



**SYLLABUS of the MODULE (SUBJECT)**  
**General Information**

<b>Module title: Biochemistry</b>	
Module type	Obligatory/Facultative (wybrać)
Faculty PMU	Faculty of Medicine and Dentistry
Major	Medicine
Level of study	long-cycle (S2J)
Mode of study	full-time studies
Year of studies, semester	Year 2, semester III/IV
ECTS credits (incl. semester breakdown)	18
Type/s of training	lectures (20h) /seminars (40h)/ practical/ (110h)
Form of assessment*	<input checked="" type="checkbox"/> graded assessment: <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> descriptive</li> <li><input checked="" type="checkbox"/> test</li> <li><input type="checkbox"/> practical</li> <li><input type="checkbox"/> oral</li> </ul> <input type="checkbox"/> non-graded assessment  <input checked="" type="checkbox"/> final examination <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> descriptive</li> <li><input checked="" type="checkbox"/> test</li> <li><input type="checkbox"/> practical</li> <li><input checked="" type="checkbox"/> oral</li> </ul>
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Tutor responsible for the module	dr n. med. Janina Zawierta; janina.zawierta@pum.edu.pl
Department's/ Clinic's/ Unit's website	<a href="https://www.pum.edu.pl/wydzialy/wydzial-medycyny-i-stomatologii/zaklad-biochemii">https://www.pum.edu.pl/wydzialy/wydzial-medycyny-i-stomatologii/zaklad-biochemii</a>
Language	English

\* replace ☐ into ☒ where applicable

## Detailed information

<b>Module objectives</b>		<p>The aim of biochemistry is to understand life processes at the molecular level and explanation of the relationship between structure and function of biomolecules in a living organism. This knowledge is fundamental to understanding the role of the various tissues and organs and consequently, the functioning of the whole body in health and disease. It also allows to purposefully respond to the appearance of pathological processes through the implementation of effective treatment. It allows to take preventive measures in relation to civilization diseases, eg. Diabetes.</p> <p>The aim of biochemistry is also to prepare students to study clinical subjects.</p>
Prerequisite /essential requirements	Knowledge	Student knows the basic models of chemical compounds. He explains the concept of: atom, molecule, chemical reagent, chemical reaction, the functional group. Identifies and defines the organic compounds: hydrocarbons, alcohols, aldehydes, ketones, acids, esters, ethers, amides, amines. Familiar with the term chemical bond, classifies types of chemical bonds. Defines the concepts of solubility, diffusion, osmosis, osmotic pressure, molarity. He knows the concepts of solution, molar concentration, percent concentration, equivalent concentration, electrolytic dissociation, ion, anion, cation.
	Skills	Student can properly use basic laboratory equipment (uses of the automatic pipette, measures the correct volume of solutions, prepares solutions in accordance with the prescribed concentration, can titrate). Performs chemical calculations based on the knowledge of chemistry and mathematics. Properly use the principles of functioning in the laboratory. Able to react properly in an emergency in a chemistry lab (action of the compounds corrosive, flammable, toxic, high temperature, etc.).
	Competences	Student can work in a team and actually perform tasks requiring precision, by following strictly established procedure. He can behave responsibly in emergency situations. It has a habit of self-education.

## Description of the learning outcomes for the subject /module

No. of learning outcome	Student, who has passed the (subject) knows /is able to /can:	SYMBOL (referring the standards)	Method of verification of learning outcomes*
W01	knows and understands the water and electrolyte balance in biological systems	B.W1	S, RZC, W, ET, EP, EU
W02	knows and understands the acid-base balance and the mechanism of action of buffers and their importance in systemic homeostasis;	B.W2	S, RZC, W, ET, EP, EU
W03	knows and understands the structure of simple organic compounds that are part of macromolecules present in cells, the extracellular matrix and body fluids	B.W10	S, RZC, W, ET, EP, EU
W04	knows and understands the structure of lipids and polysaccharides and their functions in cellular and extracellular structures	B.W11	S, RZC, W, ET, EP, EU
W05	knows and understands the 1st, 2nd, 3rd and 4th order structures of proteins; knows the post-translational and functional modifications of proteins and their importance	B.W12	S, RZC, W, ET, EP, EU
W06	knows and understands the functions of nucleotides in the cell, the primary and secondary structures of DNA and	B.W13	S, RZC, W, ET, EP, EU

