

Subject: <b>Medical Biochemistry 2</b>	Subject type:	<b>compulsory</b>
Year of study: <b>2</b>	Content:	<b>2/3 winter term</b>
Study program: <b>Dental Medicine</b>		

### **Learning outcomes** (*Aim of the course*)

Graduates will understand biochemical processes at the level of the whole organism and learn the specifics of biochemical processes in the oral cavity (e.g. calcium and phosphorus metabolism, formation and mineralization of dental tissues, effects of hormones on oral structures, caries, tartar, the impact of diet on oral health). Students know the composition and biochemistry of saliva, its relationship to digestive and other processes, including its role as a promising diagnostic material.

**Education:** lectures, seminars, practical exercises

**Assessment:** written tests and oral exam

### **Syllabus**

#### **Metabolism of nitrogenous compounds**

*Amino acid metabolism:* general reactions of amino acid degradation, degradation of the carbon skeleton of amino acids. Conversion of amino acids into physiologically active substances (e.g. catechol amines, biogenic amines and polyamines). Formation of ammonia in the body, synthesis of urea. Glucose-alanine cycle. The importance of amino acids in the formation of other substances (e.g. synthesis of creatine, glutathione). Biosynthesis of non-essential amino acids. Disorders of amino acid metabolism.

*Nucleotide metabolism:* biosynthesis of purine and pyrimidine nucleotides, pathways of nucleotide degradation. Recycling reactions. Biosynthesis of deoxyribonucleotides. Regulation of purine and pyrimidine nucleotide synthesis. Inhibitors of purine and pyrimidine nucleotide biosynthesis and their relation to cancer chemotherapy. Biosynthesis of nucleotide coenzymes - FAD, NAD<sup>+</sup>, CoA. Disorders of nucleotide metabolism.

#### **Biochemistry of organs and tissues**

*Biochemical function of blood.* Specifics of metabolism in erythrocytes. Tetrapyrrole metabolism. Structure and function of hemoglobin. Degradation of hemoglobin and the formation of bile pigments. Blood clotting. Acid-base balance (ABB) and its maintenance. Buffering systems. ABB disorders. Metabolism and function of water in living systems. Minerals in the body, their role, metabolism and related diseases.

*Biochemistry and liver functions.* Liver metabolism disorders and markers of hepatic impairment. Foreign substances (xenobiotics) in the environment and in the organism. Biotransformation of xenobiotics – reactions, enzymes, significance.

*The role of the kidneys in metabolism.* Biochemical processes taking place in the kidneys. Renal regulation of ion and water exchange. The role of the kidneys in maintaining ABB. The importance of the liver and kidneys in the detoxification of substances.

*Biochemistry of connective and supporting tissue.* Biochemistry of skeletal, cardiac and smooth muscle – contraction, relaxation. Biochemistry of connective and supporting tissue. Biochemical nature of nerve excitation transmission. Mediators (neurotransmitters). Biochemistry of membrane receptors.

*Biochemical basis of nutrition.* The role of saccharides, lipids and proteins in nutrition. Basic components of food, energy content of nutrients. Basic nutritional requirements. Special nutritional problems (e.g. malnutrition, starvation, overweight, vegetarianism). Digestion in the mouth, stomach, small intestine. Biochemical processes in the large intestine.

### **Regulation of metabolic processes**

Basic regulatory mechanisms of intermediate metabolism at the cellular level. Relationships between saccharides, lipid, protein and nucleic acid metabolism. Principles of hormonal regulation. Chemical structure of hormones, their distribution and mechanism of action.

### **Biochemistry of the oral cavity**

*Extracellular matrix (ECM)* - structure and function. Structure and properties of ECM proteins – e.g. collagen, elastin.

*Composition and metabolism of hard tissues:* bones, teeth. Inorganic and organic components of hard tissues. Metabolism of calcium, phosphorus and other elements in dental tissue. Biochemistry of calcification, process of mineralization and demineralization. Mineralization conditions. Regulation of hard tissue metabolism.

*Tooth decay,* theories of tooth decay. Nutrition and the development of tooth decay. Prevention of dental caries. Dental plaque. Composition and role of saliva. The function of saliva in relation to the formation of tooth decay. Saliva enzymes and proteins, their function. Salivary stones. Pathobiochemistry of inflammatory diseases of the periodontium. Dental hygiene.

### **Basics of clinical biochemistry**

Biological material. Basic analytical reactions and methods for determination of biologically active substances (e.g. use of enzymes in diagnostics, inflammatory markers).