

## KARTA PRZEDMIOTU

## I. Dane podstawowe

Nazwa przedmiotu	Biochemia z enzymologią
Nazwa przedmiotu w języku angielskim	Biochemistry with enzymology
Kierunek studiów	Biotechnologia
Poziom studiów (I, II, jednolite magisterskie)	I
Forma studiów (stacjonarne, niestacjonarne)	stacjonarne
Dyscyplina	biochemia
Język wykładowy	Grupy w języku polskim – język polski Grupy w języku angielskim – język angielski

Koordinator przedmiotu/osoba odpowiedzialna	Prof. dr hab. Ryszard Szyszka
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Forma zajęć ( <i>katalog zamknięty ze słownika</i> )	Liczba godzin	Semestr	Punkty ECTS
Wykład	30	III	9
konwersatorium			
ćwiczenia	60	III	
laboratorium			
warsztaty			
seminarium			
proseminarium			
Lektorat			
Praktyki			
zajęcia terenowe			
pracownia dyplomowa			
translatorium			
wizyta studyjna			

Wymagania wstępne	General and inorganic chemistry, organic chemistry
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## II. Cele kształcenia dla przedmiotu

- C1. Gaining knowledge about selected organic compounds (amino acids, proteins, nucleic acids, saccharides and fats)
- C2. Acquainting students with the methodologies of basic biochemistry and enzymology through their individual execution.
- C3. Forming skills of observation, asking questions, designing experiments, discuss the results and make proposals
- C4. Developing ability to use specific vocabulary and terms of biochemistry.

## III. Efekty kształcenia dla przedmiotu wraz z odniesieniem do efektów kierunkowych

Symbol	Opis efektu przedmiotowego	Odniesienie do efektu kierunkowego
<b>WIEDZA</b>		
W_01	The student specifies and describes the basic organic compounds and the processes which these compounds undergo	K_W01
W_02	The student describes the characteristic reactions for given compound	K_W02
W_03	The student identifies possible reasons for the failure of the experiment and describes the basic techniques used in enzymology	K_W03
W_04	The student knows characteristic methods for detection and identification of selected compounds. The student proposes the use of appropriate enzymology techniques in order to achieve a given result. The student presents the basic methods used for isolation and determination of the activity of enzymes, to characterize the mechanism of catalysis and regulation of enzymatic activity	K_W06
W_05	has knowledge of fundamental principles of H&S and ergonomics, and displays psychophysical abilities in work environment	K_W09
<b>UMIEJĘTNOŚCI</b>		
U_01	The student independently conducts basic experiments with biochemistry. The student prepares buffers and solutions with a given concentration	K_U01
U_02	The student operates simple laboratory equipment and apparatus (automatic pipette, centrifuge, shaker, spectrophotometer, water bath, transilluminator). The student carries out observations and performs basic biochemical and enzymatic measurements	K_U02
U_03	The student measures the enzyme activity and its changes under the influence of various factors (ie temperature, pH, substrate concentration, enzyme concentration, the presence of effectors)	K_U05
U_04	The student identifies enzymes from different biological sources and interpreting the enzymatic activity units	K_U07
U_05	The student describes a conducted series of experiments in a manner typical of scientific works in Polish and/or English, using scientific language	K_U10
<b>KOMPETENCJE SPOŁECZNE</b>		
K_01	The student is open-minded towards new technologies used in biochemistry and enzymology The is aware of the possibility of practical application of the presented techniques	K_K01
K_02	The student is able to express their comments and discussion The student is able to work in a group	K_K02
K_03	The student cares for the used laboratory equipment and clutter in the workplace	K_K03

#### IV. Opis przedmiotu/ treści programowe

**Lectures:** Macromolecules found in nature (proteins, nucleic acids DNA and RNA, sugars, fats, steroids, vitamins and dyes). Hierarchy of molecular organization of cell components. Amino acids and proteins - structures and functions, properties and specific reactions of amino acids. Protein properties: denaturation, isoelectric point. Enzymes, regulation of their activity, inhibitors and activators, kinetics, specificity. DNA - structures, role, properties. Replication and transcription. RNA - structure, properties and types. Pre-mRNA maturation. Genetic code, ribosomes - structure and function, translation. Post-translational protein modifications and their significance. General information about genetic engineering and DNA cloning. Metabolism - concepts and organization, obtaining energy. Carbohydrates and fats and their transformation. Structure, properties and characteristic reactions of monosaccharides and polysaccharides. Structure and properties of nucleic acids. Structure and properties of fatty acids and fats. Classification and enzyme nomenclature. Methods for modifying enzymes. Monomeric, oligomeric and multi-enzyme complexes - their structures and functions. Enzyme cofactors. Comparison of the action of enzymes and inorganic catalysts. Enzymatic units. Influence of temperature, pH of the environment, activators and inhibitors on enzymatic activity. Kinetics of enzymatic reaction. Effect of substrate and enzyme concentration on the enzymatic reaction. Initial reaction speed. Model Michaelis-Menten. Determination of Michaelis constant ( $K_m$ ) and maximum velocities ( $V_{max}$ ) of selected enzymatic reactions in the presence and absence of an inhibitor. Mechanisms of intracellular protein degradation. Industrial and clinical aspects of enzymology. Molecular aspects of the formation of life and functioning of organisms.