	RNA and the structure of chromatin		
W07	knows and understands the functions of the human genome, transcriptome and proteome and the basic methods used in their study, the processes of DNA replication, repair and recombination, transcription and translation, and degradation of DNA, RNA and proteins, as well as the concepts of gene expression regulation	B.W14	S, RZC, W, ET, EP, EU
W08	knows and understands the basic catabolic and anabolic pathways, methods of their regulation and the influence of genetic and environmental factors	B.W15	S, RZC, W, ET, EP, EU
W09	knows and understands the metabolic profiles of basic organs and systems	B.W16	S, RZC, W, ET, EP, EU
U01	can predict the direction of biochemical processes depending on the energy state of cells;	B.U6	RZC, S, PS
U02	can use basic laboratory techniques such as qualitative analysis, titration, colorimetry, pHmetry, chromatography, electrophoresis of proteins and nucleic acids	B.U8	RZC, S, PS
U03	can use simple measuring instruments and assess the accuracy of measurements	B.U9	RZC, S, PS
U04	can use databases, including the Internet, and search for the necessary information using the available tools	B.U10	RZC, S, PS
U05	can plan and perform simple scientific research and interpret their results and draw conclusions	B.U13	RZC, S, PS

Table presenting LEARNING OUTCOMES in relation to the form of classes

No. of learning outcome	Learning outcomes	Type of training						
		Lecture	Seminar	Practical classes	Clinical classes	Simulations	E-learning	Other...
W01	B.W1	x	x	x				
W02	B.W2	x	x	x				
W03	B.W10	x	x	x				
W04	B.W11	x	x	x				
W05	B.W12	x	x	x				
W06	B.W13	x	x	x				
W07	B.W14	x	x	x				
W08	B.W15	x	x	x				
W09	B.W16	x	x	x				
U01	B.U6	x	x	x				
U02	B.U8	x	x	x				
U03	B.U9	x	x	x				
U04	B.U10	x	x	x				
U05	B.U13	x	x	x				

Table presenting TEACHING PROGRAMME

No. of a teaching programme	Teaching programme	No. of hours	References to learning outcomes
Winter semester			

Lectures			
TK01	The importance of biochemistry in medicine. Proteins - structure and functions	2	B.W10, W12; B.U10
TK02	Enzymes	2	B. W10 ; B. U10
TK03	Protein digestion	2	B. W15, W16; B. U10
K04	Catabolism of amino groups of amino acids	2	B. W15, W16; B. U10
TK05	The Krebs cycle and the mitochondrial respiratory chain	2	B. W015; B. U6,U10
TK06	Acid-base balance	2	B W02, W16; B. U10
TK07	Magnesium metabolism	2	B. W10, W15; B. U10
TK08	Ethyl alcohol metabolism	2	B. W1, W4; W15; B. U10
TK09	Overall carbohydrate metabolism. Digestion of carbohydrates	2	B. W11, W15; W16; B. U10
TK10	Glycogen metabolism	2	B. W11, W15, W16; B. U10
Seminars			
TK01	<i>Amino acids and protein structure Biomedical importance of amino acids and proteins. Classification and properties of amino acids. Protein structures: primary, secondary, tertiary and quaternary. Bonds stabilizing protein structures. Properties of proteins. Functions of proteins in the body. The isoelectric point of a protein. Improper protein folding.</i>	1,5	B.W10, W12 B.U10
TK02	<i>Fibrillar proteins Structure and types of collagen. Collagen biosynthesis. Collagenopathies. The structure of elastin. Protective role of <math>\alpha</math>1-antitrypsin in elastin metabolism and the development of emphysema</i>	1,5	B.W10, W12 B.U10
TK03	<i>Enzymes: Biomedical importance of enzymes. Classification and nomenclature of enzymes. Specificity of enzymatic reactions. Factors influencing the rate of enzymatic reaction. Kinetics of enzymatic catalysis. Active site and allosteric site. Inhibition of enzymatic reactions: competitive and non-competitive inhibition. Enzymes in clinical diagnosis. Regulation of enzyme activity</i>	1,5	B. W10 B. U10
TK04	<i>Nucleotide metabolism Nucleosides and nucleotides - structure and functions. Synthesis and catabolism of purine nucleotides. Synthesis and catabolism of pyrimidines. Diseases related to purine catabolism</i>	1,5	B.W10, W13 B. U10
TK05	<i>Structure of DNA replication and repair Structure of DNA. DNA replication. Organization of eukaryotic DNA. DNA repair. Telomeres. Reverse transcriptases.</i>	1,5	B.W10, W13, W14 B.U10
TK06	<i>Structure, synthesis and processing of RNA RNA structure. Types of RNA and their functions. Transcription. Post-transcriptional modification of RNA. Alternative splicing</i>	1,5	B.W10, W13, W14 B.U10
TK07	<i>Regulation of gene expression Regulatory sequences and molecules. The operon theory. Regulation of gene expression in Eukaryotes. Hormonal regulation. Alternative splicing and mRNA editing. Regulation by changes in DNA.</i>	1,5	B.W10, W13, W14 B.U10
TK08	<i>Protein biosynthesis Properties of the genetic code. Types of mutations and their effects. Types of tRNA. Functions of the tRNA arms. Stages of</i>	1,5	B. W14, W15 B. U10

