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**PHYSIOLOGY AND
PATHOPHYSIOLOGY III
(25 pages)**

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

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Faculty of Medicine in Rijeka

Course: Physiology and Pathophysiology III

Course Coordinator: Zlatko Trobonjača, MD, PhD, Full Professor

Department: Department of Physiology, Immunology, and Pathophysiology

Study: Integrated Undergraduate and Graduate University Study of Medicine in English

Year of the study: Third

Academic year: 2020/2021

COURSE SYLLABUS

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

The basic aim of this course is to enable the students to acquire knowledge about the physiological mechanisms of the gastrointestinal and hepatobiliary system, the metabolism and regulation of body temperature, and the morphological and functional structure of the endocrine system. Also, the aim of this course is to enable the students to acquire knowledge about the pathophysiological mechanisms and impaired functioning of the gastrointestinal and hepatobiliary system, basic and specific metabolic disorders and endocrinopathies. Encouraging horizontal and vertical integration of knowledge on natural courses of physiological and etiopathogenetic processes will contribute to the understanding of the specificity of the etiological factor activity, i.e. the mechanism of origin, course, and local and systemic consequences of different diseased states.

The course is performed in the winter semester at the third year of study, in the form of lectures (34 teaching hours), seminars (45 teaching hours), and practicals (25 teaching hours), which totals 10 ECTS credits. **A) Lectures** are a form of classes that provide an introduction and an overview of a thematic unit that is taught in more detail on seminars and practicals. **B) Seminars** and **C) practicals** are a form of classes where students actively **review** and **critically discuss** physiological and pathophysiological mechanisms (of certain morphological and functional units), which are then explained at the molecular, microenvironmental, organic, systemic and whole-organism level. Active participation of students in the curriculum program is further achieved by **D) studying** natural integrators of etiopathogenetic events, the so-called etiopathogenetic clusters, **E) performing** practicals in the laboratory and on computer programs that simulate pathological conditions and provide clinical correlates of certain diseases, and **F) performing** presentations of certain teaching unit content (PowerPoint presentations).

Class attendance and student participation in all forms of classes are compulsory in accordance with the Law and the Statute of the Faculty of Medicine in Rijeka. Accordingly, student attendance at lectures, seminars, and practicals will be regularly checked. Only justifiable absences due to, for example, illness will be acceptable within the limits allowed and according to the Ordinance on Studies.

The student is obligated to prepare in advance the predefined material that is being discussed on seminars and practicals. The teacher/course coordinator continuously evaluates student participation throughout seminars and practicals (demonstrated knowledge, the ability to correlate morphological, ultrastructural, biochemical and/or functional factors into a complete image of physiological functional systems and certain diseased states). Student activity during classes (lectures, seminars, practicals) is certified in the daily work log.

Lectures, seminars, and practicals take place according to the Syllabus. Schedule of students by groups can be found on the SharePoint platform of the Department of Physiology and Immunology at the following website: https://spp.uniri.hr/ss_medri/katedre/427 - accessed via an **AAI address**.

Required reading:

1. **Guyton A.C., Hall J.E. Textbook of Medical Physiology** (13th edition), Elsevier, 2016.
2. **Gamulin S., Marušić M., Kovač Z. Pathophysiology** (7th edition), Medicinska naklada Zagreb, 2014.
3. **Kovač Z. et al. Clinical Pathophysiology – Etiopathogenetic Nodes** (Third Book: I-IV part). Medicinska naklada Zagreb 2013.
4. **Rukavina, D., Radošević Stašić, B., Lučin, P., Ćuk, M. Handbook for Practicals in Physiology, Neurophysiology, and Immunology**, Department of Physiology, Immunology, and Pathological Physiology, Faculty of Medicine in Rijeka, October 2001.

Recommended for additional reading:

1. **Ganong, W.F. Review of Medical Physiology**, (21st edition) Lange Medical Books / McGraw-Hill, Medical Pub. Division, New York 2004.
2. **Vrhovac B. et al. Interna medicina [Internal Medicine]**, (4th edition), Naklada Ljevak, Zagreb 2008.
3. **McPhee, S.J., Ganong, W.F. Pathophysiology of Disease. An introduction to Clinical medicine**, (5th edition), Lange Medical Books / McGraw-Hill, Medical Pub. Division, New York 2006.

