

Subject card

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|--|---|--|------------------------|-------------------------------------|---------|--|-----|
| Subject name and code | Fundamentals of enzymology, PG_00082051 | | | | | | |
| Field of study | Chemistry | | | | | | |
| Date of commencement of studies | October 2024 | Academic year of realisation of subject | | | | 2026/2027 | |
| Education level | Bachelor's studies | Subject group | | | | Obligatory subject group 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 Polish | |
| Semester of study | 5 | ECTS credits | | | | 2.0 | |
| Learning profile | academic | Assessment form | | | | credit | |
| Conducting unit | Laboratory of Bioorganic Chemistry -> Department of Molecular Biochemistry -> Faculty of Chemistry -> Rector | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | | dr hab. Dawid Dębowski | | | | |
| | Teachers | | | | | | |
| Lesson types | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 30.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30 |
| | E-learning hours included: 0.0 | | | | | | |
| 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 | 30 | | 5.0 | | 15.0 | 50 |
| Subject objectives | <p>Learning and understanding of the basic laws and concepts in the enzymology.</p> <p>Learning of the structure, role and mechanisms of action of selected classes of enzymes.</p> <p>Learning about examples of the use of enzymes in the cosmetics, food and pharmaceutical industries.</p> <p>Understanding the role of enzymes in the development of diseases.</p> <p>Learning of how to determine and control enzymatic activity.</p> | | | | | | |

| Learning outcomes | Course outcome | Subject outcome | Method of verification |
|-------------------|--|---|-----------------------------------|
| | [CHEML3_W01] Enumerates basic laws and theories in chemistry, physics, mathematics and biology. | <p>Describes the structure of enzymes and their active site, lists the basic functions and properties of enzymes. Explains the term enzymatic specificity taking selected proteases and lipases as examples.</p> <p>Distinguishes and characterizes the basic types of enzymes.</p> <p>Describes the mechanism of action of selected proteolytic enzymes.</p> <p>Defines the concept of cofactors and provide their division.</p> <p>Lists and describes methods of controlling enzymatic activity in the cell.</p> <p>Lists examples of the use of enzymes in the food, cosmetics and pharmaceutical industries.</p> <p>Describes basic issues related to enzymatic kinetics.</p> <p>Lists examples of enzymes that are biomarkers in selected diseases.</p> <p>Defines the concept of ribozyme and gives an example of such a compound.</p> | [SW4] test/exam - oral or written |
| | [CHEML3_U09] Is able to learn independently. | <p>Has ability to use online databases containing scientific publications about enzymes and their inhibitors (such as the PubMed database).</p> <p>Has ability to use online available databases (including BRENDA, MEROPS, EXPASY) to expand and update his knowledge.</p> | [SU4] test/exam - oral or written |
| | [CHEML3_W10] Enumerates and describes the basic aspects of the construction, operation and use of measuring apparatus and equipment used in experimental works in the field of chemistry and related sciences. | <p>Knows selected methods and devices for assessing the purity and concentration of enzymes.</p> <p>Knows the advantages and limitations of selected devices and laboratory techniques used to assess enzymatic activity.</p> | [SW4] test/exam - oral or written |
| | [CHEML3_U07] Prepares documented elaboration on a specific problem in the field of selected chemical and physical issues. | <p>Designs experiments to evaluate the activity of selected enzymes (proteases, lipases, amylases, phosphatases).</p> <p>Designs experiments to evaluate the activity of protease inhibitors.</p> <p>Designs fluorogenic peptide substrates to assess the activity of selected proteases (trypsin, chymotrypsin and elastase).</p> | [SU4] test/exam - oral or written |
| | [CHEML3_K02] Works individually demonstrating initiative and independence of activity and cooperates in a team fulfilling various roles in it. | <p>Is aware and has a knowledge that enzymology is multidisciplinary science.</p> <p>Understands the need to be able to work in a team in accordance with one's role in it (group leader/ group member)</p> | [SK4] test/exam - oral or written |

| | Course outcome | Subject outcome | Method of verification |
|---------------------------------|--|--|-----------------------------------|
| | [CHEML3_U02] Performs analyses using experimental methods and draws conclusions based on them. | Designs and performs basic experiments involving selected enzymes (proteases, amylases, lipases and phosphatases), their inhibitors and fluorogenic substrates. Analyzes the results of experiments and draws correct conclusions. | [SU4] test/exam - oral or written |
| | [CHEML3_K06] Raises her/his professional and personal competences by using information provided in various sources. | Understands the need for continuous education and updating of knowledge. Demonstrates cautious criticism in accepting information, especially available in the mass media | [SK4] test/exam - oral or written |
| | [CHEML3_K01] Identifies the level of her/his own knowledge and skills and the need for continuous learning and personal development. | Understands the need for continuous education and updating of knowledge. Is aware of the need to critically analyze own work and external source data. | [SK4] test/exam - oral or written |
| Subject contents | Basic classification of enzymes. Enzymes in online databases (including BRENDA, MEROPS, EXPASY). Methods of isolation and purification of enzymes. Structure and functions of selected enzymes and coenzymes. Substrate specificity. Localization of enzymes in cells. Basic regulation ways of enzymatic activity. Inhibition mechanisms, classification of enzyme inhibitors. The concept and unit of enzymatic activity. Basics of enzymatic kinetics. Examples of enzymes evaluated in medicinal diagnostics and analytics. Examples of enzymes regarded as disease markers. Examples of enzymes used in food, pharmaceutical and cosmetic industry. | | |
| Prerequisites and co-requisites | Basic knowledge of organic chemistry and biochemistry course. The structure of amino acids and proteins. | | |
| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
| | Written exam | 51.0% | 100.0% |
| Recommended reading | Basic literature | J. M. Berg, J. L. Tymoczko, L. Stryer, "Biochemia", PWN, Warszawa 2009. E. Bańkowski "Biochemia", Elsevier Urban & Partner Wrocław 2004. J.R. Whitaker, A.G.J Voragen, D.W.S. Wong "Handbook of food enzymology" CRC Press 2002. R.A. Copeland "Enzymes: A Practical Introduction to Structure, Mechanism, and Data Analysis", 2nd Edition, Wiley D.E. Metzler Biochemistry: "The chemical reactions of living cells" Second edition, Academic Press | |
| | Supplementary literature | H. Bisswanger "Practical enzymology", Second, completely revised edition, Wiley-Blackwell J-L. Reymond "Enzyme Assays" Wiley-VCH | |

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| | eResources addresses | Supplementary https://www.ebi.ac.uk/merops/ - The MEROPS database is an information resource for peptidases (also termed proteases, proteinases and proteolytic enzymes) and the compounds that inhibit them. |
| Example issues/ example questions/ tasks being completed | Each of the three test tubes contains an aqueous solution of a different serine protease - trypsin, chymotrypsin and elastase. Design experiments to identify these enzymes. Provide the necessary reagents and test equipment - justify your choice. Design an experiment to check whether a given compound is an inhibitor of bovine -trypsin. Provide the necessary reagents and equipment for testing - justify the choice of reagents and equipment. What is the difference between a competitive inhibitor and a noncompetitive inhibitor? How do both of these inhibitors affect V_{max} and K_m values? Present the action of both inhibitors using a Michaelis-Menten or Lineweaver-Burk plot. | |
| Work placement | Not applicable | |

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