	<i>protein biosynthesis: initiation, elongation and termination. Post-translational modifications of proteins. Effect of antibiotics on protein synthesis.</i>		
TK09	<i>Removal of amino acid nitrogen. Protein metabolic turnover. Digestion of food proteins. Reactions of deamination, deamidation and transamination: course and organ localization. Reactions releasing ammonia. Cellular mechanisms of ammonia binding and detoxification. Urea cycle. The role of the liver and muscles in the nitrogen balance of the organism: the alanine cycle. Ammonia metabolism.</i>	1,5	B. W15, W16 B. U10
TK10	<i>Breakdown and synthesis of amino acids. Glucogenic and ketogenic amino acids. Catabolism of the carbon backbones of amino acids. Biosynthesis of non-essential amino acids. Diseases related to the metabolism of amino acids.</i>	1,5	B. W15 B. U10
<b>Practical classes</b>			
TK01	<i>Amino acids and protein structure. Biomedical importance of amino acids and proteins. Properties of amino acids and proteins. Functions of proteins in the body. The isoelectric point of a protein.</i>	4	B.W10, W12 B.U08, U09, U10, U13
TK02	<i>Fibrillar proteins. Structure and types of collagen. The structure of elastin. Properties of amino acids and proteins. Protein denaturation. Protective properties of colloids.</i>	4	B.W10, W12 B.U08, U09, U10, U13
TK03	<i>Enzymes: Biomedical importance of enzymes. Specificity of enzymatic reactions. Factors influencing the rate of enzymatic reaction. Kinetics of enzymatic catalysis. Inhibition of enzymatic reactions: competitive and non-competitive inhibition. Enzymes in clinical diagnosis. Determination of amylase activity in saliva</i>	4	B. W10 B.U08, U09, U10, U13
TK04	<i>Nucleotide metabolism. Nucleosides and nucleotides - structure and functions. Synthesis and catabolism of purine and pyrimidine nucleotides. Diseases related to purine catabolism. Determination of serum transaminases activity.</i>	4	B.W10, W13 B.U08, U09, U10, U13
TK05	<i>Structure of DNA replication and repair. Structure of DNA. DNA replication. Organization of eukaryotic DNA. DNA repair. Telomeres. Reverse transcriptases. Properties of nucleic acids. DNA isolation</i>	4	B.W10, W13, W14 B.U08, U09, U10, U13
TK06	<i>Structure, synthesis and processing of RNA. RNA structure. Types of RNA and their functions. Transcription. Post-transcriptional modification of RNA. Alternative splicing. Determination of amylase activity in serum and urine</i>	4	B.W10, W13, W14 B.U08, U09, U10, U13
TK07	<i>Regulation of gene expression. Regulatory sequences and molecules. The operon theory. Regulation of gene expression in Eukaryotes. Hormonal regulation. Alternative splicing and mRNA editing. Regulation by changes in DNA. Determination of the activity of ceruloplasmin, CRP and ASO.</i>	4	B.W10, W13, W14 B.U08, U09, U10, U13
TK08	<i>Protein biosynthesis. Properties of the genetic code. Types of mutations and their effects. Types of tRNA. Functions of the tRNA arms. Stages of protein biosynthesis: initiation, elongation and termination. Post-translational modifications of proteins. Effect of antibiotics on protein synthesis. Determination of protein concentration</i>	4	B. W14, W15 B.U08, U09, U10, U13
TK09	<i>Removal of amino acid nitrogen. Protein metabolic turnover. Digestion of food proteins. Reactions releasing ammonia. Cellular mechanisms of ammonia binding and detoxification. Urea cycle. The share of liver and muscles in the nitrogen balance of the organism. Ammonia metabolism. Kay's test.</i>	4	B. W15, W16 B.U08, U09, U10, U13
TK10	<i>Breakdown and synthesis of amino acids. Glucogenic and ketogenic amino acids. Catabolism of the carbon</i>	4	B. W15 B.U08, U09, U10,

