



TOTAL per year:													
Department of Medical Biochemistry	20	20			80								
Educational objectives (max. 6 items)													
<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>													
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.W1.	Student: Describes biochemical regulation of water-electrolyte metabolism in biological systems;						test, presentation, oral response, report, colloquium, written examination	L, SE, LC				
K 02	B.W2.	Understands acid-base balance and the mechanism of buffering in physiological fluids, and their significance in the organism homeostasis;											
K 03	B.W10	Knows the structure of simple organic compounds – components of macromolecules present in cells, extracellular matrix and body fluids											
K 04	B.W11	Describes the structure of lipids and polysaccharides, and understands their functions within intracellular and extracellular structures;											
K 05	B.W12	Knows primary, secondary, tertiary and quaternary structures of proteins; knows posttranslational and functional protein modifications and their significance;											
K 06	B.W13	Knows the functions of nucleotides in the cell, primary and secondary structures of DNA and RNA as well as chromatin structure;											



K 07	B.W14	Knows the functions of genome, transcriptome and proteome of the human, and the basic methods applied in their analysis; describes the processes of replication, repairing and recombination of DNA, transcription and translation, as well as degradation of DNA, RNA and proteins; knows the idea of the regulation of gene expression;		
K 08	B.W15	Describes the basic catabolic and anabolic pathways, the modes of their regulation, and the impact of genetic and environmental factors;		
K 09	B.W16	Understands and compares metabolic profiles of the basic organs and systems;		
K 10	B.W17	Knows the concepts of oxidative potential of the organism and oxidative stress;		
K 11	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;		
K 12	B.W19	Explains medical consequences of an improper diet including the intake of excess-carbohydrates meals;		
K 13	B.W20	Knows the consequences of vitamins and minerals deficiency or excess in the organism;		
K 14	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;		
K 15	B.W22	Knows processes such as: cell cycle, proliferation, differentiation and aging of cells, apoptosis and necrosis and their role in the functioning of organism;		
K 16	B.W24	Knows the biochemistry of the skeletal and smooth muscles, and biochemical functions of the blood;		
K 17	B.W26	Knows biochemical mechanisms of hormones actions, and the consequences of disturbances in hormonal regulation;		
K 18	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.	Student: Indicates the relation between factors disturbing the equilibrium of biological processes, and physiological/pathophysiological changes.	test, presentation, oral response, report,	L, SE, LC
S 02	B.U4.	Performs biochemical calculations (calculates molar and per cent concentrations of compounds in solutions).	colloquium, written examination	



S 03	B.U7.	Can foresee the direction of biochemical processes on the basis of the energetic status of the cell;		
S 04	B.U8.	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;		
S 05	B.U10.	Uses basic laboratory techniques such as quality analysis, titration, spectrophotometry, pH measurements, chromatography, electrophoresis of proteins and nucleic acids, applied in biochemistry;		
S 06	B.U11.	Handles simple measurement utilities applied in biochemistry, and evaluates the precision of the performed measurements;		
S 07	B.U12. B.U15.	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 08		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:	120 (I sem .60+ II sem. 60)
2. Student's own work (self-study):	125,2 (I sem. 23+ II sem. 102,2)
Total student's workload	245,2
ECTS points for module/course	9,5 (3,5 +6)
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

1. (50 min) Structure and functions of fibrous and globular proteins. Peptide hormones.
2. (50 min) Enzymes – properties and kinetics.
3. (50 min) Mechanisms of action and regulation of enzyme activity.
4. (50 min) Transport across membranes, membrane receptors.
5. (50 min) Tricarboxylic acid cycle. Respiratory chain and oxidative phosphorylation.
6. (50 min) Oxidative stress and antioxidant potential of the organism.
7. (50 min) Functions, transport of lipids and its disturbances.
8. (50 min) Oxidation and biosynthesis of fatty acids. Triacylglycerols metabolism.
9. (50 min) Cholesterol metabolism and its disorders. The structure and function of prostaglandins and leukotriens.
10. (50 min) Carbohydrates metabolism (digestion and absorption, glycolysis, gluconeogenesis, pentose



phosphate pathway).

