



Syllabus for academic year: 2020/2021

Training cycle: 2019-2025

Description of the course

Module/Course	BIOCHEMISTRY		Group of detailed education results B											
			Group code B	Group name Scientific principles of medicine										
Faculty	Medicine													
Major	Medicine													
Unit realizing the subject	Department of Medical Biochemistry													
Specialties	not applicable													
Level of studies	Uniform magister studies X* 1 st degree studies <input type="checkbox"/> 2 nd degree studies <input type="checkbox"/> 3 rd degree studies <input type="checkbox"/> postgraduate studies <input type="checkbox"/>													
Form of studies	X full-time <input type="checkbox"/> part-time													
Year of studies	II	Semester	X Winter X Summer											
Type of course	X obligatory <input type="checkbox"/> limited choice <input type="checkbox"/> free choice / elective													
Course	<input type="checkbox"/> major X basic													
Language of instruction	<input type="checkbox"/> Polish X English <input type="checkbox"/> other													
* mark <input type="checkbox"/> with an X														
Number of hours														
Form of education														
	Lectures (L)	Seminars (SE)	Auditorium classes (AC)	Major Classes – not clinical (MC)	Clinical Classes (CC)	Laboratory Classes (LC)	Classes in Simulated Conditions (CSC)	Practical Classes with Patient (PCP)	Specialist Classes – magister studies (SCM)	Foreign language Course (FLC)	Physical Education obligatory (PE)	Vocational Practice (VP)	Self-Study (Student's own work)	E-learning (EL)
Winter Semester														
Direct (contact) education						25								
Online learning (synchronous)	10		10			15								



Distance learning (asynchronous)																				
Summer Semester																				
Direct (contact) education							25													
Online learning (synchronous)	5		10				15													
Online learning (asynchronous)																				
TOTAL per year:																				
Direct (contact) education							50													
Online learning (synchronous)	15		20				30													
Online learning (asynchronous)																				
Educational objectives (max. 6 items)																				
<p>C1. Acquisition of the knowledge on the basic biochemical processes and their mechanisms with the aim to acquire comprehension of physiological and pathological conditions learnt during the course of the medical studies.</p> <p>C2. Familiarize students with the basic scientific techniques applied in biochemistry, as well as with the methods of quantitative data analysis required for the proper interpretation of the results of conducted experiments.</p> <p>C3. Development and formation of the abilities of application of the novel sources of information in biochemistry. Pointing to the necessity of constant broadening the knowledge on biochemical fundamentals of processes occurring in the human organism.</p>																				
Education result matrix for module/course in relation to verification methods of the intended education result and the type of class																				
Number of course education result	Number of major education result	Student who completes the module/course knows/is able to					Methods of verification of intended education results (forming and summarising)					Form of didactic class <i>**enter the abbreviation</i>								
K 01	B.W10.	Knows the structure of basic organic compounds being components of macromolecules present in cells, extracellular matrix and body fluids					Written exams with a defined time regime, in a form of multiple choice tests, choice of yes/no answers, matching answers					L, AC, LC								
K 02	B.W11	Knows the structure of lipids and polysaccharides, and their functions within intracellular and extracellular structures;					Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving.													
K 03	B.W12.	Knows primary, secondary, tertiary and quaternary structures of proteins; knows posttranslational and functional protein modifications and their significance;					Written tests in a form of short essays, reports, short structured question													
		Knows the functions of nucleotides in the cell, primary and secondary structures of DNA and RNA as well as chromatin																		



K 04	B.W13	structure;	Oral exams with and without the access to textbooks. Direct observation and evaluation of the student's manual performance, his abilities to solve problems, and abilities to prepare and present scientific issues			
K 05	B.W15.	Knows the basic catabolic and anabolic pathways, the modes of their regulation, and the impact of genetic and environmental factors;				
K 06	B.W16	Knows metabolic profiles of the basic organs and systems;				
K 07	B.W17	Knows the biochemical pathways of the communication between cells, between the cell and extracellular matrix, as well as signal transduction pathways in the cell, and the examples of disturbances in these processes resulting in the onset of cancer and other diseases;				
K 08	B.W20.	Knows the physiology of smooth and striated muscles, and blood functions.				
K 09	B.W23.	Knows the mechanism of the organism aging				
K 10	B.W25	Knows the connections between factors disturbing the balance of biological processes, and physiological and pathophysiological changes.				
S 01	B.U3.	Performs calculations of molar and per cent concentrations of compounds.			Direct observation of student's scientific activities and his abilities of social communications , especially in a multicultural group	L, AC, LC
S 02	B.U5	Determines the influence of the pH changes on inorganic and organic compounds.				
S 03	B.U6	Can foresee the direction of biochemical processes on the basis of the energetic status of the cell.				
S 04	B.U8	Uses basic laboratory techniques such as quality analysis, titration, spectrophotometry, electrophoresis of proteins.				
S 05	B.U9	Handles simple measurement utilities, and evaluates the precision of the performed measurements.				
S 06	B.U10	Takes advantage of biochemical data bases including the Internet ones, and is able to search for the required information with the aid of the available tools.				
S 07	B.U13	Can design and perform a simple biochemical scientific investigation,				