	<i>backbones of amino acids. Biosynthesis of non-essential amino acids. Diseases related to the metabolism of amino acids. Determination of urea in serum and urine</i>		U13
<b>Simulation</b>			
<b>E-learning</b>			
<b>Summer semester</b>			
<b>Lectures</b>			
TK01	Glycolysis and gluconeogenesis	2	B. W10; W15; W16; B. U10
TK02	The pentose cycle. Fructose and galactose metabolism	2	B. W10; W15; W16; W25; B. U10
TK03	Digestion and absorption of lipids	2	B. W10; W11; W15; W16; B. U10
TK04	Lipoprotein metabolism	2	B. W10; W11; W15; W16; W25; B. U10
TK05	Cholesterol and steroid hormones metabolism	2	B. W10; W11; W15; W16; W25; B. U10
TK06	Bilirubin and iron metabolism	2	B. W10; W11; W15; W16; W25; B. U10
TK07	Biochemistry of liver	2	B. W10; W11; W15; W16; W25; B. U10
TK08	Water and mineral management	2	B. W1; W15; W16; B. U10
TK09	Kidney and urine	2	B. W1; W2; W16; W25; B. U10
TK10	Presentation of examination tests	2	
<b>Seminars</b>			
TK11	<i>Conversion of amino acids into specialized products Porphyrin metabolism. Porphyrins. Heme catabolism. Jaundice. Iron metabolism. Catecholamines: synthesis, catabolism. Histamine. Serotonin. Creatine. Melanin.</i>	1,5	B. W10, W15, W16 B. U10
TK12	<i>The citric acid cycle. Bioenergetics. Biological oxidation. Biomedical importance of the processes of obtaining and storing energy in the cell. Characteristics of the citric acid cycle reactions and their regulation. Energy balance of the citric acid cycle. The amphibolic nature of the citric acid cycle. Enzymes participating in oxidation and reduction reactions. Components of the mitochondrial respiratory chain. Redox potential. Respiratory chain poisons and compounds decoupling oxidation and phosphorylation processes. Mitochondria and apoptosis.</i>	1,5	B. W015 B. U6, U10
TK13	<i>Acid -base balance - pulmonary regulation Physiologically important blood and tissue buffer systems. Henderson-Hasselbalch equation. Contribution of the respiratory system to the maintenance of acid-base homeostasis. Carbon dioxide partial pressure.</i>	1,5	B W02, W16 B. U10
TK14	<i>Acid -base balance - renal regulation The role of the kidneys in maintaining acid-base homeostasis. Mechanisms of reabsorption and regeneration of bicarbonates in renal tubules. Renal ammonogenesis. The production of titratable</i>	1,5	B. W02, W16 B. U10

