Study program: Integrated academic studies in Dentistry

Type and level of the study program: Integrated academic studies

Course title: Biochemistry (StI-BCHEM)

Teacher: Karmen M. Stankov, Ljiljana N. Andrijević, Tatjana N. Ćebović, Jasmina N. Katanić, Jelena D. Stojčević-Maletić

Course status: compulsory

ECTS Credits: 7

Condition: None

Course aim The main goal of biochemistry course is to teach students to understand the network of biochemical processes in human body, to learn the basic principles and methods used in clinical biochemistry as well as diagnostic means. To enable future dentists to interpret obtained results in a right manner.

Expected outcome of the course: The knowledge of basic chemical constituents of human organism, general metabolic pathways and specific biochemical processes in some tissue types and system of organs in order to, understand the essence of many diseases. Appropriate taking of biological material for biochemical analysis. Assessing reliability of some biochemical methods and their use for diagnosis. Using results of biochemical analysis for diagnosis. Examining the metabolism of the most important constituents of the organism on a basis of measurement in biological samples. Proving basic laws of biochemistry based on laboratory methods.

Course description

Theoretical education

1. Introduction to biochemistry. 2. Water as biological solvent. Amino acids. 3. Peptides. Proteins – structure, qualities, classification. 4. Haemoproteins – haemoglobin, myoglobin and cytochromes. 5. Nucleic acids, general structure, types and function. DNA, genetic code, RNA.

6. Carbohydrates - structure, classification, characteristics. 7. Lipids – fatty acids, simple and complex lipids. Phospholipids and biological membranes. Transport mechanisms. 8. Glycoproteins, lipoproteins and phosphoproteins. 9. Enzymes - structure, characteristics, catalysis mechanism. Kinetics of enzyme reaction. Classification, Isoenzymes, diagnostic value. Coenzymes and vitamins. 10. Chemical thermodynamics. Bioenergetics. Biological oxidation. Transformation of energy. ETS, ATP. 11. Digestion and absorption of carbohydrates. Glycolysis. Oxidative decarboxylation of pyruvate. The Krebs cycle (the citric acid cycle). Pentose phosphate pathway. 12. Digestion and absorption of lipids. Beta oxidation of fatty acids, regulation. 13. Digestion of proteins and absorption of amino acids. Amino acids metabolism, ureogenesis. 14. Synthesis of DNA-replication. Synthesis of RNA-transcription. Synthesis of proteins. 15. Acid-base balance regulation. Electrolytes metabolism. 16. Calcium metabolism, physiological significance. 17. Parathormone, D-hormone and calcitonin. 18. Bone, dentine, cement and enamel. 19. Oral biochemistry - plaque, dental calculus, caries, saliva. 20. Hormones - classification, mechanism of action. Hormones of thyroid gland. Hormones of the adrenal medulla: adrenalin, noradrenalin, dopamine. Hormones of the pancreas. Hormones of the adrenal cortex: gluco- , and mineralocorticoids. Hormones of adeno- and neurohypophysis. Hormones of the gonads: oestrogens, progesterone, testosterone.

Practical education: exercises, other forms of education, research related activities

1. Goals of the practical lessons. Short overview of the lecture program. Assessing reliability of biochemical methods. Introduction to biochemistry laboratory practice. Glass dishes, instruments. Assessing volume. Pipetting, glass and automatic pipettes. 2. Photometry – principles of the Lambert-Beer law. Absorbance (extinction) and molar extinction coefficient. Blank and the standard solution. Colorimeter and spectrophotometer. The absorption spectrum of bromothymol blue (BTB). Application of photometry. Colorimetric determination of bromothymol blue concentration via molar extinction coefficient. 3. Photometry – standard and construction of the calibration curve. Determination of the proportionality factor. Colorimetric determination of BTB concentration via standard solution and calibration curve. 4. Quantitative determination of blood plasma protein concentration – methodology review. Quantitative determination of blood plasma protein concentration using biuret test. 5. Serum protein fractions. Albumen/Globulin index. Plasma fibrinogen isolation using salting out method.

6. Quantitative determination of blood glucose – methodology. Quantitative determination of plasma glucose using o-toluidine reaction and GOD-PAP method. 7. Qualitative determination of urine glucose – methodology review. Polarimetry – principles of the Biot law. Specific optical rotation angle. Determination of specific optical rotation angle of glucose. Quantitative determination of urine glucose using polarimetry method.

8. Qualitative assessment of enzymatic activity of α-amylase from saliva. 9. Principles of quantitative determination of enzymatic activity. Determination of the initial reaction speed of p-nitrophenyl phosphate hydrolysis with alkaline phosphatase. Determination of enzymatic activity via reaction product and UV test. 10. Isoenzymes – definition, characteristics, diagnostic importance of isoenzyme profile. Demonstration of alkaline phosphatase isoenzymes. Vitamins and coenzymes. Quantitative determination of vitamin C in urine. 11. Protein metabolism. Amino acid metabolism. Ureogenesis. Quantitative determination of urea in plasma using the Berthelot method. 12. Qualitative analysis of bile pigments. Importance of bile pigments metabolism. Demonstration of direct and indirect serum bilirubin. Demonstration of bilirubin, urobilinogen and urobilin in urine. 13. Metabolism of minerals. Quantitative determination of total calcium from blood plasma. Quantitative determination of phosphate in plasma. 14. Metabolism of minerals. Quantitative determination of chlorides in plasma.

Literature

Compulsory

1. Harvey R, Ferrier D. Lippincott's Illustrated Reviews: Biochemistry, 5th Edition. Wolters Kluwer Health, 2011.
2. Rodwell A, et al. Harper's Illustrated Biochemistry, 30th Edition. The McGraw-Hill Education, 2015.
3. Kovačević Z, Milošević Tošić M. Practical Biochemistry. Novi Sad, 2001.

Additional

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Number of active classes				Other:
Lectures:	Practice:	Other types of teaching:	Research related activities:	-
45	45	-	-	
Teaching methods Lectures for larger and smaller groups using multimedia. Testing. Practical knowledge - performing biochemical analysis and the interpretation of results.				
Student activity assessment (maximally 100 points)				
Pre-exam activities		**points**	**Final exam**	**points**
Lectures		8	Written	-
Practices		12	Practical	5
Colloquium		50	Oral	25
Essay				