11. (50 min) Glycogen metabolism. Fructose and galactose metabolism.
12. (50 min) Metabolism of heteroglycans. Regulation of carbohydrate metabolism.
13. (50 min) Nitrogen metabolism – amino acid metabolism. Genetic disorders.
14. (50 min) Urea cycle.
15. (50 min) Metabolism of nucleotides, porphyrins and bile pigments.
16. (50 min) Liver – its role in metabolism (biotransformation reactions). Biochemistry of blood cells.
17. (50 min) Iron and calcium-phosphate metabolism, its regulation and disorders.
18. (50 min) Mechanisms of peptide and steroid hormones action (vitamin A and D₃). Receptors of hormones and vitamins. Biochemistry of vision (vitamin A significance).

Seminars

1. (1h) The structure of amino acids, peptides and proteins. Peptide bond. Biological properties of proteins.
2. (1h) Classification of enzymes. Kinetics of enzymatic reactions.
3. (1h) Regulation of metabolism by control of enzyme activity.
4. (1h) The functions of biological membranes
5. (1h) Transport across biological membranes
6. (1h) Oxidoreductases and their cofactors
7. (1h) Transport of hydrogen atoms across mitochondrial membrane (glycerol-3-phosphate shuttle and malate-aspartate shuttle).
8. (1h) Tricarboxylic acid cycle – connections with other metabolic pathways.
9. (1h) Glycolysis – energy yield. Glycogen metabolism and its disturbances.
10. (1h) The control of blood glucose concentration, and its disturbances leading to diabetes.
11. (1h) Digestion, absorption and transport of lipids.
12. (1h) Biochemistry of adipose tissue. Metabolism of fatty acids and triacylglycerol synthesis.
13. (1h) Chemical structure and metabolism of steroid compounds.
14. (1h) Atherosclerosis – diagnostic significance of TAG, LDL, HDL measurements.
15. (1h) Metabolism of arginine – generation of nitric oxide and creatine.
16. (1h) Transamination reaction; its mechanism and diagnostic importance of AspAT and AlAT.
17. (1h) Metabolism of nucleotides and porphyrins.
18. (1h) Biochemistry of muscles.
19. (1h) Endogenous regulators of metabolic processes.
20. (1h) Iron metabolism and calcium-phosphate metabolism

Practical classes

1. (150 min) Introductory classes. Determination of inorganic phosphate.
2. (150 min) Determination of proteins with Biuret method. Determination of isoelectric point of proteins.
3. (150 min) Studies on kinetics of phosphatase reaction.
4. (150 min) Isolation and quantitative determination of fibrinogen. Credit for I laboratory section.
5. (150 min) Examination of enzymatic reactions catalyzed by succinate dehydrogenase.
6. (150 min) Evaluation of protein damage due to oxidative stress - assessment of thiol groups concentration. Quantitative determination of vitamin C.
7. (150 min) Examination of the reactions catalyzed by horseradish peroxidase and catalase.
8. (150 min) Determination of hydrogen peroxide generated in the cells. Credit for II laboratory section.
9. (150 min) Hydrolysis of lipids. Determination of lipase activity.
10. (150 min) Glycation in microwaves. Quantitative determination of triacylglycerols. Determination of β -lipoproteins concentration.
11. (150 min) Total cholesterol and HDL cholesterol determination in serum. Credit for III laboratory section.
12. (150 min) Repetition of laboratories. Semestral lab exam. Credit for the winter semester.
13. (150 min) Quantitative determination of sugars.
14. (150 min) Effect of pH and temperature on saccharase activity.
15. (150 min) Glycogen degradation by muscle pulp's enzymes.
16. (150 min) Determination of salivary amylase activity. Credit for IV laboratory section.
17. (150 min) Quantitative determination of creatinine. Quantitative determination of urea in urine.
18. (150 min) Examination of transamination reaction.
19. (150 min) Quantitative determination of uric acid. Isolation of DNA and its quantitative determination.
20. (150 min) Detection of xanthine oxidase in milk. Credit for V laboratory section.



21. (150 min) Quantitative determination of total bilirubin. Determination of GGT activity in serum.
22. (150 min) Quantitative determination of calcium. Determination of hemoglobin and its derivatives.
23. (150 min) Electrophoresis of serum proteins. Credit for VI laboratory section.
24. (150 min) Repetition of laboratories. Semestral lab exam. Credit for the summer semester.

Other

- 1.
 - 2.
 - 3.
- etc. ...

