



Syllabus 2019/2020														
Description of the course														
Module/Course	Biochemistry										Group of detailed education results			
											Group code: B	Group name: Scientific principles of medicine		
Faculty	Medicine													
Major	medicine													
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														
Unit teaching the course	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 60														
Department of Medical Biochemistry	10		10			40								
Summer Semester 55														
Department of Medical Biochemistry	5		10			40								
TOTAL per year: 115														



Department of Medical Biochemistry	15	20			80								
<p>Educational objectives (max. 6 items)</p> <p>C1. Acquisition of the knowledge on the metabolism of the main groups of chemical compounds in physiological and pathological conditions.</p> <p>C2. Understanding the processes leading to the diversion of normal into pathological biochemical pathways, and molecular basis of chosen disorders development.</p> <p>C3. Acquaintance with the basic scientific techniques applied in biochemistry.</p> <p>C4. Familiarity with the analysis and interpretation of the results obtained in biochemical experiments (calculations, graphs analysis etc.).</p> <p>C5. The formation of an essential biochemical foundation for further insight into molecular processes in pathological conditions and the possibilities of their regulation, in the subsequent stages of medical education.</p>													
<p align="center">Education result matrix for module/course in relation to verification methods of the intended education result and the type of class</p>													
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 important chemical compounds present in the human organism				Written exams with a defined time regime, in a form of multiple choice tests, choice of yes/no answers, matching answers Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving.	L, AC, LC						
	B.W11	Describes the structure of lipids and polysaccharides, and understands their functions within intracellular and extracellular structures;											
	B.W12.	Knows primary, secondary, tertiary and quaternary structures of proteins; knows posttranslational and functional protein modifications and their significance;											
K 02	B.W15.	Knows the functions of nucleotides in the cell, primary and secondary structures of DNA and RNA as well as chromatin structure;				Written tests in a form of short essays, reports, short structured question							
	B.W16	Describes the basic catabolic and anabolic pathways, the modes of their regulation, and the impact of genetic and environmental factors; Understands and compares metabolic profiles of the basic organs and systems;											
K 03	B.W17	Knows the concepts of oxidative potential of the organism and oxidative stress;				Oral exams with and without the							



K 04	B.W18.	Knows the enzymes involved in digestion, the mechanism of hydrochloric acid generation in the stomach, the role of the bile, the process of the absorption of digestion products, and its disturbances;	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	
	B.W19.	Explains medical consequences of an improper diet including the intake of excess-carbohydrates meals;		
	B.W20	Knows the consequences of vitamins and minerals deficiency or excess in the organism;		
K 05	B.W21	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;		
	B.W26	Knows biochemical mechanisms of hormones actions, and the consequences of disturbances in hormonal regulation;		
K 06	B.W34	Knows the principles of the experimental biochemical investigations as well as in vitro studies serving the development of medicine;		
S 01	B.U3.	Performs calculations of molar and percent concentrations of compounds in isosmotic single-compound and composed solutions).	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 pH of the solutions and 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.U7	Describes biochemical changes in the organism functioning in the situation of homeostasis disturbance, especially defines its biochemical response to physical exercise, exposition to high or low temperature, the loss of blood or water, sudden change of body verticalization, changes from state of sleep into state of wakefulness		
S 05	B.U9	Uses basic laboratory techniques such as quality analysis, titration,		



	B.U10	spectrophotometry, pH measurements, chromatography, electrophoresis of proteins and nucleic acids Handles simple measurement utilities, and evaluates the precision of the performed measurements;		
S 06	B.U11	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.U14	Can design and perform a simple biochemical scientific investigation, interpret the obtained results, and draw conclusions		

** 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 .

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

Student's amount of work (balance of ECTS points)

Student's workload (class participation, activity, preparation, etc.)	Student Workload (h)
1. Contact hours:	115 (I sem. 60+ II sem. 55)
2. Student's own work (self-study):	116 (I sem. 25+ II sem. 91)
Total student's workload	231 (85+146)
ECTS points for module/course	10 (5+5)
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)

1. Structure and functions of fibrous and globular proteins. Enzymes – properties and kinetics.
2. Mechanisms of action and regulation of enzyme activity.
3. Isoenzymes. Diagnostic significance of enzymes
4. Transport across membranes, membrane receptors.
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 (4 hours each)

1. Introductory classes to winter semester. Determination of inorganic phosphate.
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. Examination of blood clotting reaction.
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. Evaluation of lipid peroxidation reaction.
8. Hydrolysis of lipids. Determination of lipase activity.
9. Total cholesterol, LDL and HDL cholesterol determination in serum.
10. Quantitative determination of triacylglycerols. Repetition of laboratories. Credit for the winter semester.
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.
15. Quantitative determination of urea in urine.
16. Quantitative determination of uric acid.
17. Detection of xanthine oxidase in milk. Quantitative determination of creatinine.
18. Quantitative determination of calcium.
19. Determination of hemoglobin and its derivatives.
20. Quantitative determination of total bilirubin. Repetition of laboratories. Credit for the summer semester.

