

Module title:	Physiology of development	ECTS	2
Polish translation:	Fizjologia rozwoju		
Course:	Veterinary Medicine		

Module language: English		Stage: JM-FVM	
Form of studies: <input checked="" type="checkbox"/> intramural <input type="checkbox"/> extramural	Type of module: <input checked="" type="checkbox"/> basic <input type="checkbox"/> directional	<input type="checkbox"/> mandatory <input checked="" type="checkbox"/> elective	Semester: IV <input type="checkbox"/> winter semester <input checked="" type="checkbox"/> summer semester
Academic year: 2022/2023		Catalogue number:	

Module coordinator:	mgr inż. Iwona Szopa			
Teachers responsible for the module:	Academic teachers of the Institute of Veterinary Medicine; Department of Physiological Sciences; visiting professors; other specialists in the field of study.			
Objectives of the module:	<p>The discipline "Physiology of development" is an elective discipline intended to inform students about the principles of physiological regulation of development. Initially, the topics are focused on the formation and differentiation of generative cells. Afterwards, the fertilization, zygote formation and embryo implantation into the uterine mucosa will be described. The main task is to get acquainted with the early embryo development and the origin of stem cells. It is followed by the growth of embryo and origin of tropho- and embryoblast. Finally, a great part of phylo- and ontogenesis will be prepared by students. These will include molecular and morphological changes in tissue cells. After completing the course students should clearly define relationship between the three germ layers and origin of different tissues and organs. Particular concern will be put on the origin of stem cells and tissue progenitors on their respective input into the regeneration process and tumorigenesis. Practical aspects of the stem cell properties will also be addressed to tissue engineering and regenerative medicine. With respect to lectures students should be aware of the development control and cell differentiation. After completing the lecture course/seminar students are obliged to undertake multi choice test according to the general rules. It is believed that students acknowledge and appreciate the knowledge useful in other disciplines (pathophysiology, surgery, etc.).</p>			
Teaching forms, number of hours:	<p>a) Lectures; 24 hours b) Seminars; 6 hours</p>			
Teaching methods:	<ul style="list-style-type: none"> <li>• <b>Lectures:</b> Original multimedia presentations prepared by academic teachers employed at the Institute of Veterinary Medicine.</li> <li>• <b>Seminars:</b> Students prepare the multimedia or written presentations individually or in pairs, they present or submit the files to the academic teacher. Next, if possible the topic is open for discussion. Finally presentation is evaluated in the range 1-10 points.</li> </ul> <p>Detailed schedule will be defined by the coordinator of the course at the beginning of semester. Detailed organization of consultations (1h/week) will be defined by the coordinator of the course at the beginning of semester.</p>			
Formal prerequisites and initial requirements:	Required is the knowledge of molecular cell physiology, animal physiology, and biochemistry.			
Learning effects	Course outcomes:	Learning outcomes relative to the course outcomes	Impact on the course outcomes*	
Knowledge:	1	knows functions of organelles in eukaryotic cells (compartmentalization);	A.W.1 A.W.4, A.W.10, A.W.11	1 3 2
	2	metabolic processes on the molecular, cellular, organ and organism level;	A.W.4	3
	3	mechanisms underlining animal health, disease and their therapy – from the cellular level, through organs, organism, herd to the whole population of animals;	A.W.10	1
	4	relationship between factors influencing homeostasis of biological processes and physiological, and pathological changes;	A.W.11	1
	5	pathophysiological changes in the organs and systems, biological mechanisms (including immunological) and therapeutic actions facilitating recovery;	A.W.4, A.W.10 A.W.11	3 1 1
Skills:	1	describe changes in the function of the organism occurring upon alteration of homeostasis;	A.U.4	1
	2	predict direction of biochemical processes depending on the energetic status of the cell;	A.U.5	1
	3	define physiological status of the animal as an adaptive process to environmental variability;	A.U.7	1