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

1. Richard A. Harvey et al. "Lippincot's Illustrated Reviews: Biochemistry"
2. Michael Lieberman, Allan D. Marks "Mark's Basic Medical Biochemistry: A Clinical Approach", Fourth Edition
3. 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. Gerard Meisenberg, Wiliam H. Simmons “Principles of Medical Biochemistry” Mosby Elsevier, 2nd Edition
3. L. Baynes., M. Dominiczak, „Medical Biochemistry”, Mosby Elsevier, Third Edition

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

1. Laboratories, seminar rooms, lecture halls.
2. Laboratory utilities; water baths, centrifuges, incubators, spectrophotometers, glassware, pippets, chemical reagents
3. Multimedia projectors, computers, whiteboards.

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 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)

In order to obtain a credit for biochemistry it is compulsory to get a credit for all thematic sections:

1. Properly conduct the experiments designed in the course plan and present reports summarizing the obtained data, calculations and conclusions (taking into account §12 subparagraph 3 of Wrocław Medical University Regulations of Studies “Student has a right to miss 10% of obligatory classes in a given subject without giving any explanation of the absence and without the necessity to repeat these classes”).
2. Actively participate in seminars – prepare and present chosen issues and actively participate in discussion.
3. Obtain a positive grade for all laboratory exams covering both theoretical and practical material concerning all sections.

A credit for all the laboratory sections is a prerequisite for participation in the final exam in biochemistry. Final exam is in the form of a test consisting of both single-choice and open questions. To pass the exam the student should obtain at least 60% from each of the parts (single-choice and open questions). Percentage of correct answers required to obtain specific grades is given below:



Grade:	Criteria (only for courses/modules ending with an examination)
Very Good (5.0)	95% - 100%
Good Plus (4.5)	88% - 94%
Good (4.0)	80% - 87%
Satisfactory Plus (3.5)	70% - 79%
Satisfactory (3.0)	60% - 69%

Name and address of module/course teaching unit, contact: telephone and e-mail address

Department of Medical Biochemistry, Chałubińskiego 10, 50-368 Wrocław
Secretarial office: e-mail: w1-4@umed.wroc.pl; phone: 784-13-70

Coordinator / Person responsible for module/course, contact: telephone and e-mail address

Dr Małgorzata Matusiewicz; phone: 784-13-96; malgorzata.matusiewicz@umed.wroc.pl

List of persons conducting specific classes: full name, degree/scientific or professional title, discipline, performed profession, form of classes.

Teachers	Degree, field of science, profession	Form of classes
Iwona Bednarz-Misa	Doctor of Medical Sciences, Biochemist, Laboratory diagnostician, adiunct	Laboratories, seminars
Izabela Berdowska	Doctor of Medical Sciences, Biochemist, adiunct	Lectures, laboratories, seminars
Agnieszka Bronowicka-Szydełko	Doctor of Medical Sciences, Biochemist, adiunct	Laboratories, seminars
Ireneusz Ceremuga	Doctor of Medical Sciences, Biochemist, adiunct	Laboratories, seminars
Małgorzata Krzystek-Korpaczka	Doctor of Medical Sciences, Biochemist, adiunct	Laboratories, seminars
Małgorzata Matusiewicz	Doctor of Medical Sciences, Biochemist, senior lecturer	Lectures, laboratories, seminars
Magdalena Mierzchała-Pasierb	Doctor of Medical Sciences, Biochemist, adiunct	Laboratories, seminars
Paweł Serek	Master of Sciences, Laboratory diagnostician, assistant	Laboratories, seminars
Ewa Seweryn	Doctor of Medical Sciences, Biochemist, adiunct	Laboratories, seminars



Kamilla Stach	Doctor of Medical Sciences, Biochemist, assistant	Laboratories, seminars
Bogdan Zieliński	Doctor of Medical Sciences, Biochemist, adiunct	Lectures, laboratories, seminars

Date of Syllabus development

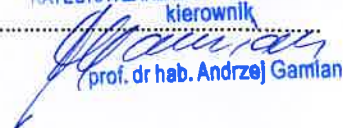
30.06.2017

Syllabus developed by

Dr Małgorzata Matusiewicz

Signature of Head of teaching unit

Uniwersytet Medyczny we Wrocławiu
KATEDRA I ZAKŁAD BIOCHEMII LEKARSKIEJ
kierownik


prof. dr hab. Andrzej Gamilan

Signature of Faculty Dean



VICE-DEAN FOR STUDIES IN ENGLISH

Prof. Andrzej Hendrich, PhD