SZKOŁA GŁÓWNA GOSPODARSTWA WIEJSKIEGO

Cell and tissue cultures

Educational subject description sheet

Basic information

Field of study Biotechnology	**Didactic cycle** 2024/25
Speciality -	**Subject code** BBTBTjS_D.320K.01618.24
Organizational unit Faculty of Biology and Biotechnology	**Lecture languages** english
Study level first cycle (engineering degree)	**Mandatory** Obligatory subjects
Study form full-time studies	**Block** Major subjects
Education profile General academic	**Disciplines** Biological sciences

Coordinator	Wojciech Pląder
Teacher	Wojciech Pląder, Piotr Bąska

Period	**Examination**	**Number of ECTS points**
Semester 6	Exam **Activities and hours** Lecture: 20 Laboratory exercises: 45	6

Goals

Code	Goal
C1	The lecture is designed to familiarize you with the theoretical foundations of in vitro culture, while in the practical part, students acquire the skills to use the most important techniques of plant and animal cultures by practically carrying out specific experiments. Students are working in chambers with vertical laminar airflow that meet the requirements of class II biosafety (Biohazard)

Entry requirements

chemistry, biochemistry, botany, cell biology, molecular biology, microbiology, genetics, plant and animal physiology, ability to work in a biological and chemical laboratory

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the current state of knowledge on cell and tissue cultures	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W03, BTj_K3_W06	Written exam, Written credit
W2	the construction, equipment and principles of operation (including health and safety regulations) of the plant and animal culture laboratory	BTj_K3_W07_inz, BTj_K3_W08, BTj_K3_W11	Assessment of speeches during classes
Skills – Student can:			
U1	work sterile in a chamber with vertical laminar airflow of the 2nd class of biological safety and can use basic (and some advanced) techniques of in vitro culture	BTj_K3_U07, BTj_K3_U10_inz, BTj_K3_U12_inz, BTj_K3_U22	Project, Assessment of speeches during classes
U2	use optical devices to observe cells, tissues and organs in vitro: a fluorescent stereoscopic microscope and an inverted microscope image analyzer with a fluorescent attachment	BTj_K3_U06_inz, BTj_K3_U12_inz, BTj_K3_U15_inz	Written exam, Written credit, Project, Assessment of speeches during classes
Social competences – Student is ready to:			
K1	constantly deepen the knowledge of the in vitro cultures, important for the development of modern plant biotechnology, and searching through various sources for information expanding this knowledge, as well as is ready to organize and present this knowledge	BTj_K3_K01, BTj_K3_K02, BTj_K3_K03, BTj_K3_K07	Written exam, Project

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Lecture topics: (I) morphogenetic abilities of plant cells, preparation of plant material, nutrients, physical conditions of the culture; growth regulators in plant in vitro cultures; methods of vegetative reproduction; microbial contamination and antibiotic therapy; obtaining haploid plants and doubled haploids; protoplast culture and fusion; selection and testing of features in culture in vitro (somaclonal variability, selection conditions and its effectiveness); (II) types of cell culture and tissues; primary cultures: methods of isolation, purification and identification of cells on the example of cells of various organs; establishing and running primary farms; assessment of the physiological state of isolated cells: indicators of cell viability and metabolic activity; cell lines: types, growth assessment, maintenance of cell lines, kinetics of cell culture, passage, development of cell lines; characteristics of selected cell lines; stem cells: sources of stem cells, methods of isolating and culturing stem cells; advantages and limitations of cell culture and tissues.	W1, W2, K1	Lecture
2.	Excercise topics: (I) learning about the structure, basic equipment and principles of the in vitro plant culture laboratory; learning sterile work; learning about the structure, principles of operation and methods of use with optical devices for monitoring plant cells, tissues and organs in vitro, familiarizing students (in the form of planned experiments) with the basic and some advanced techniques of plant cultures; team analysis of emerging technologies in in vitro plant cultures (based on for an independent literature review of the subject) - case study / project development (II) learning the basic principles of working in the animal cell culture laboratory on examples: 1) rat hepatocytes: a) isolation of hepatocytes, establishment and cultivation of cultures, b) assessment of survival and metabolic activity of the cultures grown using various indicators; 2) isolated tissues and organs: a) isolation of gastrointestinal tracts, rats and their incubation, evaluation of the influence of selected factors on the reaction of the muscular tissue in food sections, b) evaluation of the kinetics of selected compounds and their metabolism in isolated perfused porcine liver; interpretation of the obtained results.	W1, U1, U2, K1	Laboratory exercises