Course teaching plan:

List of lectures (with titles and learning outcomes):

Lecture 1. Gastrointestinal physiology: part I

Learning outcomes:

- To describe the general principles of the gastrointestinal wall structure.
- To describe the electrical activity of the gastrointestinal smooth muscle.
- To explain the blood circulation of the digestive system.
- To describe the functional movements of the digestive system.
- To describe the neural control of gastrointestinal functions (intestinal nervous system).
- To explain food intake, chewing, and swallowing.
- To describe the functions of the stomach, the movements of the small and large intestine.

Lecture 2. Gastrointestinal physiology: part II

Learning outcomes:

- To define general and locally specific principles of secretion in the digestive system.
- To explain digestion and absorption of various nutrients (carbohydrates, proteins, fats) in certain segments of the digestive system.

Lecture 3. Pathophysiology of gastrointestinal system

Learning outcomes:

- To describe the disorders of the throat, esophagus, and stomach.
- To explain the disorders of the exocrine pancreatic function.
- To describe the disorders of the small and large intestine.
- To explain the pathophysiological forms and consequences of diarrhea.
- To explain the mechanism and consequences of vomiting.
- To describe the causes and consequences of ileus.

Lecture 4. Metabolism of proteins and carbohydrates

Learning outcomes:

To describe the physiology of protein metabolism.
To explain the etiological factors, mechanisms, and consequences of impaired protein metabolism.
To explain the causes and consequences of protein deficiency.
To explain the mechanisms and effects of primary and secondary malnutrition.
To explain the physiology of carbohydrate metabolism and adenosine triphosphate formation.
To explain the etiological mechanisms and consequences of impaired carbohydrate metabolism.
To describe the causes and effects of hyperglycemia.
To describe the causes and effects of hypoglycemia.
To explain the disorders of glycogen metabolism.

Lecture 5. Lipid metabolism

Learning outcomes:

To describe the physiology of lipid metabolism.
To describe the causes, mechanisms, and pathophysiological effects of lipoprotein disorders (primary and secondary hyperlipoproteinemia, other disorders of lipoprotein metabolism).
To describe the causes, mechanisms, and pathophysiological effects of lipid deposition disorders (lipidosis, atherosclerosis, and obesity).

Lecture 6. Liver physiology

Learning outcomes:

To explain the macromorphological and micromorphological structure of the liver.
To describe the basic function unit – hepatic lobule.
To explain blood flow through the liver and the hepatic macrophage system.
To describe the system of lymph glands in the liver.
To describe the liver metabolism of carbohydrates, amino acids, and ammonia.
To explain the synthesis and degradation of proteins in the liver (glycoproteins, angiotensinogen, coagulation factors, hematopoietic factors, acute phase proteins).
To describe the detoxification mechanisms (drugs, toxic substances).
To describe the alcohol metabolism.
To explain the hormone metabolism.
To describe the metabolism of lipids (fatty acids and triglycerides) and cholesterol.
To explain the bilirubin metabolism.
To describe the biliary tree and the creation, excretion, and role of bile in the digestion and absorption of fat.
To describe the iron and vitamin storage in the liver.

Lecture 7. Disorders of hepatobiliary system: part I

Learning outcomes:

To explain the etiopathogenesis of metabolic and infiltrative liver diseases (metabolic disorders of bilirubin, jaundice, fatty liver).
To understand the etiopathogenesis of viral hepatitis (A, B, C, D, E) and autoimmune hepatitis.
To define toxic and medicated damage to the liver.
To explain the pathogenesis of alcoholic liver disease.

Lecture 8. Disorders of hepatobiliary system: part II

Learning outcomes:

To describe the pathogenesis of alcoholic, posthepatic, primary biliary, secondary biliary, and cardiac liver cirrhosis.
To understand the development of complications of liver cirrhosis (portal hypertension, ascites, spontaneous bacterial peritonitis, hepatic encephalopathy, hepatorenal syndrome, hepatopulmonary syndrome, hypersplenism, coagulopathy).
To describe diseases of the biliary system (gallstones, cholangitis).

Lecture 9. Disorders of exocrine pancreas function – acute and chronic pancreatitis

Learning outcomes:

To describe the physiological structure of the exocrine part of the pancreas.
To describe water and electrolyte secretion.
To explain formation and secretion of pancreatic digestive enzymes.

To describe control over pancreatic secretion.
To describe cystic fibrosis of the pancreas.
To explain the etiopathogenic factors, course, and complications of (local, systemic) acute pancreatitis.
To explain the etiopathogenic factors, course, and complications of chronic pancreatitis.

