SZKOŁA GŁÓWNA GOSPODARSTWA WIEJSKIEGO

Genetic engineering II

Educational subject description sheet

Basic information

Field of study Biotechnology **Speciality** - **Organizational unit** Faculty of Biology and Biotechnology **Study level** first cycle (engineering degree) **Study form** full-time studies **Education profile** General academic	**Didactic cycle** 2024/25 **Subject code** BBTBTjS_D.320K.01619.24 **Lecture languages** english **Mandatory** Obligatory subjects **Block** Major subjects **Disciplines** Biological sciences

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Teacher	Magdalena Pawełkowicz, Piotr Gawroński, Marek Koter, Grzegorz Bartoszewski, Agnieszka Skarzyńska-Łyżwa, Marcin Filipecki

Period	**Examination**	**Number of ECTS points**
Semester 6	Exam **Activities and hours** Lecture: 15 Laboratory exercises: 45	6

Goals

Code	Goal
C1	The lectures are aimed at presenting genetic engineering as an extremely dynamically developing engineering science, enabling the change of basic biological processes for research and application purposes. Genetic engineering is presented as not so much a set of advanced research methods, but also the ability to plan their sequence in the implementation of a specific task. Thus, both well-established information and the latest achievements are presented, but always in a combination with a high application potential in diagnostics, therapies and agriculture. The aim of the exercises in genetic engineering is to provide students with practical knowledge of the possibilities of genetic manipulation in accordance with the latest knowledge in this field. The topics of the exercises are selected to cover a logical thematic and experimental sequence from the knowledge and cloning of the gene from the source organism to obtaining a transgenic organism, a mutant or an edited genome. Participants of the exercises have a chance to gain laboratory skills and a holistic view of the issues of genetic engineering, with particular emphasis on their use in plant biotechnology. Students also learn to present issues / results in the form of science posters.

Entry requirements

knowledge of the biochemistry of genetics (especially molecular) is recommended

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the genetic material analysis and manipulation	BTj_K3_W01_inz, BTj_K3_W05, BTj_K3_W15_inz	Written exam, Written credit, Project
W2	the field of molecular research and molecular diagnostics	BTj_K3_W01_inz, BTj_K3_W02_inz, BTj_K3_W05	Written exam, Written credit, Project
Skills – Student can:			
U1	work with genetic material, can transform plants	BTj_K3_U01_inz, BTj_K3_U02_inz, BTj_K3_U10_inz, BTj_K3_U12_inz, BTj_K3_U13_inz	Written credit, Project
U2	search for information from various sources and use it creatively	BTj_K3_U01_inz, BTj_K3_U02_inz	Written exam, Written credit, Project
U3	prepare a scientific poster in the field of genetic engineering	BTj_K3_U01_inz, BTj_K3_U02_inz	Written credit, Project
Social competences – Student is ready to:			
K1	understand the social importance of genetic manipulation	BTj_K3_K01, BTj_K3_K03	Written exam, Written credit, Project

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	Introduction to omics analysis, importance of the genome and transcriptome, basics of sequencing technology, molecular maps; Gene construction; genomic modifications; basics of variation generation, introduction to gene therapy	W1, W2, U2, K1	Lecture
2.	Isolation of mRNA and reverse transcription, evaluation of expression by qPCR; Hybridisation methods in genetic engineering; Production of recombinant proteins, Evaluation of transgenic plants. GUS and GFP. Development of scientific questions in the form of a project.	W1, W2, U1, U2, U3, K1	Laboratory exercises

Course advanced

Activities	Methods of conducting classes
Lecture	Lecture
Laboratory exercises	Presentation, Teamwork, Interpreting the results, Laboratory (experiment), learning by experiment, Observation

Activities	Examination method	Percentage
Lecture	Written exam	40%
Laboratory exercises	Written credit	40%
Laboratory exercises	Project	20%

Activities	Credit conditions
Lecture	A pass in the lecture requires a pass in the laboratory exercise part of the course.
Laboratory exercises	The assessment of the learning outcomes consists of: 1 - assessment of the tests on the material covered (4 partial tests) (40%), 2 - assessment of the lecture test (40%), 3 - project (20%), each element separately 1, 2, 3 min. 51%. The final grade is calculated as the sum of the points obtained for each item (including their weight). In order to pass the course it is necessary to obtain (points: 1, 2, 3) 51%. The following scale is used to calculate the final score: 100-91% points - 5.0 90-81% points - 4.5 80-71% points - 4.0 70-61% points - 3.5 60-51% points - 3.0

Literature

Obligatory

1. Principles of Gene Manipulation and Genomics, S. B. Promrose and R. Twymann, Willey Blackwell
2. Introduction to Genetic Engineering, Desmond S. T. Nicholl, Cambridge University Press
3. Gene cloning and DNA Analysis, T.A. Brown, Willey Blackwell

Optional

1. Molecular Biotechnology: Principles and Applications of Recombinant DNA, B. R. Glick and C. L. Patten, ASM Press
2. Recombinant DNA Techniques: A Textbook, M. Jain, Alpha Science
3. Biochemistry, Stryer L et al., WH Freeman
4. Selected scientific articles
5. Additional interent sources indicated by the trainer

Calculation of ECTS points

Activity form	**Activity hours***
Lecture	15
Laboratory exercises	45
Preparation for the exam	30
Preparation for remote work	15
Preparing a report	15
Preparation for exercises	15
Self-study on the content covered in class	15
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_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_U01_inz	The graduate can utilise proper techniques and knowledge related to biotechnology in practice, under the care of a supervisor;
BTj_K3_U02_inz	The graduate can perform and present an independent experiment (a final diploma thesis), which reflects features such as: e.g. competences associated with the ability of proper time management, solving a research problem as well as performing tasks and interpreting the quality of results;
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_U13_inz	The graduate can propose analytical methods and plan an experiment for solving engineering tasks related to various stages of creating a biotechnological product;
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_W05	The graduate knows and understands the principles which define the three-dimensional structure of biological macromolecules, with the ability to explain and provide the examples of the relationship between structure and function
BTj_K3_W15_inz	The graduate knows and understands the systems currently recommended for managing quality and safety in the biotechnological industry; the principles of creating and developing the forms of individual entrepreneurship;