	<i>acidity and urine pH.</i>		
TK15	<i>Thyroid hormones Thyroid hormone biosynthesis. Storage and secretion of thyroid hormones. Metabolic action thyroid hormones</i>	1	B. W15, W16 B. U10
TK16	<i>Classification and structure of carbohydrates. Digestion and absorption of carbohydrates. Glycogen metabolism Classification and structure of carbohydrates. Digestion of food carbohydrates. Disturbances in digestion and absorption of carbohydrates. Structure and function of glycogen. Glycogen synthesis. Glycogen degradation. Metabolic and hormonal regulation of the processes of glycogenogenesis and glycogenolysis. Differences in the regulation of glycogen metabolism in muscles and liver. Glycogen storage diseases.</i>	1,5	B. W10, W11, W15, W16 B. U6, U10
TK17	<i>Glycolysis and gluconeogenesis Transport of glucose to cells. Glucose synthesis. Substrates of gluconeogenesis. Metabolic and hormonal regulation of gluconeogenesis. The lactic acid cycle. The role of gluconeogenesis in controlling blood glucose levels. Glycolysis reactions. Metabolic and hormonal regulation of glycolysis. Importance of glycolysis in aerobic and anaerobic conditions. Energy balance of glycolysis and oxygen combustion of glucose.</i>	1,5	B. W15, W16 B. U6, U10
TK18	<i>Pentose phosphate trail. Fructose and galactose metabolism The physiological role and tissue localization of the pentose phosphate pathway. Characteristics of the pentose phosphate pathway reaction. Importance of NADPH in metabolic processes. Effects of G6PD deficiency. Fructose metabolism. Galactose metabolism. Defects of fructose and galactose metabolism. Lactose synthesis.</i>	1,5	B. W15, W16 B. U6, U10
TK19	<i>Dietary lipid metabolism and fatty acid structure Presence of lipids in the diet. Digestion of lipids in the digestive tract: the importance of individual enzymes. Absorption of lipid digestion products. Processes of emulsification and micellization. Monoacylglycerol pathway. Lipids of physiological importance.</i>	1,5	B. W10, W11, W15, W16 B. U6, U10
TK20	<i>Synthesis of fatty acids and triacylglycerols. Fatty acid oxidation Biosynthesis of fatty acids. Localization and regulation of lipogenesis. Fatty acid catabolism: <math>\alpha</math>-oxidation. Localization and regulation of <math>\beta</math>-oxidation. Energy balance of fatty acid oxidation. Biosynthesis of acylglycerols. Metabolism of ketone bodies.</i>	1,5	B. W15 B. U6, U10
TK21	<i>Metabolism of phospholipids, glycolipids and eicosanoids Structure, synthesis, degradation and function of phospholipids. Structure, synthesis, degradation and function of glycosphingolipids. Prostaglandins, thromboxanes and leukotrienes - structure, synthesis, function.</i>	1,5	B. W10, W11, W15 B. U6, U10
TK22	<i>Cholesterol and lipoprotein metabolism Food sources of cholesterol. Cholesterol biosynthesis and its regulation. The role of the liver in cholesterol metabolism. Cholesterol catabolism - synthesis of bile acids. Primary and secondary bile acids. Enterohepatic circulation of bile acids. The role of lipoproteins in lipid transport and metabolism. Classes of apolipoproteins. Lipoprotein fractions and their metabolism. The role of receptors in lipoprotein metabolism. The role of liver and adipose tissue in lipoprotein metabolism. Intravascular lipolysis.</i>	1,5	B. W15, W16 B. U10
TK23	<i>Steroid hormones Cholesterol as a precursor to steroid hormones. Adrenal cortex hormones: mineralocorticosteroids and glucocorticosteroids. Gonadal hormones: gestagens, estrogens and androgens. Synthesis of steroid hormones. Metabolic activities of steroid hormones.</i>	1,0	B. W15, W16 B. U10
TK24	<i>Insulin and glucagon Insulin: molecular structure, synthesis, regulation of secretion, biodegradation. Metabolic and hormonal regulation of insulin secretion. Metabolic effects. Hypoglycemia. Glucagon: structure,</i>	1,5	B. W15, W16 B. U10