Course advanced

Activities	Methods of conducting classes
Lecture	Lecture, E-learning - lecture part, Presentation
Laboratory exercises	Problem lecture, E-learning - lecture part, Design method, Mastery of movement and stabilization of the technique, Teamwork, Individual work, Interpreting the results, Laboratory (experiment), learning by experiment, Observation

Activities	Examination method	Percentage
Lecture	Written exam	40%

Activities	Examination method	Percentage
Laboratory exercises	Assessment of speeches during classes	10%
Laboratory exercises	Written credit	30%
Laboratory exercises	Project	20%

Activities	Credit conditions
Lecture	obtaining a minimum of 51 points out of 100 possible
Laboratory exercises	obtaining a minimum of 51 points out of 100 possible for each of the elements

Literature

Obligatory

1. In vitro embryogenesis in plants - ed. T. A. Thorpe. Kluwer Academic Publisher, Dordrecht. Printed in the Netherlands 199
2. Butler M.: Animal Cell Culture & Technology, BIOS, USA, 2004
3. Clynes M.:Animal Cell Culture techniques, Springer Lab Manual, Berlin, 1998.

Optional

1. The latest scientific publications from specialist journals and patents in the field of in vitro cultures (including items from KGHiBR and KFiT)

Calculation of ECTS points

Activity form	Activity hours*
Lecture	20
Laboratory exercises	45
Preparing a report	15
Preparation for the exam	20
Preparation for the test	20
Self-study on the content covered in class	20
Preparation of the report	10
Student workload	**Hours** 150
Number of ECTS points	**ECTS** 6

* hour means 45 minutes

Effects

Code	Content
BTj_K3_K01	The graduate is ready to proper storage of data, updating and extending knowledge on topics related to biotechnology and the related sciences;
BTj_K3_K02	The graduate is ready to development and application of one’s skills in practice (including communication, teamwork), which enable effective lifelong learning with respect to biological sciences;
BTj_K3_K03	The graduate is ready to for safe work via the selection and application of a proper technique of handling, storing and disposing of laboratory materials (e.g. using proper techniques in terms of handling, storing and disposing of bacteria, chemical substances and dangerous bio-waste);
BTj_K3_K07	The graduate is ready to recognising the scope and ethical nature of the effects of utilising biotechnology and its impact on the society; settling ethical dilemmas related to the work of a biotechnologist;
BTj_K3_U06_inz	The graduate can use laboratory equipment in order to gather observations and data
BTj_K3_U07	The graduate can follow proper principles of safety and work ethics during the execution of scientific research using various experimental methods under laboratory and field conditions
BTj_K3_U10_inz	The graduate can critically assess the functionality and validity of technical and technological solutions used in a biotechnological process;
BTj_K3_U12_inz	The graduate can plan and perform experiments related to the preparation, creation and utilisation of biological material in a production process;
BTj_K3_U15_inz	The graduate can design modification of the features of a biological organism and the conditions of a process associated with the multiplication of biological material in accordance with the adopted assumptions, select devices and unit operations related to the extraction, purification and preservation of a bioproduct;
BTj_K3_U22	The graduate can find and assess information from various sources, including from original research, and present in a well organised manner (e.g. essays, reports and laboratory reports);
BTj_K3_W01_inz	The graduate knows and understands technologies of performing biotechnological processes
BTj_K3_W02_inz	The graduate knows and understands basics related to the life cycle of a biotechnological product, as well as devices and their instrumentation (measurement sensors) used in biotechnological production
BTj_K3_W03	The graduate knows and understands key aspects of biotechnology
BTj_K3_W06	The graduate knows and understands the functions of various cells (prokaryotic and eukaryotic), being able to critically explain, how their properties are related to varying biological functions, knowing how they can be tested experimentally
BTj_K3_W07_inz	The graduate knows and understands experimental methods serving the examination of important areas in the field of biotechnology, chemistry, biochemistry, biophysics, molecular biology and the related sciences;
BTj_K3_W08	The graduate knows and understands the features of cellular metabolism and its control, including the knowledge of certain experimental techniques;
BTj_K3_W11	The graduate knows and understands the principles of OHS and ergonomics;