratogens – selected maternal infections affecting embryonic and fetal development, including cytomegalovirus, rubella virus, varicella-zoster virus, Zika virus and <i>Toxoplasma gondii</i>. 5. Chemical teratogens – selected drugs and other chemical agents; alcohol exposure and fetal alcohol spectrum disorders (FASD), including fetal alcohol syndrome (FAS). 6. Physical teratogens – ionising radiation, hyperthermia. 7. Maternal conditions affecting embryonic and fetal development – selected maternal diseases, metabolic disorders and nutritional factors, e.g. diabetes mellitus, phenylketonuria and folate deficiency. 8. Prenatal screening, prenatal diagnosis, prevention and fetal therapy – major methods and principles; basic approaches to prevention and selected examples of fetal therapy.