Course name:

COURSE NAME (capital letters) CELL BIOLOGY

ECTS	**3**
Course status	**obligatory**
Course final assessement/evaluation of outcomes	**exam**
Prerequisites	**no**

Main field of study: agricultural sciences-veterinary and others related

field of study name (capital letters)

Profile of study	**General-academic**
The code of studies (education level)	**SI/SM (bachelor/master)**
Semester of studies	**winter**
Language of instruction	**English**

Course offered by: veterinary and others related

Name of faculty offering the course	**University Centre of Veterinary Medicine JU-UA**
Name of department offering the course	**University Centre of Veterinary Medicine JU-UA**
Course coordinator	**dr hab. Małgorzata Kotula-Balak, prof. UR**

Learning outcomes of the course:

Symbol of outcome	Description of learning outcome	Reference to	
		main field of study outcomes	discipline#
KNOWLEDGE – student knows and/or understands:			
BIK_W1	knows and knows the ultrastructure of cells and the relationship between structure and function	A.W1	RW
BIK_W2	knows and describes the structure, function and role of cell organelles	A.W1	RW
BIK_W3	knows and understands the function and importance of basic processes in the nucleus and cytoplasm of the cell	A.W4	RW
BIK_W4	knows the basic research techniques used in cell biology	A.W1	RW
SKILLS – student is able to:			
BIK_U1	use a light microscope	A.U2	RW
BIK_U2	perform microscopic preparations using histological techniques	A.U8	RW
BIK_U3	analyze cell structures on the basis of images from a light and electron microscope	A.U8	RW
BIK_U4	actively collaborating in a group	A.U15	RW
BIK_U5	is aware of the need for continuous learning	A.U21	RW
SOCIAL COMPETENCE- student is ready to:			
BIK_K1	deepening knowledge and improving skills	OK_8	RW

BIK_K2	communicating with colleagues and sharing knowledge	OK_9	RW

Teaching contents:

Lectures		**15**	**hours**
Topics of the lectures	Eukaryotic cell origin hypotheses. Basic features of cells. Prokaryotic and eukaryotic cells. Plant and animal cell. The structure of the cell nucleus: nuclear envelope, transport to and from the cytoplasm. Nucleoplasm, nuclear bodies. Structure and functions of the cell nucleus, DNA as a carrier of genetic information RNA types: mRNA, rRNA, snRNA and tRNA. Structure of the chromosome. Coding, non-coding, telomere and centromere sequences. Nucleus and the formation of ribosomes. Autonomous organelles (mitochondria and chloroplasts). Composition and function of cytoplasm. Cell cycle, cell division. Cytoskeleton: microfilaments, microtubules, intermediate filaments and nuclear lamines. The products of the cytoskeleton: microvilli, tails, cilia, centrioles, basal bodies. Cell membrane, structure and surface proteins. Intercellular junctions: desmosomes, hemidesmosomes, tight junctions, Stem cells - biological and practical importance.		
Accomplished learning outcomes	*symbols of learning outcomes for lectures BIK_1, BIK_2, BIK_3*		
Verification methods, rules and criteria of outcome assessment	*together with participation in the final asessement (in %) The condition for taking the exam is obtaining a pass from the classes.* *Written exam in the form of a single-choice test. The exam consists of 30 questions, the maximum number of points to be obtained is 30. In order for the exam to be passed*		

Classes		**13**	**hours**
Topics of the classes	Techniques used in cell biology: light and electron microscopy. Principles of operation of various types of microscopes. Histological techniques - preparation of microscopic sections from animal material (tissues and secretions). Cyto / histochemical staining technique, immunocytochemical technique. Antibodies and labels. Identification of cell organelles in preparations under the light microscope. Identification of cells in different phases of the cell cycle and cell organelles in microscopic preparations and electronograms. Techniques live staining of cells.		
Accomplished learning outcomes	*symbol of learning outcomes for the classes BIK_1, BIK_2, BIK_3, BIK_4, BIK_U1, BIK_2*		
Verification methods, rules and criteria of outcome assessment	*together with participation in the final asessement (in %) The condition for taking the exam is obtaining a pass from the classes.* *Written exam in the form of a single-choice test. The exam consists of 30 questions, the*		

