

**Subject card**

|  |  |  |   |                                     |                                   |            |     |
|--|--|--|---|-------------------------------------|-----------------------------------|------------|-----|
| <b>Subject name and code</b>                       | Biomolecules - structure, synthesis and properties (M02_B1), PG_00153663   |  |   |                                     |                                   |            |     |
| <b>Field of study</b>                              | Biotechnology  |  |   |                                     |                                   |            |     |
| <b>Date of commencement of studies</b>             | October 2024   | <b>Academic year of realisation of subject</b>           |   |                                     | 2024/2025                         |            |     |
| <b>Education level</b>                             | undergraduate studies  | <b>Subject group</b>                                     |   |                                     |                                   |            |     |
| <b>Mode of study</b>                               | full-time studies  | <b>Mode of delivery</b>                                  |   |                                     | at the university                 |            |     |
| <b>Year of study</b>                               | 1  | <b>Language of instruction</b>                           |   |                                     | Polish                            |            |     |
| <b>Semester of study</b>                           | 2  | <b>ECTS credits</b>                                      |   |                                     | 5.0                               |            |     |
| <b>Learning profile</b>                            | academic   | <b>Assessment form</b>                                   |   |                                     |                                   |            |     |
| <b>Conducting unit</b>                             |  |  |   |                                     |                                   |            |     |
| <b>Name and surname of lecturer (lecturers)</b>    | Subject supervisor   |  | dr hab. Katarzyna Węgrzyn   |                                     |                                   |            |     |
|  | Teachers   |  |   |                                     |                                   |            |     |
| <b>Lesson types</b>                                | <b>Lesson type</b>   | Lecture  | Tutorial  | Laboratory                          | Project                           | Seminar    | SUM |
|  | <b>Number of study hours</b>   | 78.0   | 0.0   | 0.0                                 | 0.0                               | 0.0        | 78  |
|  | E-learning hours included: 0.0   |  |   |                                     |                                   |            |     |
| <b>Learning activity and number of study hours</b> | <b>Learning activity</b>   | Participation in didactic classes included in study plan |   | Participation in consultation hours |                                   | Self-study | SUM |
|  | <b>Number of study hours</b>   | 78   |   | 0.0                                 |                                   | 47.0       | 125 |
| <b>Subject objectives</b>                          | Program block 01 in Module 02 aims to provide detailed knowledge about the structure and properties of biomolecules (such as active low- and medium-molecular-weight compounds as well as proteins, nucleic acids, sugars and lipids) that create more complex biological systems, cellular compartments. By completing the program block, the student will gain detailed knowledge about the synthesis of biomolecules. The student will also gain knowledge related to the use of biomolecules' isolation methods and their biochemical, biophysical and bioinformatic analysis. |  |   |                                     |                                   |            |     |
| <b>Learning outcomes</b>                           | <b>Course outcome</b>  |  | <b>Subject outcome</b>  |                                     | <b>Method of verification</b>     |            |     |
|  | [BIOTECHL3_W01] The graduate knows and understands basic biological phenomena at the molecular level, he/she is familiar with their significance for biotechnology.  |  | Student has detailed knowledge about the structure and properties of biomolecules (such as active low- and medium-molecular-weight compounds as well as proteins, nucleic acids, sugars and lipids) that create more complex biological systems, cellular compartments. |                                     | [SW4] test/exam - oral or written |            |     |
|  | [BIOTECHL3_W07] The graduate knows and understands basic techniques and research tools used in biotechnology.  |  | Student has detailed knowledge about the synthesis of biomolecules. The student has also knowledge related to the use of biomolecules' isolation methods and their biochemical, biophysical and bioinformatic analysis.   |                                     | [SW4] test/exam - oral or written |            |     |

