SVEUČILIŠTE U RIJECI - MEDICINSKI FAKULTET
UNIVERSITY OF RIJEKA - FACULTY OF MEDICINE

BIOCHEMISTRY II
(20 pages)

Faculty of Medicine, University of Rijeka

Cours: Biochemistry II
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Department: Department of Medical Chemistry, Biochemistry and Clinical Chemistry
Study: Integrated Undergraduate and Graduate University Study of Medicine in English
Year of the study: Second
Academic year: 2020./2021.

COURSE SYLLABUS

Course information (basic description, general information, teaching overview, required equipment and preparation, etc.)

Biochemistry II is a compulsory course at the second year of the Integrated Undergraduate and Graduate University Study of Medicine in English. It consists of 42 hours of lectures, 34 hours of seminars, and 34 hours of laboratory practicals, overall 110 hours (9 ECTS). Lectures and seminars are held in lecture halls of the Faculty of Medicine according to the course schedule. Laboratory practicals are held at the Department of Medical Chemistry, Biochemistry and Clinical Chemistry.

The goal of teaching Biochemistry is to understand how the human body works at the molecular level: how it uses energy, how it keeps its structure, how does it recognize different signals and respond to them, how it develops and grows, and how it protects against disease. The focus is on the integrative function of tissues and organs. This curriculum forms biochemical basis of physiology and offers the student the knowledge necessary for understanding biochemical basis of many pathobiochemical processes and diseases. Understanding these principles should help students and physicians in using the appropriate biochemical diagnostic procedure in order to improve health, in disease prevention, and in treatment of disorders at any human age.
Thorough the seminary part, students will gradually acquire and connect topics related to course aims. Students will acquire knowledge and experience in basic laboratory techniques and analytical clinical methods related to physiological and pathological states of the organism thorough laboratory practicals.

Content of the course

01. Introduction
02. Enzymes
03. Bioenergetics
04. Metabolism of carbohydrates
05. Metabolism of lipids
06. Structure and function of DNA and RNA

07. Hormon action and signal transduction
08. Biological membranes and cellular signaling
09. Metabolism of proteins and amino acids
10. Vitamins
11. Oxidative stress
12. Integration of Metabolism
13. Biomedical importance of serum enzymes and proteins

Required literature:

1. VW. Rodwell et all.: Harpers Illustrated Biochemistry, 30th edition, The McGraw -Hill Education, New York 2015.
2. Č. Milin et. all.: Handbook for seminars and Laboratory practicals in Biochemistry II, Department of Chemistry and Biochemistry Faculty of Medicine, University of Rijeka, 2019.

Recommended for additional reading:

1. JM. Berg et all: Biochemistry, 8th edition, W.H. Freeman and Company, New York, 2012.
2. DL. Nelson, MM. Cox: Lehninger Principles of Biochemistry, Fourth Edition

Course teaching plan:

The list of lectures (with the titles and learning outcomes):

L1 Importance of biochemistry in understanding health and disease and the application of biochemistry in clinical practice.
Understanding the aim of the course. Recognizing the role of Biochemistry in health care.

L2-3 Enzymes. Classification of enzymes. The kinetics of enzyme catalysis. Regulation of enzymatic activity.
To explain the structure and the function of enzymes. To explain the structure and the function of catalytic centers. To describe the kinetics and the mechanism of enzyme-catalyzed reactions. To define and describe mechanisms of enzymatic activity regulation.

L4 Digestion and absorption of carbohydrates.
To list carbohydrates that appear in the food and carbohydrates that are final products of digestion (hydrolysis catalyzed by an enzyme) being transported into enterocytes. To describe enzymes that catalyze hydrolytic cleavage of oligosaccharides and polysaccharides.

L5-6 Metabolic pathways of carbohydrates. Glycolysis. Aerobic and anaerobic glycolysis. Regulation of glycolysis.
To explain anaerobic and aerobic glycolysis pathways and state their final products. To show glycolysis schematically, list glycolysis enzymes, calculate the balance of ATP formation on the substrate level by "aerobic" glycolysis of glucose and glycogen, to describe NAD^+ and $NADH + H^+$ roles in the glycolysis, glyceraldehyde-3-P oxidation, and pyruvate reduction. To describe the cellular location of anaerobic glycolysis. To describe and discuss the regulation of glycolysis.

L7 Oxidative decarboxylation of keto acids.
To show sum equation of oxidative phosphorylation of pyruvate into acetyl-CoA; list all the enzymes, coenzymes, and cofactors involved in the formation of acetyl-CoA from pyruvate and insert them in the metabolic scheme; to state the number of ATP moles generated by formation of acetyl-CoA from one mole pyruvate; to explain the (non)possibility of pyruvate formation from acetyl-CoA.

L8-9 Citric Acid Cycle. Regulation of Citric Acid Cycle.
To state the basic role of citric acid cycle (Tricarboxylic Acid Cycle); to show the cycle schematically, to state cycle reactions' cellular locations; to state reactions by which terminal oxidations occur together with corresponding enzymes and coenzymes; to state citric acid. To list regulatory enzymes and reactions catalysed by those enzymes.

L10 Gluconeogenesis. Cory cycle.