		interpret the obtained results, and draw conclusions.		
K 01	K 07	Actively searches for proper methods of scientific problems solving.	Direct observation of student's scientific activities and his abilities of social communications, especially in a multicultural and multinational group	AC LC
K 02	K 08	Actively participates in the analysis of scientific problems.		
K 03	K 09	Eagerly collaborates in a group.		
<p>** L - lecture; SE - seminar; AC – auditorium classes; MC – major classes (non-clinical); CC – clinical classes; LC – laboratory classes; SCM – specialist classes (magister studies); CSC – classes in simulated conditions; FLC – foreign language course; PCP practical classes with patient; PE – physical education (obligatory); VP – vocational practice; SS – self-study, EL – E-learning .</p>				
<p>Please mark on scale 1-5 how the above effects place your classes in the following categories: communication of knowledge, skills or forming attitudes: Knowledge: 5 Skills: 5 Social competences: 5</p>				
Student's amount of work (balance of ECTS points)				
Student's workload (class participation, activity, preparation, etc.)			Student Workload (h)	
1. Contact hours:			50	
2. Online learning hours (e-learning):			65	
3. Student's own work (self-study):			116	
Total student's workload			231	
ECTS points for module/course			10	
Comments				
Content of classes (please enter topic words of specific classes divided into their didactic form and remember how it is translated to intended educational effects)				
Lectures				
15 lectures (45 min each)				
<ol style="list-style-type: none"> 1. Structure and functions of fibrous and globular proteins. Enzymes and their classification. 2. Kinetics and mechanisms of action of enzymes. 3. Mechanisms of regulation of enzymes activity. 4. Isoenzymes. Diagnostic significance of enzymes 5. Tricarboxylic acid cycle. Respiratory chain and oxidative phosphorylation. 6. Oxidative stress and antioxidant potential of the organism. The role of cytochrome P₄₅₀ 7. Functions, transport of lipids and its disturbances. 8. Oxidation and biosynthesis of fatty acids. Triacylglycerols metabolism. 9. Cholesterol metabolism and its disorders. Cholesterol derivatives. 10. The structure and function of eicosanoids. Steroid hormones and the mechanism of their action. 11. Carbohydrates metabolism (digestion and absorption, glycolysis, gluconeogenesis, pentose phosphate pathway). 12. Glycogen metabolism. Fructose and galactose metabolism. Metabolism of heteroglycans. Regulation of carbohydrate metabolism. 13. Nitrogen metabolism – amino acid metabolism. Genetic disorders. Urea cycle. Metabolism of nucleotides, porphyrins and bile pigments. 14. Liver – its role in metabolism (biotransformation reactions). Biochemistry of blood cells. 15. Metabolism of selected macroelements and microelements - its regulation and disorders. Biochemistry of vision (vitamin A significance). 				



Auditorium classes (45 min each)