Lecture 10. Introduction to endocrinology, Pituitary hormones

Learning outcomes:

To explain the structure of the endocrine system and the mechanisms of hormone activity.
To explain the mechanisms of adeno and neuro pituitary hormone production and function and their hypothalamic control.
To understand the causes and consequences of increased and decreased hormone secretion.
To understand the causes and consequences of disorders in the target tissue of the hormone.
To explain the disorders of hormone metabolism and regulation of hormonal systems.
To explain the pituitary function disorders.

Lecture 11. Thyroid Metabolic hormones

Learning outcomes:

To explain the production, secretion, and physiological functions of thyroid metabolic hormones.
To understand thyroid function disorders: thyrotoxicosis, hyperthyroidism, hypothyroidism, and goiter.

Lecture 12. Adrenocortical hormones

Learning outcomes:

To explain the production, secretion, and physiological functions of adrenal cortex hormones.
To understand the causes, course, and consequences of hyperfunction and hypofunction of the adrenal cortex.
To understand the disorders of the adrenal gland core.

Lecture 13. Parathyroid Hormone, calcitonin, calcium and phosphate metabolism

Learning outcomes:

To explain the production, secretion, and action of parathyroid hormone and calcitonin.
To understand the mechanisms for maintaining calcium and phosphate metabolism.
To explain calcium, phosphate, and magnesium turnover disorders.
To explain disorders with increased or decreased parathyroid hormone formation.
To explain disorders with increased or decreased calcitonin formation.

Lecture 14. Insulin, glucagon, and diabetes mellitus

Learning outcomes:

To understand the mechanisms of production, secretion, and metabolic effects of insulin, glucagon, and somatostatin.
To explain the causes and consequences of impaired insulin, glucagon, and somatostatin action.
To understand the etiopathogenesis of various types of diabetes.
To explain the course and acute and chronic consequences of diabetes.

Lecture 15. Predictors and clinical implications of metabolic syndrome

Learning outcomes:

To define the components of the metabolic syndrome.
To describe the inherited and acquired etiopathogenic factors of the metabolic syndrome.
To define the role of obesity (adipokine production and release of nonesterified fatty acids from adipose tissue and their action and ectopic accumulation in muscle tissue, liver, and pancreas) in the development of the metabolic syndrome.
To describe the release of PAI-1, TNF, IL-6, and resistin, the role in the progression of the metabolic syndrome.
To define the role of insulin resistance in the metabolic syndrome.
To describe the mechanisms and the role of atherogenic dyslipidemia, hypertension, hyperglycemia, prothrombotic, and failure status in the development of cardiovascular diseases.

Lecture 16. Reproductive functions and sex hormones

Learning outcomes:

To describe the functional structure of male genitalia.
To describe the spermatogenesis and the male sexual act.

To understand the chemical structure, secretion, metabolism, and effects of male sex hormones.
To describe the disorders of male sexual functions.
To understand the functional anatomy of female genitalia.
To describe the female sex hormone system.
To describe the monthly ovarian cycle and the function of gonadotropic hormones.
To clarify the ovarian hormone functions, estradiol and progesterone.
To describe the interaction of ovarian and hypothalamic-pituitary hormones.
To explain the female sexual act.
To describe pregnancy, lactation, and the physiology of the fetus and newborn.

Lecture 17. Integral organismic reactions to noxious stimuli

Learning outcomes:

To describe the strategy of the systemic pathobiological response of the organism under noxious stimuli.
To explain stress – spontaneous systematic directing of reactivity.
To describe acute-phase response during an inflammatory process.
To understand systemic inflammatory response and multiple organ failure.
To describe the immunological patterns of systemic response.
To understand healing and fibrosation processes and changes in tissue architecture (remodeling).

List of seminars (with titles and learning outcomes):

Seminar 1. Gastrointestinal physiology

Learning outcomes:

To explain the general principles of the gastrointestinal wall structure, blood circulation, and digestive tract mobility.
To describe the neural control of gastrointestinal functions.
To explain functional movements, suppression, and mixing of food in the digestive system.
To define general and locally specific principles of secretion in the digestive system.
To explain the digestion and absorption of different nutrients (carbohydrates, proteins, fats) in particular segments of the digestive system.

