

**DESCRIPTION OF COURSE UNIT FOR DOCTORAL STUDIES
AT VILNIUS UNIVERSITY**

Scientific Area/eas, Field/ds of Science	Medical and health sciences (M 000): Medicine (M 001); Public Health (M 004)			
Faculty, Institute, Department/Clinic	Faculty of Medicine Institute of Biomedical Sciences Department of Physiology, Biochemistry, Microbiology and Laboratory Medicine			
Course unit title (ECTS credits, hours)	Human Metabolism, its Regulation and Disorders 8 credits (212 hours)			
Study method	Lectures	Seminars	Consultations	Self-study
Number of ECTS credits	-	-	1	7
Method of the assessment (in 10 point system)	<p>Report presentation and evaluation: the report is presented on a focused topic, which is approved by the coordinating lecturers (the PhD student has to analyse, review and present the most recent scientific publications related to the relevant topic).</p> <p>Criteria for the evaluation of the report: (a) relevance, novelty and adequacy of the material provided to the chosen topic (3 points); b) general structure of the report, presentation of knowledge, argumentation, conclusions (4 points); c) answering questions, ability to participate in a discussion (3 points).</p>			
PURPOSE OF THE COURSE UNIT				
<p>To deepen the knowledge about the metabolism in human organism, its regulation and alterations in pathological conditions, as well as to provide knowledge based on the latest research on the importance of metabolism in the pathogenesis of the most common non-infectious diseases (atherosclerosis, diabetes and cancer). To promote a holistic approach to the metabolism in human organism and its significance for health and wellbeing.</p>				
THE MAIN TOPICS OF COURSE UNIT				
<p>CARBOHYDRATE METABOLISM Dietary carbohydrates, their digestion and absorption. Cellular metabolism of glucose. Blood glucose concentration, methods of determination. Hyper- and hypoglycemia. Glucosuria. Glycolysis, its regulation. Metabolism of lactic acid. The role of vitamins in carbohydrate metabolism. Glycogenolysis and glycogenesis, their hormonal regulation. Glycogenesis. Pentose phosphate pathway, its importance. Favism. Gluconeogenesis, its regulation. Fructose and galactose metabolism, their disorders. Hormonal regulation and disorders of carbohydrate metabolism.</p> <p>LIPID METABOLISM Dietary fats, their digestion and absorption. Fatty acids, their properties. Omega-3 and omega-6 polyunsaturated fatty acids. Eicosanoids. Classification of lipids and their general characteristics. Peroxide oxidation of lipids. Resynthesis of triacylglycerols in the intestinal epithelium and lipogenesis in tissues. Obesity. Lipolysis. Tissue lipases, hormonal regulation of their activity. Beta-oxidation of fatty acids. Fatty acid synthesis. Plasma lipoproteins, their metabolism. Dyslipoproteinemia. Ketone substances. Ketogenesis and ketolysis. Ketosis. Compound lipids. Classification of glycerophospholipids, their importance and metabolism. Lipotropic substances. Fatty infiltration of the liver. Structures, importance, metabolism of sphingophospholipids</p>				

(sphingomyelin) and glycolipids. Sphingolipidosis. Isoprenoids. Cholesterol structure and synthesis and metabolism. Relationship between cholesterol and lipoproteins. Significance of LCAT. Hypercholesterolemia and atherosclerosis. Importance of cholesterol determination.

PROTEIN (AMINO ACID) METABOLISM

The importance of proteins. Nitrogen balance. Dietary proteins. Protein digestion. Absorption of amino acids. Composition of gastric and duodenal juice. Gastrointestinal hormones. Decontamination of amino acid putrefactive products in the gut and liver. Transamination of amino acids. Significance of blood transaminases activity for diagnosis. Deamination of amino acids. Glutamate dehydrogenase. Catabolism of carbon skeleton of amino acids. Glycogenic and ketogenic amino acids. Decarboxylation of amino acids (biogenic amines). Use of amino acids for the synthesis of other compounds. Phenylalanine and tyrosine metabolism and disorders. Phenylketonuria. Hyperaminoaciduria. Ammonia formation, its decontamination and utilization in tissues. Role of glutamine and alanine as form of transport of ammonia in blood. Formation of ammonium salts. Hyperammonuria and acidosis. Urea synthesis. Hyperuremia. Decontamination of other compounds in the liver (hormones, bilirubin, alcohol, drugs). Synthesis of nonessential amino acids. Phosphocreatine synthesis. S-adenosylmethionine. Creatinine formation. Causes of hypercreatinemia and creatinuria. The role of vitamins in amino acid metabolism. Hormonal regulation of protein metabolism. Relationship between carbohydrate, fat and protein metabolism.

RECOMMENDED LITERATURE SOURCES

1. Nelson D.L, Cox M.M. Lehninger Principles of Biochemistry. W. H. Freeman, 8th edition, 2021.
2. Kadziauskas J. Biochemijos pagrindai : bendrasis vadovėlis / Vilniaus universiteto leidykla, 2012.
3. Baynes J.F., Dominiczak N.H. Medical Biochemistry. Elsevier, 5th Edition, 2018
4. Salway J.G. Metabolism at a Glance. Wiley-Blackwell, 4th Edition, 2017.
5. Stryer L., Berg J., Tymoczko J., Gatto G. Biochemistry. W.H. Freeman; 9th edition, 2019.
6. Devlin T.M. Textbook of Biochemistry With Clinical Correlation. Wiley; 7th edition, 2010.
7. Rodwell V.W., Bender D., Kennelly P.J., Weil P.A., Botham K.M. Harper's illustrated biochemistry. McGraw Hill, 32nd edition, 2022.
8. Alberts B., Heald R. Molecular Biology of the Cell. W. W. Norton & Company, 7th edition., 2022
9. da Poian A.T., Castanho M. A. R. B. . Integrative Human Biochemistry: A Textbook for Medical Biochemistry. Springer, 2nd edition, 2021.
10. Orešič M., Vidal-Puig A. A Systems Biology Approach to Study Metabolic Syndrome. Springer, 2014.

CONSULTING LECTURERS

1. Coordinating lecturer: Arvydas Kaminskas (Prof. Dr. HP).
2. Dovilė Karčiauskaitė (Assoc. Prof. Dr.).
3. Asta Mažeikienė (Assoc. Prof. Dr.).
4. Jonas Algis Abaravičius (Prof. Dr. HP).

APPROVED:

By Council of Doctoral School of Medicine and Health Sciences at Vilnius University:
29th of September 2022

Chairperson of the Board: Prof. Janina Tutkuvienė