Course name:

APPLICATION OF ISOTOPES AND ANTIBODIES IN LABORATORY DIAGNOSTICS

ECTS	**5**
Course status	**obligatory**
Course final assessement/evaluation of outcomes	**exam**
Prerequisites	**basic knowledge in cell biology, physiology and biochemistry**

Main field of study:

ANIMAL BIOINGINEERING or APPLIED BIOLOGY

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

Course offered by:

Name of faculty offering the course	**Faculty of Animal Science**
Name of department offering the course	**Department of Animal Physiology and Endocrinology**
Course coordinator	**Prof. dr hab. Andrzej Sechman**

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:			
AIP_W1	the basic concepts and issues of nuclear physics: atom, isotope, radioactive decay, types of radiation, radiation measurement, radioactive series; has knowledge of the use of radioactive isotopes in laboratory techniques used in animal bioengineering	BIOI2_W04 BIOI2_W05	RZ
AIP_W2	application of isotope-labeled inorganic and organic compounds for *in vivo* and *in vitrot* methods and experiments	BIOI2_W05 BIOS2_W11	RZ, NB
AIP_W3	the meaning of key terms of immunology and interaction between the antigen and antibody; methods of producing mono- and polyclonal antibodies and application of these antibodies in biology and medicine	BIOI2_W04	RZ
AIP_W4	basic laboratory methods and techniques that use antibodies and / or isotopes and explaines their use in biology, biotechnology and animal bioengineering	BIOI2_W04 BIOI2_W05 BIOS2_W11	RZ, NB
SKILLS – student is able to:			
AIP_U1	use radioactive isotopes and antibodies in *in vitro* and *in vivo* tests; perform some analyzes using radiolabelled substances and antibodies	BIOI2_U04 BIOS2_U13	RZ, NB
AIP_U2	determine the titre, cross-reactions and affinity of antibodies; use the radioimmunoassay (RIA) to determine hormone concentration in the animal blood plasma	BIOI2_U07 BIOS2_U13 BIOS2_U14	RZ, NB
AIP_U3	apply the immunohistochemical method in scientific experiments and diagnostics of cells and tissues; interpret results of immunocytochemical analyzes	BIOI2_U04 BIOS2_U04	RZ, NB
AIP_U4	use the ELISA method in laboratory diagnostics; can determine hormone concentration in the animal blood plasma using the ELISA method	BIOI2_U04 BIOS2_U13	RZ, NB

AIP_U5	perform western blot analysis to determine protein expression; isolate the total protein, perform membrane transfer and use the appropriate antibody to detect the protein on the membrane	BIOI2_U04 BIOS2_U13	RZ, NB
	SOCIAL COMPETENCE- student is ready to:		
AIP_K1	work in a group and lead a small team performing laboratory analyzes	BIOI2_K02 BIOS2_K02	RZ, NB
AIP_K2	take responsibility, risk and consequences of the use of radioactive substances in laboratory analysis.	BIOI2_K04 BIOS2_K06	RZ, NB
AIP_K3	comply with ethical principles in conducting animal experiments, performing laboratory analyzes and proper interpretation of test results.	BIOI2_K07 BIOS2_K03	RZ, NB

Teaching contents:

Lectures		**20**	**hours**
Topics of the lectures	Introduction – discussion concerning the basic problems of nuclear physics (radioactivity, dose of radioactivity, isotopes etc.) (2 h). Application of labelled preparations in vivo and in vitro (hormone kinetics, blood flow through the tissue, hormone uptake by the tissue, cell proliferation). (2 h) Principles of radioreceptorassay (RRA) – kinetics of radioligand assays, the Scatchard's plot. Application of the RRA method in biology and medicine (2 h) Overview basic concepts of immunology: antigen, antibody, characteristic antigen-antibody reaction; review of methods using isotopes and/or antibodies in laboratory diagnosis. Mono- and polyclonal antibodies - the characteristics and method of their production (4 h). Immunochemical methods (immunoassay techniques, labelling of antibodies, fluorescent and chemiluminescent methods). (2 h) Application of antibodies in selected techniques, Part I: ELISA, immunohistochemistry (2 h). Application of antibodies in selected techniques, Part II: Western blot, immunoprecipitation, immuno-PCR, EMSA (4 h). Radioimmunoassay (RIA) - the principle of the method, cross-reactivity of antibodies, the test of parallelism and recovery (2 h)		
Accomplished learning outcomes	*AIP_W1-W4; AIP_K2-K3*		
Verification methods, rules and criteria of outcome assessment	*Written exam: the student answers 4 questions covering the most important issues discussed in lectures; for a positive grade the correct answer should be given to at least 3 questions; the share of the lecture grade in the final grade is 60%.*		
Classes		**30**	**hours**
Topics of the classes	Immunocytochemistry: the localization of selected antigen in cells on paraffin sections of tissue (6 h) ELISA method: determination of hormones with the ELISA method and its application in laboratory diagnosis; determination of TSH levels in the animal or human blood plasma (6 h) Western blot: determination of protein expression in tissue homogenate; application of selected labelled antibody (6 h). Assessment of antibody properties: determination of titter and cross reactivity of antibodies applied to immunological method, the assessment of antigen-antibody affinity (6 h). RIA method: determination of thyroid hormone (T4 or T3) concentration in the animal blood plasma (6 h).		
Accomplished learning outcomes	*AIP_U1-U5; AIP_K1*		
Verification methods, rules and criteria of outcome assessment	*Participation in all laboratory exercises and answering final test questions; the share of the grade for laboratory exercises in the final grade is 40%.*		
Seminars		**0**	**hours**
Topics of the seminars	*not applicable*		
Accomplished learning outcomes	*not applicable*		
Verification methods, rules and criteria of outcome assessment	*not applicable*		

References:

Basic	*Rothfeld B.: Nuclear medicine in vitro, J.B. Lippincott Company, London, Mexico City, New York, St. Louis, Sao Paulo, Sydney, 1983.* *R.V. Lloyd, Morphology methods, Cell and Molecular Biology Techniques, Humana Press, Totowa, New Jersay, 2001.* *Ed Harlow, David P Lane: Antibodies: A Laboratory Manual, Cold Spring Harbor Laboratory Press, New York, 1988.*
Supplementary	*Publications in international scientific journals of the course coordinator and academic teachers (see PubMed).*

Structure of learning outcomes:

Discipline: # *RZ*				*3*	ECTS**
Discipline: # *NB*				*2*	ECTS**
Structure of student activities:					
Contact hours		62	hours	2,5	ECTS**
including:	lectures	20	hours		
	classes and seminars	30	hours		
	consultations	9	hours		
	participation in research	0	hours		
	mandatory trainerships	0	hours		
	participation in examinations	3	hours		
e-learning		0	hours	0	ECTS**
student own work		63	hours	2,5	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.