To describe gluconeogenesis, to define molecules that enter the gluconeogenesis pathway, to display glucose and glycogen formation from proteins and lipids, to list phosphatase involved in gluconeogenesis but not in glycolysis; to state reversible glycolysis reactions, to state allosteric enzymes involved in gluconeogenesis regulation.

L11-12 Metabolism of Glycogen. Regulation of Glycogen Metabolism.

To describe glycogen formation from glucose through glucose-l-P, and to explain the role of UTP and UDP in that reaction; to schematically show glycogen breakdown in glucose-1-P and its hormonal regulation (hormones, receptors, enzymes, second messengers), to explain the chemical background of glycogen breakdown disorders.

L13 The penthose phosphate pathway.

Schematically show direct oxidation of glucose-6-P into CO_2 and H_2O in the pentose phosphate pathway; to state the most important compounds of oxidative and non-oxidative phase; coenzymes that appear in the oxidative phase dehydrogenases, to explain the role of pentose phosphate pathway - formation of $NADPH^+ H^+$ and ribose and their role in metabolism; intermediate compounds that appear both in glycolysis and gluconeogenesis forming the link between those metabolic pathways. To explain the biochemical mechanism and clinical correlation of glucose-6-phosphate dehydrogenase deficiency.

L14-15 Bioenergetics. Oxidative Phosphorylation.

To describe oxidative phosphorylation and electron transport chain, the location of electron transport chain and its topology. To explain the coupling of oxidation of reduced coenzymes with the synthesis of ATP. To explain the ATP synthase mechanism and the regulation of the oxidative phosphorylation.

L16 Digestion and absorption of lipids.

To list the part of the digestive tract where lipolytic breakdown of triacylglycerols (lipids and oils) takes place and the factors that stimulate this breakdown; to describe the intraluminal process of triacylglycerol breakdown concerning pancreatic lipase specificity and the action of bile salts; to describe the triacylglycerol metabolism inside enterocytes.

L17-19 Mobilisation of fatty acids. Oxidation of fatty acids. Biosynthesis of fatty acids.

To explain how triacylglycerols (lipids) from adipose tissue serve as organism energy reservoir. To describe the processes by which fatty acids are transported through the blood. To explain processes of fatty acid activation and transport into the matrix of the mitochondria. To describe the catabolism of fatty acids and their cellular location.

To calculate energy balance of fatty acid breakdown. List the essential fatty acids and their characteristics. To describe the reaction catalyzed by acetyl-CoA carboxylase and understand the mechanisms by which its activity is regulated to control the rate of fatty acid synthesis. To explain reactions of fatty acid biosynthesis and the role of the multienzyme complex in that process.

L20-21 Biosynthesis of triacylglycerols and phospholipids. Glycolipids.

To outline the general structure of triacylglycerols, phospholipids, and glycerosphingolipids and indicate their functions. To explain glycerol origin for the glycerolipid biosynthesis. To explain the role of phospholipases in the degradation and remodeling of phospholipids. To display the phosphatidylcholine, phosphatidylethanolamine, phosphatidylserine, phosphatidylinositol and cardiolipin metabolism; to display sphingomyelin and glycosphingolipid metabolism; to explain the chemical background of sphingolipid metabolism disorders; to describe and to explain the eicosanoid structure, biological role, and metabolism.

L22-23 Biosynthesis and metabolism of cholesterol. Biosynthesis and metabolism of bile acids.

To explain the importance of cholesterol as an essential structural component of cell membranes, as a precursor of steroid hormones, bile acids, and vitamin D. To identify stages of cholesterol biosynthesis from acetyl-CoA. Understand the role of 3-hydroxy-3-methylglutaryl CoA reductase in controlling the rate of cholesterol synthesis and explain the mechanisms by which its activity is regulated. To display cholic, glycocholic, and taurocholic acid biogenesis (bile acids); to state physical and chemical characteristics and biosynthesis of C17, C19, and C21 steroid hormones.

L24 Classification and role of lipoproteins in the metabolism.

To count transport pathways of lipids and their metabolites from enterocytes to other parts of organism; to

define lipoproteins, to count basic types of lipoproteins and state their chemical content, to state their role in exogenous and endogenous lipid transport; to explain the chemical background of lipoprotein metabolism disorders. Indicate major types of apolipoprotein found in different lipoprotein classes.

L25 Metabolism of xenobiotics.

To define xenobiotics and to explain the biomedical significance of xenobiotic metabolism. To explain the role of liver cells in the detoxification of xenobiotics. To state and explain the reactions of phase I and II. To explain the role of cytochrome P450 and reactions catalyzed by various enzymes.

L26-27 Nucleic acid structure and function. RNA synthesis, processing, and modification. Regulation of gene expression.

To describe the structure and function of nucleic acids; to explain semiconservative replication of DNA, transcription, and protein biosynthesis (translation). Understand the flow of genetic information from DNA to RNA to proteins.

L28-29 Protein synthesis. Transport of proteins. Ubiquitination of proteins.

