

Content of lectures and exercises

Subject:	Medical Biochemistry 1	Code:	<i>ULCHBKB/MBCH-DM1/16</i>
Study Programme:	<i>Dental Medicine</i>	Study Period:	<i>2. semester</i>
Evaluation:	<i>graduated</i>	Subject Type:	<i>compulsory</i>
Content:	<i>2 h lectures and 3 h practical exercises / week</i>		<i>Total 70 hours</i>

Workplace: **Department of Medical and Clinical Biochemistry UPJŠ FM**

Week	Lectures http://portal.lf.upjs.sk	Practical Lessons http://portal.lf.upjs.sk Seminars from Medical Biochemistry
1.	INTERMEDIARY METABOLISM – CELL BIOCHEMISTRY - Subcellular localization of biochemical processes - Cellular environment, water solutions, reactions - Biomembranes structure, transport of substances through membranes - General characteristics of cell metabolism - Regulation of biochemical processes	Principles of biochemical laboratory techniques 1. Safety in biochemical laboratory 2. Principles of the clinical biochemical tests Seminar: 1. Biological material (p. 227) 2. Factors affecting the results and interpretation of biochemical examination (p. 231)
2.	ENZYMES AND THEIR ROLE IN METABOLISM - Characterization, function and structure of enzymes - Mechanism of enzymatic activity - Regulation and inhibition of enzymatic activity - Kinetic of enzymatic reactions – Michaelis and Menten equation	Cellular membranes 1. Isolation of erythrocytary membranes and detection of lipid phosphate Seminar: 1. Cellular membranes (p. 31) 2. Membrane transport (p. 33)
3.	COENZYMES - Nomenclature and classification of coenzymes - Structure, function and classification of coenzymes Metal ions as cofactors - Relationship coenzyme – apoenzyme - Importance of enzymes in medicine	Enzymes I 1. Test of the catalase activity 2. Calculation of the V_{max} and K_m of enzyme-catalyzed reactions Seminar: 1. Kinetics of enzymatic reactions (p. 17) 2. Inhibition of enzyme activity (p. 19)
4.	BIOLOGICAL OXIDATIONS I. - Energetics of biological redox processes - Macroergic compounds - Enzymes and coenzymes of redox reactions - Oxidative decarboxylation of pyruvate – acetyl-CoA - The citric acid cycle – reactions, enzymes - Regulation of citric acid cycle	Enzymes II 1. Determination of α -amylase activity in blood serum 2. Activation and inhibition of α -amylase 3. Effect of temperature and pH on the activity of α -amylase Seminar: 1. Factors affecting the velocity of enzymatic reaction (p. 21) 2. Cofactors (p. 8) 3. Enzymes in medicine (p. 23)
5.	BIOLOGICAL OXIDATIONS II. - Anaplerotic reactions - Formation of ATP in living systems - The respiratory chain - Oxidative phosphorylation - The others redox systems	Biological oxidations I 1. Detection of dehydrogenases in animal tissue Seminar: 1. Biological oxidation (p. 38) 2. Citric acid cycle (p. 52)
6.	1. REVISION TEST METABOLISM OF SACCHARIDES I. - Importance of saccharides, their digestion, resorption and transport - Overview of glucose metabolism - Glycolysis – importance, energetic balance - Regulation of glycolysis	Biological oxidations II 1. Detection of lactic acid 2. Enzymatic determination of glucose in blood Seminar: 1. Respiratory chain (p. 44) 2. Glucose (p. 58)