Other

- 1.



<p>2. 3. etc. ...</p>													
<p>Basic literature (list according to importance, no more than 3 items)</p> <ol style="list-style-type: none"> 1. Richard A. Harvey et al. "Lippincot's Illustrated Reviews: Biochemistry" VII Edition, 2017 2. Robert K. Murray et al. "Harper's Biochemistry" <p>Additional literature and other materials (no more than 3 items)</p> <ol style="list-style-type: none"> 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 													
<p>Didactic resources requirements (e.g. laboratory, multimedia projector, other...)</p> <ol style="list-style-type: none"> 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. 													
<p>Preliminary conditions (minimum requirements to be met by the student before starting the module/course)</p> <p>Student should know the principles of chemistry and biology, and have molecular biology, biophysics and medical chemistry courses completed (at the university level).</p>													
<p>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).</p> <p>Classes in biochemistry are divided into 6 thematical sections - 3 sections in each semester. Each section encompasses 3-4 laboratory classes and 3-4 auditorium classes. Each semester ends with a test checking the acquired knowledge.</p> <p>Each absence must be made up, including rector's days or dean's hours.</p> <p>Requirements for getting a credit and be able to participate in final exam:</p> <ol style="list-style-type: none"> 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 tests covering material concerning the whole material covered in a course of biochemistry . <p>Final exam</p> <ol style="list-style-type: none"> 1. First term of the final exam is in the written form - a test consisting of both single-choice and open questions.. 2. Retake exams are conducted in written or oral form. 													
<table border="1"> <thead> <tr> <th>Grade:</th> <th>Criteria for course</th> </tr> </thead> <tbody> <tr> <td>Very Good (5.0)</td> <td>92-100% of maximal points</td> </tr> <tr> <td>Good Plus (4.5)</td> <td>83-91.5% of maximal points</td> </tr> <tr> <td>Good (4.0)</td> <td>74-82.5% of maximal points</td> </tr> <tr> <td>Satisfactory Plus (3.5)</td> <td>65-73.5% of maximal points</td> </tr> <tr> <td>Satisfactory (3.0)</td> <td>56-64.5% of maximal points</td> </tr> </tbody> </table>		Grade:	Criteria for course	Very Good (5.0)	92-100% of maximal points	Good Plus (4.5)	83-91.5% of maximal points	Good (4.0)	74-82.5% of maximal points	Satisfactory Plus (3.5)	65-73.5% of maximal points	Satisfactory (3.0)	56-64.5% of maximal points
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Grade:	Criteria for exam (if applicable)
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Good Plus (4.5)	83-91.5% of maximal points
Good (4.0)	74-82.5% of maximal points
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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 course:	Dr Małgorzata Matusiewicz
Phone	71 784 13 96
E-mail	malgorzata.matusiewicz@umed.wroc.pl

<i>List of persons conducting specific classes:</i>	<i>d gree/scientific or professional title</i>	<i>Discipline</i>	<i>Performer profession</i>	<i>Form of classes</i>
Małgorzata Krzystek-Korpacka	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	PhD	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
Ireneusz Ceremuga	Doctor of Medical Sciences	Medical sciences and health sciences	Academic teacher (senior lecturer) laboratory diagnostician,	AC, LC



			biochemist	
Agnieszka Kubiak	Doctor of Biological Sciences	Medical sciences and health sciences	Academic teacher (adjunct), biotechnologist	AC, LC
Małgorzata Matusiewicz	Doctor 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

Syllabus developed by

10.07.2019

Dr Małgorzata Matusiewicz.

Signature of Head of teaching unit

Uniwersytet Medyczny we Wrocławiu
KATEDRA I ZAKŁAD BIOCHEMII LEKARSKIEJ
Kierownik

[Signature]
prof. dr hab. Andrzej Gamian

Signature of Faculty Dean

Wrocław Medical University
FACULTY OF MEDICINE
VICE-DEAN FOR STUDIES IN ENGLISH
[Signature]
Prof. Andrzej Hendrich, PhD