To explain the aim and effects of posttranslational modifications of protein on structure, biochemical activity, and intracellular traffic and sorting of proteins (trans-membrane proteins, peripheral membrane proteins, glycosylphosphatidylinositol anchored proteins); to state the examples; to explain membrane lipids and proteins mobility. To describe the role of ubiquitin in protein degradation.

L30 Midterm exam

L31 Protein metabolism. Digestion and absorption of proteins.

To understand the proteolysis in the digestive tract and the absorption of amino acids in the intestine; to know extracellular proteases and their classification (exopeptidase, endopeptidase, aminopeptidase, carboxypeptidases, dipeptidylpeptidases), to know the location of action of proteolytic enzymes, the activation and mechanisms of pepsin, trypsin, and chymotrypsin action.

L32-33 Metabolism of amino acids. Decarboxylation, transamination and oxidative deamination.

To name and know the basic pathways of amino acid degradation (decarboxylation, transamination, oxidative deamination); to explain the reaction of amino acid decarboxylation, name enzymes and co-enzymes; to list biologically important amines. To explain the processes of oxidative deamination of amino acids, formation of keto acids and ammonia, specify oxidoreductases that catalyze reactions and coenzymes; to explain the formation of ammonia in the combined processes of transamination and oxidative deamination resulting in glutamate; to explain the mechanism of transaminase action.

L34 Urea cycle

To indicate from which compounds high-energy carbamoyl phosphate is formed, schematically show intermediates of urea cycle and urea formation; to identify the subcellular locations of the enzymes that catalyses the cycle; to explain the utilization of ATP.

L35-37 Signal molecules. Role in the regulation of metabolism. Receptors and signal transduction. Hormonal regulation of metabolism.

To explain the principles of cellular signaling. To list the signal molecules according to solubility. To explain the role of receptors in signal transduction. To describe the classification of hormones. To explain the mechanisms of hormone action and the hierarchy of hormones. To explain the role of receptors and G proteins as well as the generation of second messengers in hormone signal transduction. To explain the hormonal regulation of cellular processes through activation of cAMP and phospholipase C. To understand the mechanism of steroid hormone action; to explain the mechanism of eicosanoids action. To list MAP kinases pathway; to explain the role of the transcription factor NF-κB.

L38-39 Regulation of metabolic pathways.

Integrate the metabolic destiny of a food ingredient from its digestion and absorption to complete degradation or conversion into an intermediate product. To describe the peculiarities of metabolic processes present in skeletal muscle, fatty tissue, liver, and brain.

L40-41 Biomedical importance of plasma enzymes.

To understand the biological and diagnostic importance of serum proteins and enzymes; alanine and aspartate aminotransferase (ALT and AST), glutamate dehydrogenase (GLDH), γ-glutamiltransferase (γGT), cholinesterase (CHE), creatine kinase (CK), alkaline phosphatase (ALP), lactate dehydrogenase

(LDH), lipase, and amylase. To know the application and the role of enzymes in the diagnosis and clinical practice.

The list of seminars (S) with descriptions:

S1 Enzymes
To explain the kinetics and the mechanism of enzyme-catalysed reactions. To describe and to explain the regulation of enzymatic activity.

S2 Cofactors. Water soluble vitamins.
To classify and to describe the structure of cofactors. To explain the modalities of coenzyme action. To explain the role of water-soluble vitamins in enzymatic activity.

S3 Biochemically important reactions.
To indicate, explain the physiological role and mechanism of biochemically important reactions.

S4 Carbohydrate metabolism. Regulation of gluconeogenesis.
To describe the conversion of galactose, mannose, and fructose into glucose (monosaccharide interconversion); to state enzymes (and coenzymes) involved in the enzyme catalyzed epimerization of galactose into glucose; to explain the chemical background of galactose metabolism disorders; to show and to explain fructose metabolism, to explain the chemical background of fructose metabolism disorders.

S5 Function and structure of respiratory chain complexes.
To illustrate the structure of the respiratory chain. List respiratory chain complexes involved in the transfer of electrons. To explain the mechanism of electron transfer and chemiosmotic hypothesis. Understand the role of ubiquinone cycle and synthesis of ATP.
To classify enzymes and cofactors according to the type of catalysed reaction. To explain the role of specific cofactor in biocatalysis.

S6 Free radicals, oxidative stress, and antioxidants' structure and nature.
To explain the mechanisms of formation and the role of free radicals as well as the mechanisms of free radicals' elimination.

S7 Fat soluble vitamins.
To explain the biological role of vitamins in human health. To explain the structure, principal functions, and metabolism of fat-soluble vitamins A, D, E, K. To explain the role of vitamin A in the metabolism of rhodopsin (rhodopsin biosynthesis), gene expression, and tissue differentiation. To describe the metabolism of vitamin D in the skin, liver, and kidney. To explain the role of vitamin D in the control of calcium homeostasis. To explain vitamin E antioxidative properties in cell membranes and plasma proteins. To describe the role of vitamin K in blood clotting

S8 Metabolism of lipids.
To name and understand the structure and chemistry of physiologically important lipids. To define the meaning of the term lipids, and to explain their distribution according to their role and structure; to know the most important representatives of elementary and complex lipids, biological important steroids, biological important terpenes. To identify essential fatty acids and to explain their characteristics. To explain the biosynthesis of polyunsaturated fatty acids. To identify ketone bodies, to describe the reaction by which they are formed and used as a fuel for extrahepatic tissues. Identify pathological conditions when ketosis and ketoacidosis occur. To explain biochemical mechanism and biochemical aspects of clinical disorders of lipoprotein metabolism.