Seminars		**2**	**hours**
Topics of the seminars	Individual preparation of a multimedia presentation related to the selected topic of the class module.		
Accomplished learning outcomes	*symbol of learning outcomes for the classes BIK_1, BIK_2, BIK_3, BIK_4, BIK_U1, BIK_2*		
Verification methods, rules and criteria of outcome assessment	*together with participation in the final asessement (in %)he condition for taking the exam is obtaining a pass from the classes.*		

References:

Basic	*Alberts B et al., Essential Cell Biology*
Supplementary	*English-language scientific journals (Elsevier, Springer, Wiley) available on-line*

Structure of learning outcomes:

Discipline: # (*provide appripriate symbol*)			*3.0*	ECTS**
Discipline: # (*provide appripriate symbol - if the course relates to more than one academic discipline*)			…	ECTS**
Structure of student activities:				
Contact hours	37	hours	1 ,5	ECTS**
including: lectures	15	hours		
classes and seminars	15	hours		
consultations	3	hours		
participation in research	0	hours		
mandatory trainerships	0	hours		
participation in examinations	4	hours		
e-learning	0	hours	…	ECTS**
student own work	30	hours	1, 5	ECTS**

Syllabus valid from the academic year 2021/2022

*** where 10 hours of classes = 1 ECTC (in case of 15 h → 2 ECTS)**

** stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25 - 30 hours of classes

academic discipline code: RZ - animal science and fishery, PB - biological sciences, etc.

Załącznik nr.2

Malgorzata Kotula-Balak, Prof. Dr. Ph.D., D.Sc. (Prof. dr hab.)

University of Agriculture in Krakow

University Centre of Veterinary Medicine JU-UA

Address: Redzina 1C/room; 30-248 Krakow, Poland**, Room** 1.9;

Phone: +48 12 431 66 48

Email: malgorzata.kotula-balak@urk.edu.pl

Consultation hours: Friday 13.00-15.00

Research interest:

My research focuses on the cellular and molecular regulation of the endocrine glands with special emphasis on the hormonal regulation of the male reproductive system in health and disease. Reproductive tissues and cells (e.g. Leydig cells, spermatozoa) are analyzed to reveal fertility disruption causes. I am interested in histopathology (e.g. hyperplasia, tumorigeneses, fibrosis), cell ultrastructure and molecular status including mRNA, protein expressional patterns, cell signaling (e.g. *via* non-classical estrogen receptors), and cellular processes (e.g. senescence, autophagy). For the research, I utilize animals (e.g. boar, horse dog, rodents) and human tissues obtained from medical clinics. I use *in vivo* and *in vitro* (cell lines, primary cultures) systems and a wide range of laboratory techniques: RNA sequencing, siRNA transfection, Western blot, immunohistochemistry, immunoassays, cell imaging techniques (e.g. light and electron microscopies), morphometry.

Research experience:

For many years my scientific interests are focusing on estrogen role in the male gonad. Results of my research (including cooperation with foreign collaborators) broadens knowledge in the biology of reproduction on estrogen signaling in mammalian males. We as first showed (1) estrogen synthase (P450 aromatase) expression and localization in germ cells of seasonally breeding rodent-bank vole; (2) regulation of gap junction proteins by xenoestrogens in cells of seminiferous epithelium in bank vole testis; (3) expression at mRNA and protein level as well as localization and estrogen/xenoestrogen regulation of estrogen-related receptors (ERR) in Leydig cells of rodents; (4) presence of telocytes (unique interstitial tissue cells), and regulation of telocytes by estrogens as well as their effects on Leydig cell function in mouse and bank vole gonad, and (5) epigenetic regulation (proteins controlling biogenesis and function of microRNA; Drosha, Dicer, Argonaute2,

Exportin5) via estrogens in boar immature Leydig cells. These findings allowed for further research and methodological approaches (undertaken also by others) with the use of described cellular and molecular targets for diagnostics and therapy of male infertility based on estrogen action. All mentioned findings were published in original articles from JCR database.

