

Subject:	Medical Biochemistry 1	Code:	ULCHBKB/LB-ZL1/25
Study Programme:	Dental Medicine	Study Period:	3. semester
Evaluation:	graduated	Subject Type:	compulsory
Content:	2 h lectures and 3 h practical exercises / week		total 70 hours

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.	CELL BIOCHEMISTRY - Water metabolism, pH, buffer systems - Biological membranes and cellular transport - Redox processes and their energetics - Macroergic compounds, energy-coupled reactions - General characteristics of cellular metabolism	Principles of biochemical laboratory techniques 1. Safety in biochemical laboratory 2. Introduction to the study of Medical Biochemistry I Seminar 1. Biochemical properties of aqueous solutions, buffers 2. Effect of acids and bases on pH of a buffer system, Henderson-Hasselbalch equation
2.	SACCHARIDES - Biologically significant monosaccharides, disaccharides and their derivatives - Oligosaccharides, polysaccharides and their importance - The role of complex carbohydrates (e.g. peptidoglycans, proteoglycans, glycoproteins) in metabolism	Cell membranes 1. Isolation of erythrocyte membranes and detection of lipoid phosphate Seminar 1. Cell membranes (p. 31) 2. Membrane transport (p. 33)
3.	LIPIDS AND STEROIDS - Fatty acids - Triacylglycerols (TAG), sphingolipids - Eicosanoids – medical importance - Complex lipids (e.g. phospholipids, glycolipids, lipoproteins) - Derived lipids – classification and importance	Chemical properties of saccharides 1. Reactions of monosaccharides and disaccharides 2. Hydrolysis of sucrose, Detection of starch Seminar 1. Monosaccharides, disaccharides and complex carbohydrates and their importance (p.74)
4.	AMINO ACIDS, PEPTIDES AND PROTEINS - Amino acids (AA) – structure, properties - Important derivatives of AA - Peptides – peptide bond, classification, properties - Biochemically important peptides (e.g. glutathione) - Proteins – structure, properties, function - Biochemically important proteins (e.g. haemoglobin, elastin, collagen)	Chemical properties of lipids 1. Hydrolysis of neutral lipids 2. Detection of cholesterol Seminar 1. Complex lipids and their significance (p.78)
5.	NUCLEIC ACIDS - Nucleotides and nucleosides - DNA structure, conformation, biological properties - RNA structure, function and classification - Isolation and detection of NA - Methods used in diagnostics (e.g. PCR) OTHER MEDICALLY IMPORTANT SUBSTANCES - Terpenes, alkaloids and flavonoids – structure, properties, biological significance - Vitamins – structure, properties, biochemical significance	Reactions of AA 1. Ninhydrin reaction Chemical properties of proteins 1. Detection of peptide bond – biuret reaction 2. Salivary protein precipitation Seminar 1. Structure, composition and importance of hemoglobin, collagen, elastin
6.	ENZYMES AND THEIR ROLE IN METABOLISM - Role of enzymes in metabolism - Enzymes as biocatalysts – structure and function - Classification of enzymes - Coenzymes – classification, mechanism of action	Seminar 1. Preparation for the first revision test 2. Revision of bioorganic chemistry 3. Structure and function of saccharides, lipids, amino acids, proteins, and nucleic acids

7.	1st REVISION TEST* (1. – 5. week) KINETICS OF ENZYME REACTIONS AND COENZYMES - Kinetics of enzyme reactions – Michaelis Menten equation, inhibitors - Regulation of enzyme activity - Diagnostic significance of enzymes	Enzymes and their role in metabolism 1. Effect of pH on the activity of salivary α-amylase Seminar 1. Classification and catalytic activity of enzymes (p. 8) 2. Coenzymes (p. 8)
8.	CITRIC ACID CYCLE AND RESPIRATORY CHAIN - Citric acid cycle (CAC) – reactions, enzymes - Regulation and energy balance of the CAC - Oxidative decarboxylation of pyruvate, acetyl-CoA - Anaplerotic reactions of CAC - Respiratory chain – oxidative phosphorylation - Inhibitors and uncouplers of the respiratory chain	Regulation of enzymatic activity 1. Effect of temperature on the activity of salivary α-amylase 2. Activation and inhibition of α-amylase by inorganic ions Seminar 1. Kinetics of enzyme reactions (p. 17) 2. Factors affecting the rate of enzyme reaction (p. 21)
9.	METABOLISM OF SIMPLE SACCHARIDES - Carbohydrate digestion, absorption and transport - Glycolysis and gluconeogenesis – reactions, regulation - The pentose-phosphate pathway - Metabolism of fructose, galactose, and mannose - Glycemia	Biological oxidations 1. Evidence of dehydrogenases in animal tissue Seminar 1. Respiratory chain and oxidative phosphorylation (p. 44) 2. Citric acid cycle (p. 52)
10.	METABOLISM OF POLYSACCHARIDES AND COMPLEX SACCHARIDES - Glycogen – metabolism and regulation - Formation of glucuronic acid and its importance - Metabolism of aminosaccharides - Metabolism of GAG and glycoproteins - Disorders of saccharide metabolism	Metabolism of glucose 1. Enzymatic determination of glucose in blood Seminar 1. Digestion and transport of saccharides (p. 58, 61) 2. Glycolysis (p. 63) and gluconeogenesis (p. 66) 3. Glycemia (p. 68)
11.	METABOLISM OF SIMPLE LIPIDS - Lipid digestion - β-oxidation of fatty acids (FA) and FA biosynthesis - Metabolism of ketone bodies and their significance - Metabolism of triacylglycerols (TAG)	Metabolism of saccharides 1. Isolation and detection of glycogen in the liver Seminar 1. Glycogen (p. 70) 2. Metabolism of complex saccharides (p. 74)
12.	METABOLISM OF CHOLESTEROL, STEROIDS, AND LIPOPROTEINS - Metabolism of cholesterol – transport, reactions, regulation, significance - Cholesterol as a precursor of biologically active substances – steroid hormones, bile acids - Lipoproteins – composition, function, significance	Seminar 1. Preparation for the second revision test 2. Revision of Metabolism of saccharides (p. 58-82) 3. Revision of Metabolism of lipids (p. 83-89)
13.	2nd REVISION TEST* (6. – 12 week) METABOLISM OF COMPLEX LIPIDS - Metabolism of phospholipids - Metabolism of glycolipids - Metabolism of sphingolipids - Biosynthesis of eicosanoids and their significance	Metabolism of lipoproteins and cholesterol 1. Determination of the lipid profile 2. Determination of TAG by calculation. Calculation of HDL and LDL cholesterol Seminar 1. Metabolism of cholesterol and steroids 2. Eicosanoids (p. 90) and lipoproteins (p. 92) 3. Significance of lipids in diagnostics (p. 104)
14.	3rd REVISION TEST – practical exercises, seminars* OXIDATIVE STRESS - Reactive oxygen and nitrogen species - Mechanisms of oxidative damage to higher fatty acids and proteins - Antioxidant protection in the body - Natural antioxidants	Credit week 1. Final evaluation of practical exercises 2. Credit donation

* After writing the revision test, students can view the evaluation of their answers within one week.