

SUBJECT CARD

Faculty of Medicine and Health Sciences

Field of studies: Medicine

Form of studies: Full-time course

Degree: long-cycle Master's programme

Specializations: No specialization

Academic year: 2022/2023

ELEMENTS OF LIVING MATTER	
SUBJECT NAME	Elements of living matter
NUMBER OF ECTS POINTS	4
LANGUAGE OF INSTRUCTION	English
TEACHER(S)	dr Małgorzata Kalemba-Drożdż, mkalemba-drozd@afm.edu.pl dr Janusz Ligęza, jligeza@afm.edu.pl mgr Sonia Trojan
PERSON RESPONSIBLE	dr Małgorzata Kalemba-Drożdż
NUMBER OF HOURS	
LECTURES	40
CLASSES	20
GENERAL OBJECTIVES	
OBJECTIVE 1	To familiarize students with function organic compounds spawning a human body. To acquaint students with the basic metabolism processes.
OBJECTIVE 2	Giving the regulation of enzyme, substrate, hormonal and neural circuits and metabolic cycles of forming the basis of health and disease status. Specifying the role of DNA in bodily functions.
LEARNING OUTCOMES	
MK1	Knowledge: Student is familiar with the construction of simple organic compounds that builds macromolecules in cells, extracellular matrix and body fluids.
MK2	Knowledge: Student is familiar with the structure of lipids and polysaccharides and their functions in cellular and extracellular structures.
MK3	Knowledge: Student knows the primary, secondary, tertiary and quaternary protein structures; is familiar with the posttranslational and functional modifications of the protein and their importance.

ELEMENTS OF LIVING MATTER

MK4	Knowledge: Student knows the function of nucleotides in the cell; primary and secondary structure of RNA; the structure of DNA and chromatin.
MK5	Knowledge: Student knows the functions of the human genome, transcriptome and proteome as well as the basic methods used in their study; knows replication processes, DNA repair and recombination; transcription and translation; degradation of DNA, RNA and proteins; the concepts of regulation of gene expression.
MK6	Knowledge: the Student knows the basic catabolic and anabolic pathways, how they are regulated and how genetic and environmental factors affect them.
MK7	Knowledge: Student knows the way of signal transduction pathways: intracellular, between the cells, between cell and extracellular matrix, as well as examples of disorders in these processes leading to the development of cancers and other diseases.
MK8	Knowledge: Student knows the processes of: cell cycle, proliferation, differentiation and ageing of cells, apoptosis and necrosis as well as their importance for the functioning of the body.
MS1	Skills: Student can predict the direction of biochemical processes depending on the energy state of the cells.
MS2	Skills: Student can use basic laboratory techniques such as qualitative analysis, titration, colorimetry, pH-metry, chromatography, electrophoresis of proteins and nucleic acids.
MS3	Skills: Student can operate Simple Measuring Instruments and assess the accuracy of measurements.
MS4	Skills: Student can use databases, including the Internet ones; searches for the information, which is needed, using the available tools.
MS5	Skills: Student can select and perform basic statistical analyzes, use appropriate methods to present results, interpret meta-analysis results and perform survival probability analysis.
MS6	Skills: Student can plan and conduce simple scientific researches, interpret their results and take conclusions.
MC1	Social competences: Student perceives and recognizes their own limitations and self-evaluates deficits and educational needs.
MC2	Social competences: Student uses objective sources of information.
MC3	Social competences: Student formulates conclusions from their own measurements or observations.

ELEMENTS OF LIVING MATTER

MC4	Social competences: Student implements the principles of professional camaraderie and cooperation in a team of professionals, including representatives of other medical professions, also in a multicultural and multi-ethnic environment.
MC5	Social competences: Student has an awareness of their own limitations and the ability to constantly learn.

INTRODUCTORY REQUIREMENTS

Knowledge of the principles of physics and chemistry underlying biological processes