	<i>synthesis, secretion. Metabolic effects</i>		
TK25	<i>State of satiety and state of starvation Regulatory mechanisms of the resorptive state. The role of the liver in the distribution of nutrients. Adipose tissue as an energy reservoir. Skeletal muscles at rest. Energy consumption by the brain. Organ metabolism in a starving state: liver, adipose tissue, muscles, brain, kidneys.</i>	1,5	B. W15, W16 B. U10
TK26	<i>Diabetes and obesity Type I diabetes mellitus: causes, diagnosis, metabolic changes, treatment. Type II - causes of insulin resistance, metabolic changes, treatment. Chronic sequelae and prevention. The causes of obesity. Anatomical differences in the distribution of fat. Weight regulation. Molecular influences. Metabolic effects. The impact of obesity on health. Weight reduction.</i>	1,5	B. W15, W16 B. U10
TK27	<i>Vitamins Vitamin classification: fat and water soluble vitamins. Vitamin metabolism. Metabolic disorders associated with hypo- or hypervitaminosis.</i>	1,0	B. W15 B. U10
TK28	<i>Macronutrients and trace elements The importance of macronutrients in metabolism: calcium, phosphorus, magnesium, sodium, potassium, chloride and micronutrients: copper, manganese, zinc. Health effects of the deficiency of ultra-trace elements: iodine, selenium, molybdenum.</i>	1,0	B. W15 B. U10
<b>Practical classes</b>			
TK11	<i>Conversion of amino acids into specialized products Porphyrin metabolism. Porphyrins. Heme catabolism. Jaundice. Iron metabolism. Catecholamines: synthesis, catabolism. Histamine. Serotonin. Creatine. Melanin. . Determination of iron and TIBC concentration in the serum. Detection of urobilinogen in urine</i>	4	B. W10, W15, W16 B. U08, U09, U10, U13
TK12	<i>The citric acid cycle. Bioenergetics. Biological oxidation. Biomedical significance of the processes of obtaining and storing energy in the cell. Energy balance of the citric acid cycle. The amphibolic nature of the citric acid cycle Components of the mitochondrial respiratory chain. Redox potential. Respiratory chain poisons and compounds decoupling oxidation and phosphorylation processes. Investigation of cytochrome oxidase activity.</i>	4	B. W015 B. U6, U08, U09, U10, U13
TK13	<i>Acid-base balance - pulmonary regulation Physiologically important blood and tissue buffer systems. Henderson-Hasselbalch equation. Contribution of the respiratory system to the maintenance of acid-base homeostasis. Carbon dioxide partial pressure. Properties of buffers</i>	4	B. W02, W16 B. U08, U09, U10, U13
TK14	<i>Acid economy - renal regulation The role of the kidneys in maintaining acid-base homeostasis. Mechanisms of reabsorption and regeneration of bicarbonates in renal tubules. Renal ammonogenesis. The production of titratable acidity and urine pH. Urine titratable acidity.</i>	4	B. W02, W16 B. U08, U09, U10, U13
TK15	<i>Thyroid hormones Thyroid hormone biosynthesis. Storage and secretion of thyroid hormones. Metabolic action of thyroid hormones. Arranging diets.</i>	2	B. W15, W16 B. U08, U09, U10, U13
TK16	<i>Classification and structure of carbohydrates. Digestion and absorption of carbohydrates. Glycogen metabolism Classification and structure of carbohydrates. Digestion of food carbohydrates. Disturbances in digestion and absorption of carbohydrates. Structure and function of glycogen. Metabolic and hormonal regulation of the processes of glycogenogenesis and glycogenolysis. Testing the content of sugars in food products</i>	4	B. W10, W11, W15, W16 B. U6, U08, U09, U10, U13
TK17	<i>Glycolysis and gluconeogenesis Glucose synthesis. Substrates of gluconeogenesis. The lactic</i>	4	B. W15, W16 B. U6, U08, U09,