S9 Metabolism of iron, porphyrins and bile pigments.
To describe the mechanism of iron absorption, distribution, and storage into tissues. To describe the physiological and clinical role of transferrin, ferritin, iron concentration in serum, and hepcidin in the human organism. To explain the causes and clinical picture of iron deficiency. To explain the pathway of porphyrin biosynthesis. To describe the causes and clinical picture of various porphyrias.

S10 Metabolic functions of the liver.
To know and explain synthetic, metabolic, and excretory function of the liver. To explain the mechanisms of

heme degradation. To explain metabolic degradation pathway of bilirubin, name and explain related metabolic disorders. To know the synthesis of bile acids.

S11 Catabolism of carbon skeletons of amino acids. Metabolic transformation of individual amino acids.

To describe metabolic pathways for glycine, serine, aspartic and glutamic acid, arginine, histidine, phenylalanine, tyrosine, tryptophan, cysteine catabolism; metabolic scheme of aromatic amino acid degradation. To explain the mechanism of phenylketonuria, alcaptonuria, albinism, and disease of metabolism of branched-chain amino acids.

S12 Plasma proteins and their physiological, biochemical, and diagnostic functions. Biomedical importance of plasma proteins.

To indicate the composition and the role of blood. To classify plasma proteins. To list and explain the separation methods of plasma proteins. To indicate the causes of changes in the concentration of plasma proteins. To specify and distinguish acute phase proteins. To know the application and the role of haptoglobin, ceruloplasmin, α_2-macroglobulin, transferrin, α_1-fetoprotein, α_1-antitrypsin, fibrinogen, and α_1-acid glycoprotein in the disease diagnosis and clinical practice. To clarify the diagnostic value of serum proteins in the case of α_1-antitrypsin deficiency.

The list of laboratory practicals (LP) with short explanations:

LP1 Methods in biochemistry

To explain the principle of the methods used in biochemical laboratories (chromatography, mass spectrometry, immunochemical methods (ELISA), western blot, DNA analysis). Apply High Performance Liquid Chromatography (HPLC) to separate the analyte in the mixture.

LP2 Factors affecting enzymatic activity

To explain the influence of pH and temperature on the ALP enzymatic activity. To explain how substrate concentration and inhibitor affect the rate of enzyme-catalyzed reaction.

LP3 Qualitative and quantitative analysis of carbohydrates

To apply a qualitative reaction to detect carbohydrates in biological samples. To measure serum glucose concentration, interpret, and explain the results.

LP4 Electrophoresis of lipoproteins

To apply spectrophotometry and electrophoresis in order to determine serum lipid profile. Apply qualitative methods for the detection of pathological components of urine.

LP5 Determination of iron concentration in serum

To determine parameters of iron status. To apply qualitative methods for the detection of pathological components of urine.

LP6 Determination of non-protein nitrogen compounds

To measure urine and serum renal function parameters, interpret the results, and explain possible causes of hyperuricemia and urinary infections. Apply qualitative methods for the detection of pathological components in the urine.

LP7 Determination of clinically important enzymes

To determine serum activities of ALT, AST, ALP, CHA, and γ-GT and to relate their activity with specific physiological and pathological processes.

LP8 Clinical laboratory

LP9 Midterm exam

Student obligations:

Class attendance, including test attendance, is mandatory. Students may be absent from 30% of each form of teaching provided they have a justifiable cause. If a student is absent for more than 30% of the classes, he/she will have to re-enroll the course.

Absence from seminars is compensated by an oral colloquium. Students are expected to actively participate in all aspects of the course, complete laboratory reports on time, and attend the examinations. Moreover,

preparation of the course content, which is going to be discussed during seminars and laboratory practicals, is obligatory. During laboratory practicals, a student is obligated to wear a lab coat, to have tools (a wiping pad, a ruler, and a calculator), and the Handbook for seminars and practicals in Biochemistry II.

Exam (exam taking, detailed exam description of the oral/written/practical part, point distribution, grading criteria):

Student grading will be conducted according to the current Ordinance on Studies of the University of Rijeka (approved by the Senate) and the Ordinance on Student Grading at the Faculty of Medicine in Rijeka (approved by the Faculty Council).

Assessment of the student work

Student work will be assessed and graded during the course and on the final exam. During the course, students may obtain a total of 100 grade points (credits). Students can achieve up to 70% of the final grade during the classes, and a maximum of 30% of the final grade at the final exam.

Evaluation of students' progress during classes, midterms, and the final exam in academic year 2020/2021 is shown in Table 1.

