

## Subject card

|                                             |                                                                                                                                                                                                                                                                                                                                                                |                                                          |                                             |                                     |                                                                                                                                                |            |     |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----|
| Subject name and code                       | Basis of genetic engineering, PG_00154426                                                                                                                                                                                                                                                                                                                      |                                                          |                                             |                                     |                                                                                                                                                |            |     |
| Field of study                              | Biology                                                                                                                                                                                                                                                                                                                                                        |                                                          |                                             |                                     |                                                                                                                                                |            |     |
| Date of commencement of studies             | October 2024                                                                                                                                                                                                                                                                                                                                                   |                                                          | Academic year of realisation of subject     |                                     | 2026/2027                                                                                                                                      |            |     |
| Education level                             | undergraduate studies                                                                                                                                                                                                                                                                                                                                          |                                                          | Subject group                               |                                     | Obligatory subject group in the field of study<br>Optional subject group<br>Subject group related to scientific research in the field of study |            |     |
| Mode of study                               | full-time studies                                                                                                                                                                                                                                                                                                                                              |                                                          | Mode of delivery                            |                                     | at the university                                                                                                                              |            |     |
| Year of study                               | 3                                                                                                                                                                                                                                                                                                                                                              |                                                          | Language of instruction                     |                                     | Polish                                                                                                                                         |            |     |
| Semester of study                           | 5                                                                                                                                                                                                                                                                                                                                                              |                                                          | ECTS credits                                |                                     | 1.0                                                                                                                                            |            |     |
| Learning profile                            | academic                                                                                                                                                                                                                                                                                                                                                       |                                                          | Assessment form                             |                                     |                                                                                                                                                |            |     |
| Conducting unit                             | Pracownia Biochemii Mikroorganizmów -> Katedra Biochemii Ogólnej i Medycznej -> Faculty of Biology                                                                                                                                                                                                                                                             |                                                          |                                             |                                     |                                                                                                                                                |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                                             |                                                          | prof. dr hab. Sabina Kędzierska-Mieszkowska |                                     |                                                                                                                                                |            |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                             |                                     |                                                                                                                                                |            |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                                                    | Lecture                                                  | Tutorial                                    | Laboratory                          | Project                                                                                                                                        | Seminar    | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                                          | 0.0                                                      | 0.0                                         | 15.0                                | 0.0                                                                                                                                            | 0.0        | 15  |
|                                             | E-learning hours included: 0.0                                                                                                                                                                                                                                                                                                                                 |                                                          |                                             |                                     |                                                                                                                                                |            |     |
|                                             | Additional information:<br>Designing experiments, working in groups, discussion, preparing a multimedia presentation, consultations organized in individual cases                                                                                                                                                                                              |                                                          |                                             |                                     |                                                                                                                                                |            |     |
| Learning activity and number of study hours | Learning activity                                                                                                                                                                                                                                                                                                                                              | Participation in didactic classes included in study plan |                                             | Participation in consultation hours |                                                                                                                                                | Self-study | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                                          | 15                                                       |                                             | 2.0                                 |                                                                                                                                                | 8.0        | 25  |
| Subject objectives                          | The main goal of this course is to familiarize students with the basic concepts and techniques of genetic engineering and its practical application in various areas of our lives. Class participants have the opportunity to acquire skills in: (1) designing experiments related to cloning genes, examining their expression and identifying their products |                                                          |                                             |                                     |                                                                                                                                                |            |     |

| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Subject outcome                                                                                                                                                                                                                                                 | Method of verification                                                                                  |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
|                                 | [BIOLL3_K01] The graduate is prepared to evaluate their own knowledge, understand the need for continuous learning and development, and is open to new ideas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | the student knows the limits of his or her own knowledge and understands the need for constant learning and development and is open to new ideas                                                                                                                | [SK1] oral statement/conversation/discussion<br>[SK8] observation of student's independent or team work |
|                                 | [BIOLL3_W14] The graduate knows the theoretical basis of experimental methods and the most important techniques of the biological sciences                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | the student explains the theoretical basis of experimental methods and lists the most important methods and techniques used in genetic engineering, biotechnology and molecular biology                                                                         | [SW1] oral statement/conversation/discussion<br>[SW2] presentation/project/paper/report                 |
|                                 | [BIOLL3_U10] The graduate will be able to prepare oral presentations in Polish and a foreign language on specific topics in the field of biology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | the student has the ability to give oral presentations in Polish on specific issues in the field of genetic engineering                                                                                                                                         | [SU1] oral statement/conversation/discussion                                                            |
|                                 | [BIOLL3_W16] The graduate knows and understands the relationship between the achievements of the chosen field of science and discipline of natural sciences and the possibilities of their use in socio-economic life, taking into account the sustainable use of biodiversity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | the student explains the connections between the achievements of genetic engineering and the possibilities of their use in socio-economic life, taking into account the sustainable use of biological diversity                                                 | [SW1] oral statement/conversation/discussion<br>[SW2] presentation/project/paper/report                 |
|                                 | [BIOLL3_W10] The graduate is familiar with the development and current state of knowledge and the latest trends in biology, as well as their relationship with other natural disciplines                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | the student is aware of the development and current state of knowledge and the latest research trends in the fields of molecular genetics, molecular biology, medical biology and biotechnology and indicates their relationship with other natural disciplines | [SW1] oral statement/conversation/discussion<br>[SW2] presentation/project/paper/report                 |
|                                 | [BIOLL3_U08] The graduate is able to learn independently, in a focused manner                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | the student learns independently, in a directed manner, striving to expand existing knowledge in the field of genetic engineering                                                                                                                               | [SU1] oral statement/conversation/discussion<br>[SU2] presentation/project/paper/report                 |
|                                 | [BIOLL3_K08] The graduate is ready to be honest, reliable and apply the principles of savoir-vivre in academic and professional work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | the student understands the need for honesty and reliability in scientific and professional work                                                                                                                                                                | [SK1] oral statement/conversation/discussion<br>[SK8] observation of student's independent or team work |
|                                 | [BIOLL3_U07] The graduate should be able to independently search for and use available sources of biological information, including electronic sources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | the student independently searches for and uses available sources of biological information, including electronic sources, especially when preparing a multimedia presentation on a given topic                                                                 | [SU1] oral statement/conversation/discussion<br>[SU2] presentation/project/paper/report                 |
|                                 | [BIOLL3_U06] The graduate can read with comprehension simple scientific biological texts in Polish and simple texts in English                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | the student reads and understands simple scientific biological texts in the field of molecular genetics, molecular biology, biotechnology and medical biology in Polish and simple texts in English                                                             | [SU1] oral statement/conversation/discussion<br>[SU2] presentation/project/paper/report                 |
| Subject contents                | Practical applications of genetic engineering. Achievements and problems of genetic engineering (including ethical assessment of genetic engineering applications). Eukaryotic vectors, artificial chromosomes (BAC, YAC). The use of plants to produce biopharmaceuticals. Gene therapy, i.e. improving genes. RNA interference. Transgenic organisms. Basics of molecular diagnostics. Site-specific mutagenesis. Real-time PCR technique and its application in medicine. RNAseq technique as a comprehensive method of understanding the transcriptome; GFP as a basic tool in molecular biology. Molecular guardians - a new face of the RNA world. Overproduction of heterologous proteins in bacteria E. coli. Methods of purifying recombinant proteins from bacterial cells. |                                                                                                                                                                                                                                                                 |                                                                                                         |
| Prerequisites and co-requisites | Completed courses: Biochemistry, Molecular biology with biotechnology. Knowledge of the structure and properties of basic types of biological macromolecules, molecular mechanisms of the flow of genetic information and the regulation of its expression.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                 |                                                                                                         |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Passing threshold                                                                                                                                                                                                                                               | Percentage of the final grade                                                                           |
|                                 | participation in the discussion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 5.0%                                                                                                                                                                                                                                                            | 10.0%                                                                                                   |
|                                 | preparing and delivering a multimedia presentation on a given topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 51.0%                                                                                                                                                                                                                                                           | 90.0%                                                                                                   |

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|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Recommended reading                                            | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Literature studied independently by the student: Original experimental and review works provided by the lecturer and source materials selected by the student. Lecture materials provided by the lecturer. Buchnowicz J. (ed.). 2012. Molecular biotechnology. Genetic modifications, progress, problems. PWN, Warszawa. Brown T. A. 2009. Genomes. PWN, Warsaw.                                                                                                                                                                                                                                                                                                                                                                                |
|                                                                | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Additional literature: Ledakowicz S (ed.) 2014. Biochemical engineering. WNT, Warsaw. Berg J. M., Tymoczko J. L., Stryer L. 2009. Biochemistry. PWN, Warsaw. Watson J. D. et al. 2006. Recombinant DNA: Genes and Genomes - A Short Course. Baskerville Beucher; Węgleński P. (ed.). 2007. Molecular genetics. PWN, Warsaw; Hanych, B. Kędzierska, S., Walderich B., Uznański, B. and Taylor A (1993) Expression of the Rz gene and the overlapping Rz1 reading frame present at the right end of the bacteriophage lambda genome. Gene, 129: 1-8; Kędzierska, S., Wawrzynów, A. and Taylor A. (1996) The Rz1 gene product of bacteriophage lambda is a lipoprotein localized in the outer membrane of <i>Escherichia coli</i> . Gene, 168: 1-8 |
|                                                                | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Adresy na platformie eNauczanie:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Example issues/<br>example questions/<br>tasks being completed | <p><b>Sample presentation topics:</b></p> <ol style="list-style-type: none"> <li>1. Genetic engineering - opportunities and threats;</li> <li>2. GFP protein as a basic method in molecular biology;</li> <li>3. Theoretical and practical aspects of the RNA interference phenomenon;</li> <li>4. Overproduction and purification of recombinant, heterologous proteins in <i>E. coli</i> bacteria cells;</li> <li>5. RNA sequencing - a comprehensive method of understanding the transcriptome;</li> <li>6. CRISPR-Cass system - from bacterial resistance to genome engineering.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Work placement                                                 | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

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