| Subject contents                | <p>F1. Introduction</p> <ul style="list-style-type: none"> <li>• Compounds C, H, O, N, P, and S as the basis of life on Earth, primary synthesis</li> <li>• Core structures of simple biomolecules and their derivatives</li> <li>• Structures composed of simple repeating units</li> <li>• Main families of chemical compounds and connections between compounds from different families</li> </ul> <p>F2. Carbohydrates</p> <ul style="list-style-type: none"> <li>• Structure of simple and complex sugars (homo- and heteroglycans)</li> <li>• Transformations of simple sugars</li> <li>• Synthesis of complex sugars</li> </ul> <p>F3. Nucleic Acids</p> <ul style="list-style-type: none"> <li>• Structure of nitrogenous bases, nucleosides, and nucleotides, glycosidic and phosphoester bonds</li> <li>• Structure of oligonucleotides and nucleic acids, anhydride bonds of phosphoric acid, peptide analogs of nucleic acids, synthesis of oligonucleotide probes</li> <li>• Interconversions of nucleic acids, levels of genetic information transfer</li> <li>• Components of DNA, base pairing, tautomeric forms, B-helix shape, sequence recognition, DNA topology</li> <li>• Components of RNA, differences in spatial structure, spatial structures</li> <li>• DNA synthesis, replication models</li> <li>• Chromosome segregation</li> <li>• Replication forks, direction of DNA synthesis</li> <li>• <i>E. coli</i> polymerases</li> <li>• DNA helicase, topoisomerase, gyrase, SSB protein, polC holoenzyme, beta clamp</li> <li>• Coordination of leading and lagging strands, removal of Okazaki fragments, initiation at oriC, decatenation</li> <li>• Mutations, mutagens, DNA polymerase slippage</li> <li>• DNA repair systems</li> <li>• Emergency replication, homologous recombination, site-specific recombination</li> <li>• RNA synthesis</li> <li>• Linking transcription and translation via ppGpp</li> <li>• Synthesis and processing of rRNA and tRNA</li> <li>• Antibiotics inhibiting the replication process</li> </ul> <p>F4. Proteins</p> <ul style="list-style-type: none"> <li>• Structure of amino acids, peptide bond, oligopeptides</li> <li>• Protein structure (primary, secondary, tertiary, and quaternary structure); modular structures of proteins</li> <li>• Protein synthesis</li> <li>• Post-translational modifications of proteins</li> <li>• Proteins degradation in a cell</li> </ul> <p>F5. Lipids</p> <ul style="list-style-type: none"> <li>• Structure and biosynthesis of fatty acids</li> <li>• Modifications of fatty acids</li> <li>• Structure and biosynthesis of phospholipids, glycolipids, and triacylglycerols</li> <li>• Structure and biosynthesis of sphingolipids, ether lipids, suberin, cutin, and waxes</li> <li>• Structure and biosynthesis of cholesterol and plant isoprenoids</li> </ul> <p>F6. Analysis of Biomolecules methods</p> <ul style="list-style-type: none"> <li>• Chromatographic methods</li> <li>• Methods used in the analysis of nucleic acids and proteins</li> <li>• Methods used in the analysis of lipids</li> <li>• Databases and basic bioinformatics methods</li> </ul> |                               |                   |                               |    |       |       |                  |      |       |        |       |       |            |       |       |
|---------------------------------|--|-------------------------------|-------------------|-------------------------------|----|-------|-------|------------------|------|-------|--------|-------|-------|------------|-------|-------|
| Prerequisites and co-requisites |  |                               |                   |                               |    |       |       |                  |      |       |        |       |       |            |       |       |
| Assessment methods and criteria | <table border="1"> <thead> <tr> <th data-bbox="456 1628 794 1659">Subject passing criteria</th> <th data-bbox="799 1628 1137 1659">Passing threshold</th> <th data-bbox="1142 1628 1481 1659">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 1666 794 1697">F6</td> <td data-bbox="799 1666 1137 1697">40.0%</td> <td data-bbox="1142 1666 1481 1697">15.0%</td> </tr> <tr> <td data-bbox="456 1704 794 1736">Integration exam</td> <td data-bbox="799 1704 1137 1736">0.0%</td> <td data-bbox="1142 1704 1481 1736">40.0%</td> </tr> <tr> <td data-bbox="456 1742 794 1774">F4, F5</td> <td data-bbox="799 1742 1137 1774">50.0%</td> <td data-bbox="1142 1742 1481 1774">20.0%</td> </tr> <tr> <td data-bbox="456 1780 794 1812">F1, F2, F3</td> <td data-bbox="799 1780 1137 1812">50.0%</td> <td data-bbox="1142 1780 1481 1812">25.0%</td> </tr> </tbody> </table>   | Subject passing criteria      | Passing threshold | Percentage of the final grade | F6 | 40.0% | 15.0% | Integration exam | 0.0% | 40.0% | F4, F5 | 50.0% | 20.0% | F1, F2, F3 | 50.0% | 25.0% |
| Subject passing criteria        | Passing threshold  | Percentage of the final grade |                   |                               |    |       |       |                  |      |       |        |       |       |            |       |       |
| F6                              | 40.0%  | 15.0%                         |                   |                               |    |       |       |                  |      |       |        |       |       |            |       |       |
| Integration exam                | 0.0%   | 40.0%                         |                   |                               |    |       |       |                  |      |       |        |       |       |            |       |       |
| F4, F5                          | 50.0%  | 20.0%                         |                   |                               |    |       |       |                  |      |       |        |       |       |            |       |       |
| F1, F2, F3                      | 50.0%  | 25.0%                         |                   |                               |    |       |       |                  |      |       |        |       |       |            |       |       |