Table 1. Distribution of grade points in the course "Biochemistry II"

	Evaulation	Grade points
Midterm exams	Midterm exam I	18
	Midterm exam II	18
	Midterm exam III	18
	Total	**54**
Laboratory practicals	Completed practical and accepted written report	8
Seminars	Active participation/short written exams	8
TOTAL		**70**
Final exam	Written exam (30 questions)	15
	Oral exam	15
	Total	**30**
TOTAL		**100**

Written midterm exams

During the semester, three written midterm exams are planned, which will include the content of lectures, seminars, and laboratory practicals.
At each midterm exam, the maximum of grade points that a student can obtain is 18.

All written midterm exams consist of 40 multiple choice questions and are evaluated according to the criteria shown in Table 2. In order to obtain grade points, a student should have/gain a minimum 50% of correct answers on each midterm exam. Settled midterm exams are valid for the current academic year in which they are placed.

Table 2. Evaluation of written midterm exams I-III

% of correct answered questions	Grade points/credits
50.00 - 54.99	9
55.00 - 59.99	10
60.00 - 64.99	11
65.00 - 69.99	12
70.00 - 74.99	13
75.00 - 79.99	14
80.00 - 84.99	15
85.00 - 89.99	16
90.00 - 94.99	17
95.00 - 100.00	18

Correction of the midterm exams

A student can access the correction of the midterm exams if he/she i) did not obtain a minimum criteria (50% on each midterm) or ii) is not satisfied with the obtained credits and iii) in case of absence at the midterm exam due to a justified reason.
If a student retakes the midterm exam because he/she is not satisfied with the obtained grade points, only the credits gained from the retaken midterms will be considered.
Evaluation of the midterm corrections will be performed according to the criteria shown in the Table 2.
Students will have the opportunity to correct one or more midterm exam only once. Correction of the midterm exam I-III will be held after completing regular class in terms set by the course schedule.

Laboratory practicals

A student can gain 8 credits throughout laboratory practicals. Evaulation of laboratory practicals implais precisely completed experimental part of laboratory practical (maximum of 4 grade points) and completed and accepted written report (maximum of 4 grade points).
During laboratory practicals, the oral examination of the student can be performed by the teacher.

Seminars

Throughout the course, 12 seminars are planned during which students can achieve 8 grade points.
A student can obtain a maximum of 6 grade points through short written exams and additional 2 grade points through active participation.

Final exam

The final exam is mandatory and comprises written and oral assessment. During the final exam, students can gain a maximum of 30 credits, 15 credits in the written part and 15 credits during the oral assessment. Students are required to meet the minimum criteria for both parts of the final exam.

The written and the oral part of the final exam cover the entire course content.
The written part of the final exam consists of 30 multiple choice questions. In order to meet minimum criteria and earn grade points, students must have 50% of correctly solved questions.

Achievements during the written part of the final exam will be converted into grade points according to the criteria shown in Table 3. In case when a student did not achieve the minimum criteria on the written part of the final exam, attending the final exam on the following exam term is mandatory.

Assessment of the oral part of the final exam:
7.5 credits: minimum criteria satisfied
8 - 9 credits: average criteria satisfied with noticeable errors
10 - 12 credits: answer with a few errors
13 - 15 credits: outstanding answer.

In order to pass the final exam, a student must achieve at least 50% of positive answers on both written and oral parts of the final exam.
If the student is not satisfied with the final grade, he/she may refuse the grade. In case a student does not accept the grade, he/she must re-enter the final exam.

Table 3. Evaulation of the written part of a final exam

% of correct answered questions	Grade points/credits
50.00 - 59.99	7.5
60.00 - 64.99	8
65.00 - 69.99	9
70.00 - 74.99	10
75.00 - 79.99	11
80.00 - 84.99	12
85.00 - 89.99	13
90.00 - 94.99	14
95.00 - 100.00	15

Conditions for admission to the final exam

A student who accomplishes 35 or more grade points during all course classes can access the final exam.
If a student achieves less than 35 grade points during all course classes, correction of the midterm exams will be organized.
A student who achieves less than 35 grade points during all course classes even after the correction of the midterm exams, or is absent for more than 30% of all forms of classes, is graded as unsuccessful (F) and must re-enter the course.

Final grade

The final grade represents a sum of all grade points obtained during all course classes and on the final exam. Students are evaluated according to the ECTS (A-F) and numerical (1-5) system.

The ECTS and the numerical grading system are defined by the following criteria:
A (5) 90 - 100 credits
B (4) 75 - 89.99 credits
C (3) 60 - 74.99 credits
D (2) 50 - 59.99 credits
F (1) 0 - 49.99 credits

Other important information regarding the course:

Teaching is held at the prescribed time and it is not possible to enter after the teacher enters. Food and beverages are not permitted in the classroom or in the laboratory. This includes plate lunches, drinks, candies, etc., whether opened or not. Likewise, cell phones are not allowed in the classroom during the midterm or final exams. Students must arrive on time for exam attendance. Anyone late for more than 15 minutes may be refused to undertake the exam.

Academic Honesty

It is expected that all students and teachers follow the code of academic honesty in accordance with the Code of ethics for the students of the Faculty of Medicine at the University of Rijeka.

Please read the policy regarding academic honesty at:

http://medical-studies-in-english.com/wp-content/uploads/2016/12/CODE-OF-ETHICS.pdf

Contact information

For questions and concerns, please feel free to contact us by e-mail or via the Department website.
If you want to speak with a teacher during office hours (each working day between 11:00 am and 13:00 am), please let us know by e-mail or in class.