COURSE PROGRAM

DETAILED DESCRIPTION OF THE TOPIC BLOCKS

LECTURE 1	The molecular structure of the human body. Molecules and macromolecules. Information transduction. Catabolism and anabolism. Amino acids – structure and functions. Catabolism – transamination, deamination, urea cycle. Amino acid metabolic blocks.
LECTURE 2	Peptides – structure and functions. Peptide bond. Structure and function of proteins. 1',2',3' and 4' structure. Composition of culture media.
LECTURE 3	Enzymes. Structure of enzymes, mechanism of action. Specificity. Classification. Cofactors. Factors affecting activity. Enzyme kinetics. Inhibitors.
LECTURE 4	Saccharides. Sugars' stereochemistry. Structure and functions of mono- and polysaccharides. Glycolipids. Blood groups AB0.
LECTURE 5	Glucose metabolism: glycolysis, pentose phosphate pathway, gluconeogenesis, Cori's cycle, hexoses' metabolism. Glycogen synthesis, glycogenolysis. Transport of glucose through membranes.
LECTURE 6	Krebs cycle. Electron transport chain. The mechanism of ATP synthase action.
LECTURE 7	Structure and function of lipids. Simple lipids, membrane lipids, waxes, isoprene lipids. Lipid digestion and fatty acid absorption. Beta-oxidation of fatty acids, liponeogenesis. Keton bodies. Structure and function of serum lipoproteins. Functions of cholesterol and its derivatives. Structure and function of eicosanoids. Construction of biological membranes.
LECTURE 8	Structure and function of nucleotides. Synthesis and catabolism of purine and pyrimidine nucleotides. Structure and function of nucleic acids.
LECTURE 9	Genetic code. Non-coding RNA. DNA replication. Transcription and translation. Regulation of gene expression at the level of transcription and translation. Protein biosynthesis. Post-translational protein modification.

ELEMENTS OF LIVING MATTER	
LECTURE 10	Basics of hormonal regulation. Synthesis, transport, mechanism of hormone action. The role of free radicals in life processes. Detection of reactive oxygen species. Antioxidative systems of the organism.
CLASS 1	Characteristic reactions of amino acids. Quantitative determination of total protein by BCA and Bradford methods in blood serum. Definition of serum, plasma, whole blood. Statistical analysis of data.
CLASS 2	Detection of enzymatic activity. Determination of the activity of enzymes such as pancreatic amylase, peroxidase, lactate dehydrogenase, creatine kinase, to assess the functions of the organs: liver, pancreas, skeletal muscles and heart muscle. Enzyme-linked immunoassays.
CLASS 3	Enzyme kinetics. Enzyme inhibitors.
CLASS 4	Saccharides. Quantitative determination of glucose. Glycolysis and fermentation. Detection of the presence of starch and glycogen in biological material.
CLASS 5	Lipids. Qualitative analysis of lipids.
DIDACTIC METHODS (APPLIED)	
	Lectures Multimedia presentations Laboratory exercises Group work Learning by doing Basic statistical analysis of data in MS Excel
STUDENTS WORKLOAD	
CONTACT HOURS WITH THE ACADEMIC TEACHER	60 hours
HOURS WITHOUT THE PARTICIPATION OF THE ACADEMIC TEACHER	Preparation for classes: 30 hours Preparation of report, presentation, medical history: 10 hours Preparation for the exam: 20 hours
TOTAL NUMBER OF HOURS FOR THE COURSE	120 hours
CONDITIONS FOR COURSE COMPLETION	
	<ol style="list-style-type: none"> 1. Active participation in classes. 2. Positive rating in all partial tests. 3. Submission of written reports on all laboratory classes. 4. Positive rating in the final exam.

ELEMENTS OF LIVING MATTER

METHODS OF ASSESMENT

IN TERMS OF KNOWLEDGE	Open questions, test
IN TERMS OF SKILLS	Observation of students during work, submitting a written report on the experiments carried out using laboratory techniques
IN TERMS OF SOCIAL COMPETENCE	Observation of a student during group work, active participation in classes
FORMATIVE	Entrance tests with open questions on each exercise
SUMMATIVE (I & II terms)	EXAM: test 60-80 questions, 2 open questions, calculations RETAKE EXAM: test, open questions

GRADING SCALE

3,0 (Satisfactory)	60-69% of the maximum number of points (applies to tests and final test)
3,5 (Satisfactory plus)	70-79% of the maximum number of points (In open questions the student demonstrates a satisfactory mastery of knowledge but does not use appropriate nomenclature)
4,0 (Good)	80-84% of the maximum number of points (In open questions the student has mastered the knowledge to a good level, uses the correct nomenclature)
4,5 (Good plus)	85-90% of the maximum number of points (In open questions, the student demonstrates having extensive knowledge, but not outside the scope of the discussed material)
5,0 (Very Good)	91-100% of the maximum number of points (In open questions, the student demonstrates having extensive knowledge, thinks independently and constructs research problems)

BASIC LITERATURE

- [1] Murray, Robert K. — Harper's biochemistry, Stamford, CT; London, 1996, Appleton & Lange
- [2] Donald Voet, Judith G. Voet — Biochemistry, United Kingdom, 2011, Wiley
- [3] Denise Ferrier „Biochemistry”. Lippincott's Illustrated Reviews

SUPPLEMENTARY LITERATURE

- [1] N. V. Bhagavan. „Medical Biochemistry”, Academic Press
- [2] Gerald Litwack „Human Biochemistry”, Academic Press