	<i>acid cycle. The role of gluconeogenesis in controlling blood glucose. Importance of glycolysis under aerobic and anaerobic conditions. Energy balance of glycolysis and oxygen combustion of glucose. Testing the properties of sugars</i>		U10, U13
TK18	<i>Pentose phosphate trail. Fructose and galactose metabolism The physiological role and tissue localization of the pentose phosphate pathway. Effects of G6PD deficiency. Fructose and galactose metabolism. Defects of fructose and galactose metabolism. Lactose synthesis. Perform a sucrose loading test</i>	4	B. W15, W16 B. U6, U08, U09, U10, U13
TK19	<i>Dietary lipid metabolism and fatty acid structure Presence of lipids in the diet. Digestion of lipids in the digestive tract. Absorption of lipid digestion products. Processes of emulsification and micellization. Lipids of physiological importance. Study of the properties of fats</i>	4	B. W10, W11, W15, W16 B. U6, U08, U09, U10, U13
TK20	<i>Synthesis of fatty acids and triacylglycerols. Fatty acid oxidation Biosynthesis of fatty acids. Localization and regulation of lipogenesis. Fatty acid catabolism: <math>\alpha</math>-oxidation. Localization and regulation of <math>\beta</math>-oxidation. Energy balance of fatty acid oxidation. Biosynthesis of acylglycerols. Metabolism of ketone bodies. . Lipase activity test</i>	4	B. W15 B. U6, U08, U09, U10, U13
TK21	<i>Metabolism of phospholipids, glycolipids and eicosanoids Structure, synthesis, degradation and function of phospholipids. Structure, synthesis, degradation and function of glycosphingolipids. Prostaglandins, thromboxanes and leukotrienes - structure, synthesis, function. Determination of the acid number.</i>	4	
TK22	<i>Cholesterol and lipoprotein metabolism Food sources of cholesterol. Cholesterol biosynthesis and its regulation. The role of the liver in cholesterol metabolism. Synthesis of bile acids. Enterohepatic circulation of bile acids. The role of lipoproteins in lipid transport and metabolism. Classes of apolipoproteins. The role of liver and adipose tissue in lipoprotein metabolism. Determination of cholesterol and triacylglycerol in serum.</i>	4	B. W15, W16 B. U08, U09, U10, U13
TK23	<i>Steroid hormones Cholesterol as a precursor to steroid hormones. Adrenal cortex hormones: mineralocorticosteroids and glucocorticosteroids. Gonadal hormones: gestagens, estrogens and androgens. Reactions to detect steroid compounds.</i>	4	B. W15, W16 B. U08, U09, U10, U13
TK24	<i>Insulin and glucagon Insulin: molecular structure, synthesis, regulation of secretion, biodegradation. Metabolic and hormonal regulation of insulin secretion. Metabolic effects. Hypoglycemia. Glucagon: structure, synthesis, secretion. Metabolic effects. Sucrose hydrolysis.</i>	4	B. W15, W16 B. U08, U09, U10, U13
TK25	<i>State of satiety and state of starvation Regulatory mechanisms of the resorptive state. The role of the liver in the distribution of nutrients. Adipose tissue as an energy reservoir. Skeletal muscles at rest. Energy consumption by the brain. Organ metabolism in a starving state: liver, adipose tissue, muscles, brain, kidneys. Carrying out the synthesis of starch. Detection of ketone bodies in urine.</i>	4	B. W15, W16 B. U08, U09, U10, U13
TK26	<i>Diabetes and obesity Type I diabetes mellitus: causes, metabolic changes. Type II - causes of insulin resistance, metabolic changes. Chronic sequelae and prevention. The causes of obesity. Anatomical differences in the distribution of fat. Weight regulation. Metabolic effects. The impact of obesity on health. Glucose tolerance test.</i>	4	B. W15, W16 B. U08, U09, U10, U13
TK27	<i>Vitamins Vitamin classification: fat and water soluble vitamins. Vitamin metabolism. Metabolic disorders associated with hypo- or hypervitaminosis. Vitamin C determination</i>	4	B. W15 B. U08, U09, U10, U13
TK28	<i>Macronutrients and trace elements The importance of macronutrients in metabolism. Health effects</i>	4	B. W15 B. U08, U09, U10,

	<i>of deficiency of ultra-trace elements. Examination of mineral and organic components of the tooth, determination of serum phosphate concentration.</i>		U13
<b>Simulation</b>			
<b>E-learning</b>			

<b>Booklist</b>
Obligatory literature:
1. Biochemistry. Denise R. Ferrier. Seventh edition
2.
Supplementary literature:
1.
2.

<b>Student's workload</b>	
Form of student's activity (in-class participation; activeness, produce a report, etc.)	Student's workload [h]
	Tutor
Contact hours with the tutor	170
Time spent on preparation to seminars/ practical classes	224
Time spent on reading recommended literature	
Time spent on writing report/making project	
Time spent on preparing to colloquium/ entry test	28
Time spent on preparing to exam	120
Other .....	
Student's workload in total	542
<b>ECTS credits for the subject (in total)</b>	18
<b>Remarks</b>	

\* Selected examples of methods of assessment:

EP – written examination

EU – oral examination

ET – test examination

EPR – practical examination

K – colloquium

R – report

S – practical skills assessment

RZC – practical classes report, incl. discussion on results

O – student's active participation and attitude assessment

SL – lab report

SP – case study

PS – assessment of student's ability to work independently

W – entry test  
PM – multimedial presentation  
other...