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Expected competencies at course enrollment:

Students are expected to have basic knowledge of biology and chemistry.

COURSE SCHEDULE for academic year 2020./2021.

Date	Lectures (L)	Seminars (S)	Laboratory Practicals (LP)	Lecturer
1st week 02/10/2020	**L1** 11:00-12:00 Lecture room 1			D. Detel, Associate professor
06/10/2020			**LP1** (group I and II)08:00-11:00*	I.Potočnjak, PhD, Assistant
06/10/2020			**LP1** (group III and IV)12:00-15:00*	L. Batičić, Assistant professor L. Šimić, Assistant
06/10/2020			**LP1** (group V) 16:00-19:00	I.Potočnjak, PhD, Assistant
09/10/2020	**L2,3** 10:00-12:00 Lecture room 1*			D. Detel, Associate professor
2th week 12/10/2020		**S1** (group I) 09:00-11:00 Lecture room 6*		D. Detel, Associate professor
13/10/2020		**S1** (group II) 11:00-13:00 Lecture room 9*		D. Detel, Associate professor
14/10/2020	**L4** 12:00-13:00 Lecture room 1*			J. Marinić, Assistant professor
16/10/2020	**L5,6** 10:00-12:00 Lecture room 1*			J. Marinić, Assistant professor
3rd week 19/10/2020		**S2** (group I) 08:00-10:30 Lecture room 6*		I.Potočnjak, PhD, Assistant
20/10/2020			**LP2** (group I and II)08:00-11:00*	I.Potočnjak, Assistant
20/10/2020			**LP2** (group III and IV)12:00-15:00*	L. Batičić, Assistant professor L. Šimić, Assistant
20/10/2020			**LP2** (group V) 16:00-19:00	I.Potočnjak, PhD, Assistant
21/10/2020	**L7** 12:00-13:00 Lecture room 1*			J.Varljen, Full professor
22/10/2020		**S2** (group II) 13:00-15:30 Lecture room 9*		I.Potočnjak, Assistant
23/10/2020	**L8,9** 10:00-12:00 Lecture room 15*			J.Varljen, Full professor
4th week 26/10/2020		**S3** (group I) 08:30-10:30 Lecture room 6*		I.Potočnjak, PhD, Assistant

27/10/2020		**S3** (group II) 11:00-13:00 Lecture room 6*		I.Potočnjak, PhD, Assistant
28/10/2020	**L10** 12:00-13:00 Lecture room 8*			J. Marinić, Assistant professor
30/10/2020	**L11,12** 10:00-12:00 Lecture room 1*			D. Detel, Associate professor

5th week 2/11/2020		**S4** (group I) 08:00-10:00 Lecture room 6*		J. Marinić, Assistant professor
3/11/2020			**LP3** (group I and II)08:00-11:00	I.Potočnjak, PhD, Assistant
3/11/2020			**LP3** (group III and IV)11:00-14:00	L.Batičić, Assistant professor L. Šimić, Assistant
3/11/2020			**LP3** (group V) 16:00-19:00	I.Potočnjak, PhD, Assistant
4/11/2020	**L13** 12:00-13:00 Lecture room 1*			D. Detel, Associate professor
5/11/2020		**S4** (group II) 12:00-14:00 Lecture room 6*		J. Marinić, Assistant professor
6/11/2020	**L14,15** 10:00-12:00 Lecture room 8*			M.Tota, Associate professor
6th week 09/11/2020		**S5** (group I) 08:00-10:30 Lecture room 6*		L. Batičić, Assistant professor
10/11/2020		**S5** (group II) 11:00-13:30 Lecture room 5*		L. Batičić, Assistant professor
11/11/2020	**L16,17** 12:00-14:00 Lecture room 8*			J. Marinić, Assistant professor
13/11/2020	**Midterm exam I** 10:00 - 11:00 Lecture room 2			
7th week 16/11/2020		**S6** (group I) 08:30-11:00 Lecture room 7*		J. Marinić, Assistant professor
17/11/2020		**S6** (group II) 11:00-13:30 Lecture room 4*		J. Marinić, Assistant professor
20/11/2020	**L18,19** 10:00-12:00 Lecture room 1*			J. Marinić, Assistant professor
8th week 23/11/2020		**S7** (group I) 08:00-10:00 Lecture room 4*		L. Batičić, Assistant professor
25/11/2020	**L20,21** 12:00-14:00 Lecture room 1*			D. Detel, Associate professor
26/11/2020		**S7** (group II) 12:00-14:00 Lecture room 5*		L. Batičić, Assistant professor
27/11/2020	**L22,23** 10:00-12:00 Lecture room 1*			D. Detel, Associate professor
9th week 30/11/2020		**S8** (group I) 08:00-10:30 Lecture room 9*		J. Marinić, Assistant professor

