

Subject: MEDICAL BIOCHEMISTRY 1	Subject type:	compulsory
Study year: 2	Content:	2/3 winter term
Study program: General 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. Only with such a view can the future doctor take an objective and exact opinion when deciding on the treatment procedure. 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 and written exam

Syllabus

General features of cellular metabolism

The cell and intermediary metabolism. Biological membranes – transport mechanisms, cellular compartments and their corresponding biochemical processes. Markers of cytosol and cellular compartments. Regulatory mechanisms of metabolism.

Enzymes

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

Mechanism of nutrients oxidation

Relationship of redox potential and change the standard free enthalpy, free energy of hydrolysis of macroergic bonds. Respiratory chain: mechanism of electron transport and proton pumping. Oxidative phosphorylation (chemical and chemiosmotic theory), Coupling of oxidative phosphorylation and cellular respiration. ATPase – structure, inhibitors of oxidative phosphorylation, uncouplers, ionophores. Mitochondrial transport systems, shuttles. Formation of oxygen radicals, damage of membranes by oxygen radicals. Reactions of ATP formation on substrate level.

Citric acid cycle

Central role of acetyl CoA. Oxidative decarboxylation of pyruvate. Individual reactions of citric acid cycle (CAC). Synthetic reaction arising from intermediates of CAC. Anaplerotic reactions of CAC. Energy balance, regulation of reactions and conditions of CAC course.

Metabolism of saccharides

Glycolysis – reactions, energetic balance, glucose transport. Glucose-6-P as a key metabolite of saccharide metabolism. Gluconeogenesis – significance, enzymes, regulation. Cori cycle. Metabolism of glycogen – reactions of glycogenolysis and glycogenesis. Regulation of

saccharide metabolism (role of epinephrine, glucagon, insulin). Pentose phosphate pathway - reactions, importance, and regulation. Mutual conversion of saccharides, glucuronic acid and its importance. Metabolism of galactose, fructose and aminosaccharides. Disorders of saccharide metabolism (e.g. galactosemia, fructosuria, glycogenoses)

Biochemistry of lipids

Metabolism of lipids – biological importance of lipids in a diet, digestion and transport of lipids. Fatty acid degradation (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, biosynthesis and importance. Metabolism of cholesterol: biosynthesis of steroid hormones, bile acids and vitamin D. Structure, properties and function of lipoproteins.

Oxidative stress

Free radicals derived from oxygen and nitrogen, formation and classification. Biological and toxicologic importance of NO. Damage of biological membranes through free radicals. Lipoperoxidation. Oxidative stress and proteins. Oxidative damage of nucleic acids. Mechanism of elimination of toxic radicals. Natural and synthetic antioxidants.