	4	listen and explain in the language that is understandable and appropriate for the situation;	A.U.13	1
	5	operate in the interdisciplinary team;	A.U.15	1
	6	understand the need of continuous education for professional development;	A.U.21	1
	7	utilise computer systems and current sources of veterinary knowledge for effective use and process of information;	C.U.2, C.U.3	1
Competences:	1	formulate constructive criticism regarding cell functions with their relation to organs;	KS.1, KS.4, KS.5, KS.6, KS.7	2
	2	evaluate physiological parameters of the cell;	KS.1, KS4	2
	3	conduct basic physiological experiments (scientific) and draw correct conclusions based on the observations;	KS.5	2
	4	perform critical self-evaluation, formulate constructive criticism regarding veterinary practice, accept criticism regarding postulated solutions, factual respond to that criticism based on the current scientific knowledge;	KS.4, KS.8, KS.7, KS.9	2
	5	communicate with co-workers and share the knowledge;	KS.3, KS.4, KS.7, KS.9	1
	6	constantly update knowledge and skills for professional development;	KS.1, KS.4, KS.5, KS.6, KS.7, KS.8, KS.9,	2
Objectives of the module required to obtain learning effects:	<p><u>Lectures (12 lectures, 2 hours each):</u></p> <p><b>Fertilization and early embryo development</b> – among others: oogenesis and spermatogenesis, the origin and growth of ovarian follicles, ovulation and maturation of ovarian follicle, growth of spermatids and spermatozoa, fertilization of ovum, migration in oviduct and uterus.</p> <p><b>Mechanisms of implantation, types and functions of fetal membranes</b> – among others: fetal membranes, origin of amnion, allantois, chorion and allanto-chorion, placenta (fetal part – chorion, and maternal part – uterine mucosa), vascular system development, fetal blood circulation and blood-tissue exchange between mother and fetus.</p> <p><b>Fetal development. Tissue and organ differentiation and maturation</b> – among others: apoptosis as a tool in organogenesis, molecular mechanisms of apoptosis, phases of apoptosis, examples of apoptosis in fetal development.</p> <p><b>Endocrinology of pregnancy and its role in early development.</b> Exo- and endocrine functions of placenta.</p> <p><b>Cell differentiation</b> – among others: steps in cell differentiation of early embryo.</p> <p><b>Morphogenesis – introduction</b> – among others: primary and secondary organogenesis, gastrulation, main genes of differentiation. Morphogenesis in examples.</p> <p><b>Immunology of pregnancy</b> – among others immune tolerance in pregnancy, immunosuppressive factors produced by the placenta, mechanism of tolerance and immune cells involved.</p> <p><b>Protooncogenes</b> – among others: <i>Wnt</i> genes, their respective functions, <i>notch</i> gene and cellular competence in stem cell differentiation.</p> <p><b>Regenerative medicine and tissue engineering</b> – among others: types of transplantation, causes of failures, research efforts in engineering of organ and tissue development, research methods.</p> <p><b>Stem cells</b> – among others definition of stem cells, types, location in the body, molecular and functional characteristics of stem cells.</p> <p><b>Perspectives of stem cell application and remedies in clinical practice</b> – among others: technologies for embryonic and adult stem cell isolation, danger and hazard stem cell usage, cloning, definition, natural cloning, therapeutic cloning (regenerative and reproductive).</p> <p><b>The effect of environmental factors on prenatal development, and individual health status</b> – among others: fetal reprogramming, examples of fetal tissue reorganization (<i>tissue remodelling</i>) in response to environment in early life.</p> <p><u>Seminars (6 hours):</u></p> <p>Nervous system. Development and organogenesis of the central and peripheral nervous system. Inter species and inter sex differences. Prenatal and postnatal development of endocrine system. Neuronal stem cells.</p> <p>Hematopoietic system. Unique properties of the structure, development and functions of blood cells in fetal and individual postnatal life in domestic animals. Bone marrow stem cells.</p> <p>Cardiovascular system. Adaptation of fetal circulation to prenatal life, blood-tissue exchange, fundamental role of the placenta. Inter species differences. Stem cells of the heart.</p> <p>Respiratory system. Adaptation of fetal circulation to respiration in prenatal life. Gas exchange and saturation in the placenta. Pregnancy adaptation to fetal respiration. Pre- and postnatal development of respiratory system. Inter species differences. Stem cells in airways (respiratory epithelium).</p> <p>Skeleto-muscular system (part I). Development of skeletal muscle, functional differentiation with respect to molecular regulations. Inter trait and inter species differences. Stem cells in skeletal muscle.</p> <p>Skeleto-muscular system (part II). Development of bones and skull. Cell differentiation of osteoblasts, osteoclasts and osteocytes. Pre- and postnatal development of skeleton.</p> <p>Digestive system. Development of digestive tract. Pre- and postnatal functional status. Inter species differences. Stem cells in intestine crypts.</p> <p>Excretory system. Morphological and functional development of the kidney. The formation renal blastema. Pre- and postnatal development.</p> <p>Reproductive system. Basic sex differences in prenatal life. Sex determination and development of female and male. Inter species differences.</p>			

Assessment methods:	Attendance to the lectures and seminars are mandatory, according to the general academic regulations, the student can be absent on 20% of lectures. Final exam: Final exam contains 25 questions (choice test, 1 point per correct answer). To pass, student must present or submit seminar, and collect 13 points (51%). Retake is provided for students who failed or could not attend the first term. Both terms have the same form. No extra assessment methods are anticipated. In case of unforeseen, unusual circumstances mandatory remote teaching and remote assessment methods might be adopted.
Detail description of assessment methods; Formal documentation of learning outcome:	No extra assessment methods are anticipated. eHMS entry. Records collected in the course portfolio i.e. individual records of student results, presence lists, database of oral and written questions, written assessments of the students.
Elements impelling final grade:	Exam results: 100%  The following scale is used to <b>grade the semester</b> : 0 - 12 points - failing grade (2), 13 - 15 points - passing grade (3), 16 - 17 points - passing plus grade (3.5), 18 - 20 points - good grade (4), 21 - 22 points - good plus grade (4.5), 23 - 25 points - excellent grade (5).  Once the student failed to pass the final exam twice she/he obtained failing grade.
Teaching base:	Lecture facilities of the Institute of Veterinary Medicine, MS Teams.
Mandatory and supportive materials :	
1.Student Textbooks:	„Human Physiology/Development: birth through death”
2. Relevant scientific publications.	
ANNOTATIONS	

\* 3 – complete and detailed, 2 – moderate, 1 – basic.

Quantitative summary of the module:

Estimated number of work hours per student (contact and self-study) essential to achieve presumed learning outcomes of the module - base for quantifying ECTS:	<b>50 h</b>
Total ECTS points, accumulated by students during contact learning:	<b>1 ECTS</b>