1/12/2020			**LP4** (group I and II)08:00-11:00	I.Potočnjak, PhD, Assistant

1/12/2020			**LP4** (group III and IV)12:00-15:00	L. Batičić, Assistant professor L. Šimić, Assistant
1/12/2020			**LP4** (group V) 16:00-19:00	I.Potočnjak, PhD, Assistant
2/12/2020	**L24** 12:00-13:00 Lecture room 1*			D. Detel, Associate professor
3/12/2020		**S8** (group II) 12:00-14:30 Lecture room 7*		J. Marinić, Assistant professor
4/12/2020	**L25,26** 10:00-12:00 Lecture room 1*			J. Marinić, Assistant professor L. Batičić, Assistant professor
10th week 07/12/2020		**S9** (group I) 08:30-11:00 Lecture room 9*		D. Detel, Associatet professor
09/12/2020	**L27** 12:00-13:00 Lecture room 8*			L. Batičić, Assistant professor
10/12/2020		**S9** (group II) 11:00-13:30 Lecture room 6*		D. Detel, Associate professor
11/12/2020	**L28,29** 10:00-12:00 Lecture room 15*			L. Batičić, Assistant professor
11th week 15/12/2020			**LP5** (group I and II) 08:00-10:30	I.Potočnjak, PhD, Assistant
15/12/2020			**LP5** (group Iil and IV)11:00-13:30	L. Batičić, Assistant professor L. Šimić, Assistant
15/12/2020			**LP5** (group V) 16:00-19:00	I.Potočnjak, PhD, Assistant
16/12/2020	**L30** 12:00-13:00 Lecture room 1*			D. Detel, Associate professor
18/12/2020	**L31 Midterm exam II** 10:00-11:00 Lecture room 2			D. Detel, Associate professor
12th week 21/12/2020		**S10** (group I) 08:00-10:30 Lecture room 9*		I.Potočnjak, PhD, Assistant
22/12/2020		**S10** (group II) 12:00-14:30 Lecture room 4*		I.Potočnjak, PhD, Assistant
23/12/2020	**L 32,33** 11:00-13:00 Lecture room 8*			D. Detel, Associate professor
13th week 7/1/2021		**S11** (group I) 12:30-15:00 Lecture room 9*		J.Marinić, Assistant professor
8/1/2021	**L34,35** 10:00-12:00 Lecture room 1*			D. Detel, Associate professor J.Marinić, Assistant professor
14th week 11/1/2021		**S12** (group I) 08:00-10:30 Lecture room 7*		I.Potočnjak, PhD, Assistant

11/1/2021		**S11** (group II) 11:00-13:30 Lecture room 7*		J.Marinić, Assistant professor

12/1/2021			**LP6** (group I and II)08:00-11:00	I.Potočnjak, PhD, Assistant
12/1/2021			**LP6** (group III i IV)12:00-15:00	L. Šimić, Assistant
			LP6 (group V) 16:00-19:00	I.Potočnjak, PhD, Assistant
13/1/2021	**L36,37** 12:00-14:00 Lecture room 1*			J.Marinić, Assistant professor
14/1/2021		**S12** (group II) 12:00-14:30 Lecture room 9*		I.Potočnjak, PhD, Assistant
15/1/2021	**L38,39** 10:00-12:00 Lecture room 1*			D.Detel, Associate professor
15th week 19/1/2021			**LP7** (group I and II) 08:00-11:00	I.Potočnjak, PhD, Assistant
19/1/2021			**LP7** (group III and IV) 12:00-15:00	L.Batičić, Assistant professor L. Šimić, Assistant
19/1/2021			**LP7** (group V) 16:00-19:00	L. Šimić, Assistant
20/1/2021	**L40,41** 11:00-13:00 Lecture room 1*			D.Detel, Associate professor
21/1/2021		**S13** (group I and II) 14:00-16:00		D.Detel, Associate professor J.Marinić, Assistant professor
16th week 25/1/2021			**LP8** (group I and II) 08:00-11:00	I.Potočnjak, PhD, Assistant
26/1/2021			**LP8** (group III and IV) 8:00-11:00	L.Batičić, Assistant professor
27/1/2021			**LP8** (group V) 08:00-11:00	L. Šimić, Assistant
27/1/2021	**Midterm exam III** (the time and place of the exam will be announced)			
9/2/2021	**CORRECTION TEST I-III** (the time and place of the exam will be announced)			
23/2/2021	**CORRECTION TEST I-III** (the time and place of the exam will be announced)			

*Taking into consideration the current epidemiological situation of COVID-19, during the winter semester of the academic year 2020/2021 the lectures and seminars will be held online at given time (e.g. through the MS Teams app).

According to the course coordinator decision, specific lectures and seminars will be held on site. Possible changes in the course timetable will be announced in advance. Students are expected to regularly check the Merlin platform for updates.