Visiting Scholar

-School of Biomedical Sciences Adelaide University, Adelaide Australia, 2009; 12 months,

-Section on Genetics and Endocrinology, National Institutes of Health; Bethesda, United States of America, 2013; 3 months

-Graduated School of Veterinary, Kobe University, Kobe, Japan, 2018; 2 weeks

-Biomedical School University of Iceland, Reykjavik, Iceland, 2017; 1 week

- Zhongshan Hospital Institute of Clinical Sciences, Fudan University, Shanghai, China, 2019; 1 week

-Veterinary Faculty, University of Cordoba, Cordoba, Spain 2020; 1 week

- Veterinary Faculty, Ankara University, Ankara, Turkiye 2021; 1 week

-Veterinary Faculty, National University of Hanoi, Hanoi, Vietnam, 2022; 1 week

D.Sc. (Habilitation) (2014, *Estrogen role in functioning of rodent Leydig cells and spermatozoa*)

Ph.D. (2003; *Androgen aromatization in testes with disturbed spermatogenesis*)

Professional profiles (examples):

ORCID: https://orcid.org/my-orcid?orcid=0000-0002-6379-996X

List of publications:

1. Ramisz G, Turek W, Chmurska-Gasowska M, Rak A, Pietsch-Fulbiszewska A, Galuszka A, **Kotula-Balak M,** Tarasiuk K. Senescence and adiponectin signaling - Studies in canine testis. *Ann Anat.* 2020; 20;234:151606.

2. Lustofin K, Niedbala P, Pawlicki P, Tuz R, Płachno BJ, Profaska-Szymik M, Galuszka A, Stolarczyk P, Gorowska-Wojtowicz E, **Kotula-Balak M.** Senescent cells in rabbit, nutria and chinchilla testes-Results from histochemical and immunohistochemical studies. *Anim Reprod Sci.* 2021; 226:106701.

3. Leal LF, Szarek E, Berthon A, Nesterova M, Faucz FR, London E, Mercier C, Abu-Asab M, Starost MF, Dye L, Bilinska B, **Kotula-Balak M,** Antonini SR, Stratakis CA. Pde8b haploinsufficiency in mice is associated with modest adrenal defects, impaired steroidogenesis, and male infertility, unaltered by concurrent PKA or Wnt activation. *Mol Cell Endocrinol.* 2021; 15;522:111117.

4. Witkowski M, Pardyak L, Pawlicki P, Galuszka A, Profaska-Szymik M, Plachno BJ, Kantor S, Duliban M, **Kotula-Balak M**. The G-Protein-Coupled Membrane Estrogen Receptor Is Present in Horse Cryptorchid Testes and Mediates Downstream Pathways. *Int J Mol Sci.* 2021; 22(13):7131.

5. Kotula-Balak M, Duliban M, Gurgul A, Krakowska I, Grzmil P, Bilinska B, Wolski JK. Transcriptome analysis of human Leydig cell tumours reveals potential mechanisms underlying its development. *Andrologia*. 2021; 8:e14222.

6. Duliban M, Pawlicki P, Gurgul A, Tuz R, Arent Z, **Kotula-Balak M**, Tarasiuk K. Peroxisome Proliferator-Activated Receptor γ, but Not α or G-Protein Coupled Estrogen Receptor Drives Functioning of Postnatal Boar Testis-Next Generation Sequencing Analysis. *Animals* 2021; 11(10), 2868.

7. Galuszka A, Pawlicki P, Pardyak L, Chmurska-Gąsowska M, Pietsch-Fulbiszewska A, Duliban M, Turek W, Dubniewicz K, Ramisz G, **Kotula-Balak M**. Abundance of estrogen receptors involved in non-canonical signaling in the dog testis. *Anim Reprod Sci.* 2021; 235:106888.

8.Witkowski M, Duliban M, Rak A, Profaska-Szymik M, Gurgul A, Arent ZJ, Galuszka A, **Kotula-Balak M**. Next-Generation Sequencing analysis discloses genes implicated in equine endometrosis that may lead to tumorigenesis. *Theriogenology*. 2022; 1;189:158-166.

9. Pawlicki P, Galuszka A, Pardyak L, Tuz R, Płachno BJ, Malopolska M, Dubniewicz K, Yang P, **Kotula-Balak M**, Tarasiuk K. Leydig Cells in Immunocastrated Polish Landrace Pig Testis: Differentiation Status and Steroid Enzyme Expression Status. *Int J Mol Sci.* 2022; 30;23(11):6120

10. Pawlicki P, Koziorowska A, Koziorowski M, Pawlicka B, Duliban M, Wieczorek J, Płachno BJ, Pardyak L, Korzekwa AJ, **Kotula-Balak M.** Senescence and autophagy relation with the expressional status of non-canonical estrogen receptors in testes and adrenals of roe deer (Capreolus capreolus) during the pre-rut period. *Theriogenology*. 2023; 1;198:141-152