**Classes:** Structure, properties and characteristic reactions of amino acids. Protein structures. Properties of proteins: denaturation, isoelectric point. Quantitative measurement of proteins in solution using colorimetric methods. Structure, properties and characteristic reactions of monosaccharides and polysaccharides. Chemical and enzymatic hydrolysis of starch. Structure and properties of nucleic acids. Quantitative measurement of DNA in solution using colorimetric and fluorescent methods. Structure and properties of fat acids and fats. Comparison enzymes as biological catalysts with inorganic catalysts. Enzymes characteristics: chemical constitution and catalytic mechanisms. Nomenclature and classification. Enzymatic activity units. Identification and quantitative determination of selected enzymes. Methods for the study of enzyme activity and physicochemical properties. Analysis of enzymes specificity e.g. selected hydrolases. The factors influencing enzymatic activity – pH, activators and inhibitors. Kinetics of enzyme reactions. Influence of concentration of substrate and concentration of enzyme on the enzymatic reaction. The initial reaction velocity. Michaelis-Menten model. Determination of Michaelis constant ( $K_M$ ) and maximum velocity ( $V_{max}$ ) of selected enzymatic reactions in without and in the presence of inhibitor.

#### V. Metody realizacji i weryfikacji efektów kształcenia

Symbol efektu	Metody dydaktyczne (lista wyboru)	Metody weryfikacji (lista wyboru)	Sposoby dokumentacji (lista wyboru)
<b>WIEDZA</b>			
W_01	conventional lecture,	Written exam,	Evaluated test, exam,
W_02	laboratory analysis	test	protocol
W_03	laboratory analysis	test	Evaluated test, exam,
W_04			protocol
<b>UMIEJĘTNOŚCI</b>			
U_01	Laboratory classes	observation; test of practical	Report printout,
U_02		skills, report	Observation report

U_03 U_04 U_05			
<b>KOMPETENCJE SPOŁECZNE</b>			
K_01 K_02 K_03	Laboratory classes	Test of practical skills,	Report printout, Observation report

**VI. Kryteria oceny, wagi**

<b>Very good (5)</b>	the student realizes the assumed learning outcomes at a very good level	the student demonstrates knowledge of the education content at the level of 95-100%
<b>Over good (4.5)</b>	the student accomplishes the assumed learning outcomes an over good level	the student demonstrates knowledge of the education content at the level of 85-94 %
<b>Good (4)</b>	the student accomplishes the assumed learning outcomes at a good level	the student demonstrates knowledge of the education content at the level of 75-84%
<b>Quite good (3.5)</b>	the student accomplishes the assumed learning outcomes at a quite good level	the student demonstrates knowledge of the education content at the level of 65-74%
<b>sufficient (3)</b>	the student accomplishes the assumed learning outcomes at a sufficient level	the student demonstrates knowledge of the education content at the level of 51-64%
<b>insufficient (2)</b>	the student accomplishes the assumed learning outcomes at an insufficient level	the student demonstrates knowledge of the education content below the level of 51%

**VII. Obciążenie pracą studenta**

Forma aktywności studenta	Liczba godzin
Liczba godzin kontaktowych z nauczycielem	90
Liczba godzin indywidualnej pracy studenta	135

**VIII. Literatura****Grupy w języku polskim**

Literatura podstawowa
1. Berg J.M. , Stryer L., Tymoczko L.W., Biochemia, PWN, Warszawa, 2011
2. Kłyszajko-Stefanowicz L. (red.), Ćwiczenia z biochemii, Wydawnictwo Naukowe PWN, 2003.

3. Szyszka R., Ćwiczenia z biochemii i technik współczesnej biologii molekularnej, Wydawnictwo KUL, Lublin, 1998.
4. Hames B.D., Hooper N.M., Krótkie wykłady, Biochemia, PWN, Warszawa, 2010.
5. Witwicki J., Ardelt W. (red.) Elementy enzymologii. PWN, Warszawa, 1989
6. Murray R.K., Granner D.K., Rodwell V.W., Biochemia Harpera, Wyd. PZWL, 2012
Literatura uzupełniająca
1. Doonan S., Białka i peptydy, Wydawnictwo Naukowe PWN, Warszawa, 2008.
2. Fisher J., Arnold J.R.P., Krótkie wykłady, Chemia dla biologów, Wydawnictwo Naukowe PWN, Warszawa, 2008
3. Bereta J., Koj A., Zarys Biochemii., Seria Wydawnicza WBBiB UJ, Kraków 2009

Grupy w języku angielskim

Literatura podstawowa
1. Biochemistry Eighth edition by Berg, Jeremy M., Tymoczko, John L., Gatto, Gregory J., Stryer (2015)
2. BIOS Instant notes in Biochemistry third edition by D. Hames, N. Hooper (2005)
3. Practical Enzymology, Second Edition by H. Bisswanger (2012)
Literatura uzupełniająca
Handbook of Biochemistry and Molecular Biology, 5th Edition, Roger L. Lundblad, Fiona Macdonald, CRC Press