Seminar 2. Pathophysiology of gastrointestinal system

Learning outcomes:

To explain the functional disorders of the pharynx, esophagus, stomach, exocrine part of the pancreas, small and large intestine.
To explain the pathophysiological forms of diarrhea and the vomiting mechanism.
To understand the causes and consequences of ileus.

Seminar 3. Metabolism of proteins and carbohydrates

Learning outcomes:

To explain the physiology of carbohydrate metabolism and adenosine triphosphate formation.
To explain the etiological mechanisms and consequences of impaired carbohydrate metabolism.
To understand the causes and effects of hyperglycemia.
To understand the causes and effects of hypoglycemia.
To explain the disorders of glycogen metabolism.
To understand the physiology of protein metabolism.
To explain the etiological mechanisms and consequences of impaired protein metabolism.
To understand the causes and consequences of protein deficiency.
To explain the mechanisms and effects of primary and secondary malnutrition.

Seminar 4. Lipid metabolism

Learning outcomes:

To understand the physiology of lipid metabolism.
To describe the causes, mechanisms, and pathophysiological effects of lipoprotein disorders.
To describe the causes, mechanisms, and pathophysiological effects of lipid deposition disorders.

Seminar 5. Dietary Balances, regulation of feeding, metabolism, body temperature regulation

Learning outcomes:

To understand the mechanisms and importance of maintaining a balanced diet and regulating food intake (obesity and fasting).

To describe the energetics and intensity of metabolism.

To explain the mechanisms of maintaining normal body temperature.

To describe the organism's response to environmental temperature changes.

To explain the pathogenetic causes, course, and consequences of hyperthermia and hypothermia.

Seminar 6. Metabolism of specific metabolic substances

Learning outcomes:

To explain the metabolism and mechanisms of action of vitamins and minerals.

To explain the etiopathogenesis of turnover disorders of specific metabolic substances.

To understand vitamin change disorders (hypovitaminosis, hypervitaminosis).

To understand the disorders in changes of elements in traces.

Seminar 7. General endocrinology, pituitary gland

Learning outcomes:

To explain the structure of the endocrine system and the mechanisms of hormone action.

To explain the mechanisms of adeno and neuro pituitary hormone production and action and their hypothalamic control.

To understand the causes and consequences of increased and decreased hormone secretion.

To understand the causes and consequences of disorders in the target hormone tissue.

To explain disorders of hormone metabolism and regulation of hormone systems.

To explain impaired function of the anterior and posterior pituitary lobe.

Seminar 8. Thyroid and adrenal gland

Learning outcomes:

To explain the production, secretion, and physiological functions of thyroid metabolic hormones.

To understand thyroid function disorders: thyrotoxicosis, hyperthyroidism, hypothyroidism, asphyxiation.

To explain the production, secretion, and physiological functions of adrenal cortex hormones.

To understand the causes, course, and consequences of hyperfunction and hypofunction of the adrenal cortex.

To understand the disorders of the adrenal gland core.

Seminar 9. Parathyroid glands

Learning outcomes:

To explain the production, secretion, and action of parathyroid hormone and calcitonin.

To understand the mechanisms of maintaining calcium and phosphate metabolism.

To explain the disorders of calcium, phosphate, and magnesium turnover.

To explain the disorders with increased and decreased parathyroid hormone production.

To explain the disorders with increased and decreased calcitonin formation.

Seminar 10. Endocrine pancreas, diabetes mellitus

Learning outcomes:

To understand the mechanisms of production, secretion, and metabolic effects of insulin, glucagon, and somatostatin.

To explain the causes and consequences of impaired insulin, glucagon, and somatostatin action.

To understand the etiopathogenesis, course, and acute and chronic consequences of diabetes.

Seminar 11. Reproductive functions and sex hormones

To explain the formation, secretion, and action of male and female sex hormones.

To understand biofeedback mechanisms in the regulation and function of sex hormones.

To explain hormonal effects in pregnancy.

List of practicals (with titles and learning outcomes):

Practical 1: Gastrointestinal system and metabolism

Learning outcomes:

I. Theoretical part:

To understand the material discussed on lectures (content of the L 1., L 2., L 3., L 4.) and seminars (content of the S 1., S 2., S 3., S 4., S 5., S 6.). This material covers the fields of physiology and pathophysiology of the digestive system, normal and impaired metabolism of proteins, carbohydrates, and lipids, as well as the fields of nutrition, energetics, metabolism intensity and thermoregulation.