1. Introduction to biochemistry. Organization of classes
2. Correlation between structure and function of selected proteins
3. Enzymatic kinetics. Types of inhibition and their biomedical significance. Allosteric enzymes.
4. Regulation of metabolism via enzymatic control (feedback inhibition and covalent regulation, isoenzymes, proenzymes)
5. Biological membrane functions, transport across the membranes on the chosen examples including glycerol-3-phosphate and malate-aspartate shuttle.
6. Oxidoreductases and their cofactors, Krebs cycle – its biomedical significance.
7. Complexes of respiratory chain and disturbances in its function. Reactive oxygen and nitrogen species and antioxidant mechanisms.
8. Digestion and absorption of lipids. Plasma lipoproteins and their biomedical significance.
9. Ketone bodies and their biomedical significance. Hormonal regulation of fatty acids and triacylglycerol metabolism. Metabolism of adipose tissue.
10. Biochemistry of steroids compounds (cholesterol, steroid compounds, vitamin D)
11. Metabolism of glucose and its transport - GLUT-transporters. Regulation of glycolysis and fates of pyruvate in connections to the type and conditions of the cells.
12. Sources of substrates for gluconeogenesis; comparison of the process with glycolysis. Cori and alanine cycle.
13. Allosteric and hormonal regulation of glycogen metabolism. Metabolism of selected isomers of glucose.
14. The course and biomedical significance of hexose monophosphate shunt. Hormonal regulation of carbohydrate metabolism. Health implications.
15. Decarboxylation and biologically active amines. Metabolism of phenylalanine and tyrosine – diversity of metabolic pathways and biologically active products.
16. Metabolism of arginine and biomedical role of resulting products. Degradation of heme and biomedical significance of the process.
17. Functions of nucleotides. Origins of uric acid and its biomedical significance.
18. Metabolism of calcium and phosphate. Metabolism of iron. Endogenous regulators of metabolic processes.
19. Biochemistry of muscle contraction. Synthesis of collagen and its disturbances.
20. Specificity of biochemical processes in the liver. The role of the liver in xenobiotics metabolism.

Practical classes (180 minutes each)

1. Introductory classes to winter semester. Determination of pyruvate.
2. Determination of aminotransferases reaction - examination of transamination reaction.
3. Studies on kinetics of phosphatase reaction.
4. Examination of the reaction catalyzed by horseradish peroxidase. Test.
5. Examination of enzymatic reaction catalyzed by succinate dehydrogenase.
6. Examination of the reaction catalyzed by catalase.
7. Antioxidative potential - quantitative determination of vitamin C. Test.
8. Hydrolysis of lipids. Determination of lipase activity.
9. Total cholesterol, LDL and HDL cholesterol determination in serum. Test.
10. Quantitative determination of triacylglycerols. Repetition of laboratories.
11. Introductory classes to summer semester. Determination of salivary amylase activity.
12. Quantitative determination of sugars. Glycation in microwaves.
13. Effect of pH and temperature on saccharase activity.
14. Glycogen degradation by muscle pulp's enzymes. Test.
15. Quantitative determination of urea in urine.
16. Quantitative determination of uric acid.
17. Detection of xanthine oxidase in milk. Quantitative determination of creatinine. Test.
18. Quantitative determination of calcium.
19. Determination of hemoglobin and its derivatives. Test.
20. Quantitative determination of total bilirubin. Repetition of laboratories.

Other

1. Consultations.

Basic literature (list according to importance, no more than 3 items)

1. Richard A. Harvey et al. "Lippincot's Illustrated Reviews: Biochemistry" VII Edition, 2017
2. Robert K. Murray et al. "Harper's Biochemistry"

Additional literature and other materials (no more than 3 items)

1. Thomas M. Devlin „Biochemistry with Clinical Correlations”, Willey-Liss, New York
2. L. Baynes., M. Dominiczak, „Medical Biochemistry”, Mosby Elsevier, Third Edition
3. J.R. McIntosh “Understanding cancer” CRC Press Taylor and Francis Group, 2019

Additionally, for the laboratories, the laboratory manual is required: „Laboratory manual for the second-year students of English Division medical studies” 2017, from Wrocław Medical University

Didactic resources requirements (e.g. laboratory, multimedia projector, other...)

1. Biochemical laboratories, seminar rooms, lecture hall.
2. Laboratory equipment - spectrophotometers, centrifuges, incubators, water baths, dryers, laboratory scales, electrophoresis apparatuses, power suppliers, microwave ovens, glassware and laboratory plastics, automatic pipettes, thermoblocks, lyophilisators, refrigerators, freezers.
3. Chemical reagents, protein standards, kits dedicated to colorimetric determination of biochemical parameters, biological material, distilled water.
4. Audio-visual equipment - multimedia projectors, computers, etc.

Preliminary conditions (minimum requirements to be met by the student before starting the module/course)

Student should know the principles of chemistry and biology, and have molecular biology, biophysics and medical chemistry courses completed (at the university level).

Conditions to receive credit for the course (specify the form, criteria and conditions of receiving credit for classes included in the module/course, admission terms to final theoretical or practical examination, its form and requirements to be met by the student to pass it and criteria for specific grades).

Each absence must be made up, including rector's days or dean's hours.