List of lectures, seminars, and laboratory practicals:

	Topics of the Lectures	Teaching Hours	Lecture Room
L1	Importance of biochemistry in understanding health and disease and the application of biochemistry in clinical practice.	1	1
L2	Enzymes. Clasification of enzymes. The kinetics of enzyme catalysis.	1	1
L3	Regulation of enzymatic activity.	1	1
L4	Digestion and absorption of carbohydrates	1	1
L5	Metabolic pathways of carbohydrates. Glycolysis.	1	1
L6	Regulation of glycolysis.	1	1
L7	Oxidative decarboxylation of ketoacids. Oxidation of pyruvate.	1	1
L8	The Citric acid cycle: degradation of acetyl-CoA.	1	15
L9	Regulation of the citric acid cycle.	1	15
L10	Gluconeogenesis.	1	8
L11	Metabolism of Glycogen.	1	1
L12	Regulation of glycogen metabolism.	1	1
L13	The penthose phosphate pathway.	1	1
L14	The respiratory chain.	1	8
L15	Energetics and principles of the respiratory chain.	1	8
L16	Digestion and absorption of lipids.	1	8
L17	Fat mobilization.	1	8
L18	Oxidation of fatty acids.	1	1
L19	Biosynthesis of fatty acids.	1	1
L20	Biosynthesis of triacyglycerols and phospholipids.	1	1
L21	Glycolipids: structure, biosynthesis, and biodegradation.	1	1
L22	Biosynthesis and metabolism of cholesterol.	1	1
L23	Biosynthesis and metabolism of bile acids.	1	1
L24	Lipoproteins. Classification and its role in metabolism.	1	1
L25	Metabolism of xenobiotics.	1	1
L26	Nucleic acid structure and function.	1	1
L27	Replication. RNA synthesis. Regulation of gene expression.	1	8
L28	Protein syntesis. Posttranslational modification of proteins.	1	15
L29	Intracellular traffic and sorting of proteins.	1	15
L30	Metabolism of proteins. Digestion and absorption of proteins.	2	1
L31	Midterm exam	1	2
L32	Metabolism of amino acids. Decarboxylation.	1	8
L33	Transamination. Oxidative deamination.	1	8
L34	Urea cycle.	1	1
L35	Signal molecules.	1	1
L36	Receptors and signal transduction.	1	1

L37	Hormonal regulation of metabolism.	1	1
L38	Regulation of metabolic pathways.	1	1
L39	Relationships in intermediary metabolism.	1	1
L40	Clinical importance of AST, ALT, GLDH, γGT, and CHE.	1	1
L41	Clinical importance of CK, ALP, LDH, lipase, and amylase.	1	1
	Total number of lectures	**42**	

	Topics of Seminars (S)	Teaching Hours	Lecture Room
2nd week S1	Enzymes	2	Group I: 6 Group II: 9
3trd week S2	Cofactors. Water soluble vitamins.	3	Group I: 6 Group II: 9
4th week S3	Biochemically important reactions	2	Group I: 6 Group II: 6
5th week S4	Metabolism of carbohydrates	2	Group I: 6 Group II: 6
6th week S5	Function and structure of respiratory chain complexes	3	Group I: 6 Group II: 5
7th week S6	Free radicals, oxidative stress, and antioxidants' structure and nature	3	Group I: 7 Group II: 4
8th week S7	Fat soluble vitamins.	2	Group I: 4 Group II: 5
9th week S8	Metabolism of lipids	3	Group I: 9 Group II: 7
10th week S9	Metabolizam of iron, porphyrins, and bile pigments	3	Group I: 9 Group II: 6
12th week S10	Function of the liver in metabolism	3	Group I: 9 Group II: 4
13th week S11	Catabolism of carbon skeletons of amino acids. Metabolic transformation of individual amino acids.	3	Group I: 9 Group II:7
14th week S12	Plasma proteins and their physiological, biochemical, and diagnostic functions	3	Group I: 7 Group II: 9
15th week S13	Oral colloqium and Consultation(s)	2	
	Total	**34**	

	Topics of Laboratory Practicals (LP)	Teaching Hours	Lecture Room
1st week LP1	**Methods in biochemistry**	4	Online
3rd week LP2	**Factors affecting enzymatic activity** The influence of pH, temperature, and substrate concentration on the enzymatic activity. Determination of the type of enzyme inhibition.	4	Online
5th week LP3	**Qualitative and quantitative analysis of carbohydrates** Quantitative determination of glucose in blood. Detection of glucose in urine.	4	Department of Chemistry and Biochemistry
9th week LP4	**Electrophoresis of lipoproteins** Quantitative determination of triglycerides in serum. Detection of ketone bodies in urine. Determination of total cholesterol in serum. Determination of serum HDL and LDL cholesterol in serum.	4	Department of Chemistry and Biochemistry
11th week LP5	**Determination of iron concentration in serum** Determination of TIBC and UIBC. Detection of hemoglobin/bilirubin in urine.	3	Department of Chemistry and Biochemistry.
14th week LP6	**Determination of non-protein nitrogen compounds:** urea, creatinine, and uric acid in urine. Detection of nitrites in urine.	3	Department of Chemistry and Biochemistry
15th week LP7	**Determination of clinically important enzymes:** ALT, AST, ALP, CHE, and γGt.	4	Department of Chemistry and Biochemistry
16th week LP8	**Clinical laboratory** Biological material and processing in clinical bichemistry Biochemical results and and their interpretation	4	Clinical Hospital Center Rijeka
LP9	**Midterm exam**	4	
	Total	**34**	

	Final exam dates
1.	11.02.2021.
2.	25.02.2021.
3.	08.07.2021.
4.	02.09.2021.
5.	16.09.2021.