II. Practical part:

To describe the performance and to understand the effects of vagus stimulation and histamine injection on gastric secretion.

To solve the study guide algorithms of the digestive system and metabolism.

Textbook: Zdenko Kovač, Stjepan Gamulin editors: Study guide algorithms – problem solver (Book two) Medicinska naklada Zagreb, 2011.:

Problem 22. Molecular-cellular pathogenesis of familial hypercholesterolemia (str.103 –106)

Problem 2. Etiopathogenesis of cystic fibrosis (str.5 – 8).

Problem 117. Pathophysiology of gluten sensitive enteropathy (str. 530-533).

Problem 118. Pathogenesis of diarrhea in the cholera syndrome (str. 534-537).

Problem 119. Pathophysiology of peptic disease in the course of gastrinoma (Zollinger- Ellison syndrome) (str. 538-541)

Practical 2: Liver physiology and pathophysiology

Learning outcomes:

I. Theoretical part:

To understand the material discussed on lectures (content of the L 5., L 6., L 7., L 8.; L9). This material covers the field of physiology and pathophysiology of the hepatobiliary system and the field of physiology and pathophysiology of the pancreas.

II. Practical part:

To explain the performance and consequences of ligation of the ductus choleductus in a rat.

To solve the study guide algorithms of liver physiology and pathophysiology:

Textbook: Zdenko Kovač, Stjepan Gamulin editors: Study guide algorithms – problem solver (Book two) Medicinska naklada Zagreb, 2011.:

Problem 122. Pathophysiology of liver cirrhosis (str. 550 – 554).

Problem 124. Pathophysiology of the obstructive icterus caused by cholelithiasis (str. 561-564).

Problem 125. Pathophysiology of acute cholecystitis (str. 565 – 568).

Problem 126. Pathophysiology of acute liver failure in hepatitis B (str. 569 – 573).

Practical 3: Sports Physiology

Learning outcomes:

I. Theoretical part:

To understand the effect of low oxygen pressure on the body.

To explain physiological problems in deep-sea diving and other hyperbaric conditions.

To describe the sports physiology.

II. Practical part:

To explain the performance of biofeedback tests.

To describe the performance and significance of the physiology of aerobic exercises.

To solve the etiopathogenetic clusters of liver physiology and pathophysiology:

Practical 4: Endocrinology

Learning outcomes:

I. Theoretical part:

To understand the material discussed on lectures (content of the L 9., L 10., L 11., L 12., L 13., L 14.) and seminars (content of the S 7., S 8., S 9., S 10.). This material covers the fields of physiology and pathophysiology of general endocrinology, pituitary hormones, thyroid metabolic hormones, adrenal cortex hormones, parathyroid hormone, calcitonin, calcium and phosphate metabolism, and insulin, glucagon, and diabetes.

II. Practical part:

To explain the performance and effect of thyroid hormone on oxygen consumption.

To explain the performance and effect of inducing hypocalcemic tetany in rats.

To explain the performance and significance of Thorn's test in rats.

To explain the performance and effects of insulin hypoglycemia in rats.

To explain the performance and significance of the glucose tolerance test.

To solve the study guide algorithms of the endocrine system.

Textbook: Zdenko Kovač, Stjepan Gamulin editors: Study guide algorithms – problem solver (Book two) Medicinska naklada Zagreb, 2011.:

Problem 36. Pathophysiology of hyperfunctioning thyroid adenoma caused by a point mutation in the thyrotropin receptor (str. 168 – 172).

Problem 38. Pathophysiology of hyperosmolar syndrome in the course of newly diagnosed diabetes mellitus (str. 178 – 182)

Problem 20. Pathogenesis of diabetes mellitus related chronic complications (str. 93 – 97)

Problem 39. Pathogenesis of primary aldosteronism (Conn's syndrome) (str. 183 – 186)

Problem 40. Pathophysiology of Cushing's disease (str. 187 – 190)

Practical 5: Reproduction

Learning outcomes:

I. Theoretical part:

To understand the material discussed on lectures (content of the L 15.). This material covers the field of physiology and pathophysiology of reproductive functions and sex hormones.

To describe the reproductive and hormonal functions in men.

To explain the action of the epiphysis.

To understand the physiology of women before pregnancy and the effects of female sex hormones.

To describe pregnancy and lactation.

To explain the physiology of the fetus and newborn.