Requirements for getting a credit and be able to participate in final exam:

1. Proper execution of 20 laboratory classes and preparation of reports summarizing the obtained data, correct calculations and conclusions
2. Active participation in 20 auditorium classes – analysis and solving scientific problems and active participation in discussion.
3. Obtaining positive grades from all tests covering material concerning the whole material covered in a course of biochemistry. Criteria of tests credits obtaining are the same as final examination criteria.

Final exam

1. First term of the final exam is in the written form - a test consisting of both single-choice and/or open questions..
2. Retake exams are conducted in written or oral form.

Grade:	Criteria (only for courses/modules ending with an examination)
Very Good (5.0)	≥ 93% of maximal points
Good Plus (4.5)	≥ 85% of maximal points
Good (4.0)	≥ 77% of maximal points
Satisfactory Plus (3.5)	≥ 69% of maximal points
Satisfactory (3.0)	≥ 60% of maximal points



	Criteria (only for courses/modules ending with e credit)
Credit	Does not apply to the Faculty of Medicine

Grade:	Criteria (examination evaluation criteria)
Very Good (5.0)	≥ 93% of maximal points
Good Plus (4.5)	≥ 85% of maximal points
Good (4.0)	≥ 77% of maximal points
Satisfactory Plus (3.5)	≥ 69% of maximal points
Satisfactory (3.0)	≥ 60% of maximal points
Name of unit teaching course:	Department of Medical Biochemistry
Address	Chałubińskiego 10, 50-368 Wrocław
Phone	71 784-13-70
E-mail	wl-4@umed.wroc.pl

Person responsible for module	Dr hab. Małgorzata Matusiewicz
Coordinator	Dr hab. Małgorzata Matusiewicz
Telephone	71 784 13 96
E-Mail	<u>malgorzata.matusiewicz@umed.wroc.pl</u>

List of persons conducting specific classes				
Full name	Degree/scientific or professional title	Discipline	Performed profession	Form of classes
Małgorzata Krzystek-Korpaczka	Doctor hab. of Medical Sciences	Medical sciences and health sciences	Academic teacher (professor), biochemist	AC, LC
Iwona Bednarz-Misa	Doctor of Medical Sciences, specialist in medical laboratory diagnostics	Medical sciences and health sciences	Academic teacher (adjunct), laboratory diagnostician, biochemist	AC, LC
Izabela Berdowska	Doctor of Medical Sciences	Medical sciences and health sciences	Academic teacher (adjunct), biochemist	L, AC, LC
Mariusz Bromke	Doctor of Natural Sciences	Medical sciences and health sciences	Academic teacher (adjunct), biochemist	AC, LC
Agnieszka Bronowicka-Szydelko	Doctor of Medical Sciences	Medical sciences and health sciences	Academic teacher (adjunct), laboratory diagnostician, biochemist	AC, LC



Lukasz Kotyra	Physician	Medical sciences and health sciences	Ph.D. student	LC
Ireneusz Ceremuga	Doctor of Medical Sciences	Medical sciences and health sciences	Academic teacher (senior lecturer) laboratory diagnostician, biochemist	AC, LC
Agnieszka Kubiak	Doctor of Biological Sciences	Medical sciences and health sciences	Academic teacher (adjunct), biotechnologist	AC, LC
Małgorzata Matusiewicz	Doctor hab. of Medical Sciences	Medical sciences and health sciences	Academic teacher (senior lecturer) biochemist	L, AC, LC
Magdalena Mierzchała-Pasierb	Doctor of Medical Sciences	Medical sciences and health sciences	Academic teacher (adjunct), biochemist	AC, LC
Paweł Serek	Doctor of Medical Sciences	Medical sciences and health sciences	Academic teacher (assistant) laboratory diagnostician,	AC, LC
Ewa Seweryn	Doctor of Medical Sciences	Medical sciences and health sciences	Academic teacher (adjunct), biochemist	AC, LC
Kamilla Stach	Doctor of Medical Sciences	Medical sciences and health sciences	Academic teacher (assistant), biochemist	AC, LC
Izabela Szczuka	Doctor of Medical Sciences	Medical sciences and health sciences	Academic teacher (assistant), biochemist	AC, LC
Bogdan Zieliński	Doctor of Medical Sciences	Medical sciences and health sciences	Academic teacher (adjunct), biochemist	AC, LC

Date of Syllabus development

30.09.2020

Syllabus developed by

Dr hab. Małgorzata Matusiewicz

Signature of Head of teaching unit

Signature of Faculty Dean

Wrocław Medical University
Faculty of Medicine
Vice-Dean for Studies
.....
prof. Beata Szczyżńska, PhD

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