Subject: **MEDICAL BIOCHEMISTRY 1**	Subject type:	**compulsory**
Study year: **1**	Content:	**2/3 summer term**
Study program: **Dental Medicine**		

Learning outcomes *(Aim of course)*

In the medical study, medical biochemistry plays an irreplaceable role, which is to teach students to perceive life processes as events taking place at the molecular level. The graduate masters the course of biochemical processes, is able to distinguish pathological processes from physiological processes at the level of reactions taking place in the cell. It perceives biochemical reactions in the cell as part of metabolism and understand the regularities of metabolism regulation.

Education: lectures, seminars, practical exercises
Assessment: written tests, written exam

Syllabus

The cell and its intermediary metabolism. Biological membranes – transport mechanisms, cell organelles – biochemical processes taking place in them. Markers of cytosol and individual cell organelles. Regulatory mechanisms of metabolism.

Enzymes
Catalysis of biochemical processes, activation energy, the difference between the catalysts of the living and non-living world. Classification, distribution and properties of enzymes. Coenzymes and prosthetic groups – chemical structure, mechanism of action, classification by function. Mechanism of action of enzymes, specificity of enzymes (substrate, effect). Factors influencing enzyme reactions. Kinetics of enzymatic reactions. Inhibition and regulation of enzymes. Use of enzymes in medicine.

Mechanism of nutrients oxidation
Relationship between redox potential and change of standard free enthalpy. Free energy of hydrolysis of macroergic bonds. Respiratory chain: mechanism of electron and proton transport by individual coenzymes, mechanism of aerobic phosphorylation (chemical and chemiosmotic theory), coupling of aerobic phosphorylation and cellular respiration. ATPase – structure, aerobic phosphorylation inhibitors, uncouplers and ionophores. Transport systems (shuttles). Formation of oxygen radicals. Damage to membranes by oxygen radicals. Reactions of ATP formation at the substrate level.

Citric acid cycle
The role of Acetyl-CoA and oxidative decarboxylation of pyruvate. The course of citric acid cycle (CAC) reactions. Synthetic reactions starting from intermediates of CAC. Anaplerotic reactions of CAC. Energy balance, regulation of reactions and conditions of CAC reactions.

Metabolism of saccharides
Glycolysis – reactions, energy balance, glucose importance. Glucose-6-P as a key metabolite of carbohydrate metabolism. Gluconeogenesis – significance, enzymes, regulation. Cori cycle. Glycogen metabolism – reactions, regulation, importance. Regulation of saccharide metabolism (e.g. the role of adrenaline, glucagon, insulin). Pentose cycle: reactions, significance and regulation of the pentose cycle. Metabolism of monosaccharides and their derivatives (e.g.

galactose, fructose, glucuronic acid, aminosaccharides). Disorders of saccharide metabolism (e.g. galactosemia, pentosuria, fructosuria, glycogenosis).

Biochemistry of lipids

Lipid metabolism - biological importance of lipids in nutrition, digestion and transport of fats. Degradation of fatty acids (alpha, beta and omega oxidation). Formation and degradation of ketone bodies. Biosynthesis of saturated and unsaturated fatty acids. Biosynthesis of triacylglycerols. Regulation and disorders of lipid metabolism. Eicosanoids – classification, classification, biosynthesis, biological significance. Classification, metabolism and biological significance of sphingolipids. Phospholipids – classification, biosynthesis and significance. Cholesterol metabolism: biosynthesis of steroid hormones, bile acids, vitamin D. Structure, properties and function of lipoproteins.

Biochemistry of nucleic acids and proteosynthesis

Arrangement of genetic material, genes. Genetic code and its properties. Non-nuclear forms of DNA. DNA replication. DNA mutations and repairs. DNA transcription. Biosynthesis of tRNA, mRNA and rRNA. Inhibitors of nucleic acid biosynthesis. Gene manipulations and gene therapy. Diagnostic use of DNA analysis (e.g. PCR). Reverse transcriptase and viruses (e-g. HIV). Proteosynthesis in eukaryotic and prokaryotic cells (amino acid activation, initiation, elongation and termination). Inhibition of proteosynthesis. Co-translational and post-translational modification of peptides and proteins. Protein folding. Synthesis of secretory and membrane proteins. Distribution of synthesized proteins. Regulation of gene expression.