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7.	<p>METABOLISM OF SACCHARIDES II.</p> <ul style="list-style-type: none"> - Gluconeogenesis - Regulation of gluconeogenesis - The pentose phosphate pathway - Metabolism of fructose, galactose, and mannose 	<p><i>Metabolism of saccharides I</i></p> <ol style="list-style-type: none"> 1. Substrate specificity of glycosidases 2. Detection of glycolysis intermediates <p>Seminar:</p> <ol style="list-style-type: none"> 1. Glucose transport into the cell (p. 61) 2. Glucose in the blood (p. 68) 3. Glycolysis (p. 63)
8.	<p>METABOLISM OF SACCHARIDES III.</p> <ul style="list-style-type: none"> - Synthesis and degradation of glycogen - Regulation of glycogen metabolism - Metabolism of uronic acids - Formation of glucuronic acid and its importance - Metabolism of amino saccharides 	<p><i>Metabolism of saccharides II</i></p> <ol style="list-style-type: none"> 1. Oral glucose tolerance test 2. Determination of glycated hemoglobin <p>Seminar:</p> <ol style="list-style-type: none"> 1. Gluconeogenesis (p. 66) 2. Pentose phosphate pathway (p. 67) 3. Clinically significant saccharides (p. 77)
9.	<p>METABOLISM OF LIPIDS I.</p> <ul style="list-style-type: none"> - Digestion and resorption of lipids - Degradation of triacylglycerols - Fatty acids catabolism (α – oxidation, β – oxidation, ω – oxidation) and their biosynthesis - Metabolism of ketone bodies 	<p><i>Metabolism of saccharides III</i></p> <ol style="list-style-type: none"> 1. Isolation and detection of glycogen from liver <p>Seminar:</p> <ol style="list-style-type: none"> 1. Glycogen (p. 70) 2. Important derivatives of monosaccharides (p. 73) 3. Glycoproteins (p. 74)
10.	<p>METABOLISM OF LIPIDS II.</p> <ul style="list-style-type: none"> - Biosynthesis of fatty acids - Biosynthesis of triacylglycerols - Biosynthesis of cholesterol - Transport and excretion of cholesterol 	<p><i>Metabolism of lipids I</i></p> <ol style="list-style-type: none"> 1. Hydrolytic cleavage of lipids by lipase 2. Determination of lipase activity in blood serum of patient <p>Seminar:</p> <ol style="list-style-type: none"> 1. Metabolism of lipids (p. 84) 2. Ketone bodies (p. 89)
11.	<p>2. REVISION TEST</p> <p>METABOLISM OF LIPIDS III.</p> <ul style="list-style-type: none"> - Metabolism of eicosanoids - Lipoproteins - Metabolism of glycerophospholipids - Metabolism of sphingolipids and glycolipids 	<p><i>Metabolism of lipids II</i></p> <ol style="list-style-type: none"> 1. Determination of triacylglycerols in blood serum 2. Determination of total lipids in blood serum <p>Seminar:</p> <ol style="list-style-type: none"> 1. Metabolism of TAG (p. 87) 2. Metabolism of steroids (p. 100)
12.	<p>GENETIC MATERIAL, DNA REPLICATION</p> <ul style="list-style-type: none"> - Organization of genetic material in DNA (genes) - Genetic code - DNA replication of procaryotes and eukaryotes - Virus HIV, COVID-19 and reverse transcriptase - Molecular basics of mutations 	<p><i>Metabolism of lipids III</i></p> <ol style="list-style-type: none"> 1. Determination of cholesterol in blood serum 2. Calculation of HDL and LDL cholesterol 3. Determination of β-lipoproteins in blood serum <p>Seminar:</p> <ol style="list-style-type: none"> 1. Eicosanoids (p. 90) 2. Lipoproteins (p. 92) 3. Significance of lipids in diagnostics (p. 104)
13.	<p>TRANSCRIPTION AND PROTEOSYNTHESIS</p> <ul style="list-style-type: none"> - Biosynthesis of tRNA, mRNA, rRNA - Molecular mechanism of proteosynthesis - Regulation and inhibition of proteosynthesis - Mechanism of protein folding, co- and posttranslational modifications 	<p><i>Nucleic acids</i></p> <ol style="list-style-type: none"> 1. Electrophoretic detection of DNA 2. PCR, RT-PCR <p>REVISION TEST – practical exercises/seminars</p> <p>Seminar:</p> <ol style="list-style-type: none"> 1. Replication of DNA (p. 142) 2. Transcription – synthesis of RNA (p. 144) 3. Translation – proteosynthesis (p. 146)
14.	<p>REGULATION OF GENE EXPRESSION</p> <ul style="list-style-type: none"> - The principles of gene expression regulation - Genetic manipulations and gene therapy - Diagnostic applications of DNA analysis – molecular methods 	<p><i>Evaluation of practical exercises</i></p> <ol style="list-style-type: none"> 1. Summary of patient’s biochemical parameters 2. Individual evaluation of student work