|  |                          |  |
|--|--------------------------|--|
| Recommended reading  | Basic literature         | <ul style="list-style-type: none"> <li>• Biochemistry, The Chemical Reactions of Living Cells. David E. Metzler, vol. 1 &amp; 2. Second Edition, Elsevier, Academic Press, 2004</li> <li>• Biochemistry, J.M. Berg, J.L. Tymoczko, L. Stryer, Scientific Publishing House PWN, Warsaw 2013</li> <li>• LIPIDS - Chris Somerville, John Browse, Jan Jaworski, John Ohlrogge. In: Biochemistry &amp; Molecular Biology of Plants. B. Buchanan, W. Gruissem, R. Jones, Eds. 2000, American Society of Plant Physiologist, Rockville, Maryland, USA (or 2nd edition, ISBN: 978-0-470-71421-8; Published 2015 by John Wiley &amp; Sons, Ltd)</li> <li>• Plant Physiology. J. Kopcewicz and S. Lewak, Eds. 2002. Scientific Publishing House PWN Warsaw</li> <li>• Molecular Cell Biology, Lodish et al., edition IX (2021)</li> <li>• Molecular Biology of the cell, Alberts et al., editionVII (2022)</li> <li>• Genomes, A.T. Brown, edition IV (2018), PWN</li> <li>• Molecular Biology of the Gene, Watson et al., 7th edition (2014)</li> <li>• Genes XI, Lewin, 11th edition (2014)</li> </ul> |
|  | Supplementary literature | <ul style="list-style-type: none"> <li>• Molecular Genetics, Węgleński et al., 6th edition (2012), PWN</li> <li>• Molecular Biology of Bacteria, Baj and Markiewicz, 1st edition (2012), PWN</li> <li>• Essential Cell Biology, Alberts et al., 2nd edition (2005), PWN</li> <li>• Principles of Biochemistry, Lehninger, 5th edition (2008)</li> <li>• Molecular Cloning, Sambrook and Russel, 4th edition (2012)</li> <li>• Molecular Cloning - A Laboratory Manual by Sambrook, Fritsch, and Maniatis</li> <li>• Molecular Cloning - A Laboratory Manual. 4th edition, (2012) Green, Sambrook</li> <li>• Materials prepared by the instructor</li> <li>• Materials independently searched and selected by students related to the classes using library resources and electronic sources</li> </ul>   |
|  | eResources addresses     | Adresy na platformie eNauczanie:   |
| Example issues/<br>example questions/<br>tasks being completed |                          |  |
| Work placement   | Not applicable           |  |

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