II. Practical part:

To describe the performance and significance of demonstrating chorionic gonadotropin in the urine of pregnant women with the Asheim–Zondek test.

To explain the performance and significance of the effect of sex hormones on cytological findings of the vaginal smear in female rats.

To solve the study guide algorithms of reproduction.

Textbook: Zdenko Kovač, Stjepan Gamulin editors: Study guide algorithms – problem solver (Book two) Medicinska naklada Zagreb, 2011.:

Problem 71. Pathogenesis of fetal erythroblastosis (str. 330 – 333).

Problem 37. Pathophysiology of adrenocortical insufficiency syndrome (str. 173 – 177).

WARNING: students are obligated to bring the following items on practical classes: a) lab coat and b) Handbook for Practicals in Physiology, Neurophysiology, and Immunology, which is available in the electronic form on the Department's website (can be downloaded from the SharePoint platform of the Department of Physiology).

Student obligations:

Students are obligated to regularly attend and actively participate in all forms of classes. The student should be prepared for seminar and practical classes and familiarize with the material from the syllabus for each seminar and practical.

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

ECTS grading system:

Student work will be evaluated during classes and at the final exam. A maximum of **70 grade points** can be obtained during classes and up to **30 grade points** at the final exam, which totals **100 grade points**.

I. The following components are evaluated during classes (up to 70 grade points):

- a) acquired knowledge (up to 56 grade points)
- b) participation in classes (up to 10 grade points)
- c) class attendance (up to 4 grade points)

a) acquired knowledge (up to 56 grade points)

During classes, acquired knowledge will be evaluated by means of **two tests comprising 50 questions**. The **first test** will be held after teaching the following content: **physiology and pathophysiology of metabolism, digestive and hepatobiliary systems**. The **second test** will be held after teaching the following content: **physiology and pathophysiology of the endocrine system**. A student may obtain up to **28 grade points** on each test as follows:

Correct answers	Grade points
48,49,50	28
46,47	27
44,45	26
42,43	25
40,41	24
38,39	23
36,37	22
34,35	21
32,33	20
30,31	19
28,29	18
25,26,27	17

A student can access the correction of the first and second midterm exam if they did not obtain a minimum criteria the first time, in case of absence at the midterm exam the first time, or if they are not satisfied with the obtained credits at the exam the first time. If a student retakes the midterm exam because they are not satisfied with the obtained grade points, only the credits obtained at the retaken midterm exam will be considered. Correction of midterm exams will take place between two exam terms in February 2020.

b) participation in classes (up to 10 grade points)

Based on oral discussions and/or written tests, student knowledge is graded at all seminar classes. A student can obtain grade points during classes only if they were **graded** at least 9 times out of a total of 11 possible seminars. The obtained average grade is converted into grade points as shown in the table:

Average grade	Grade points
4.26 – 5.0	10
3.76 – 4.25	8
3.26 – 3.75	6
2.76 – 3.25	4
2.00 – 2.75	3

c) class attendance (up to 4 grade points)

By attending all forms of classes (lectures, seminars, practicals), students can obtain grade points in the following way:

100%	4 grade points
90%-99%	3 grade points
80%-89%	2 grade points
70%-79%	1 grade points

II. Final exam (up to 30 grade points)

The final exam consists of an oral and a written part. A student must solve **at least 50% of the test** in order to access the oral part of the final exam. The written and the oral part of the final exam comprise a sum, and the final grade corresponds to the total number of grade points as shown in the table:

Total number of grade points	Grade
15 – 17	sufficient (2)
18 -22	good (3)
23 – 26	very good (4)
27 - 30	excellent (5)

Out of the total number of grade points obtained at the written part of the final exam, the student can obtain a maximum of 25 grade points, and a minimum of 13 grade points as shown in the table:

Correct answers	Number of grade points
78,79,80	25
75,76,77	24
72,73,74	23
68,69,70,71	22
64,65,66,67	21
60,61,62,63	20
57,58,59	19
54,55,56	18
51,52,53	17
48,49,50	16
46,47	15
43,44,45	14
40,41,42	13

A student can access the oral part of the final exam only if they obtained a minimum of 13 grade points (at least 50% of the test) at the written part of the final exam. A student can obtain grade points at the oral part of the exam as shown in the table:

Grade obtained at the oral part of the final exam	Number of grade points obtained at the oral part of the final exam
excellent (5)	5
very good (4)	4
good (3)	3
sufficient (2)	2
insufficient (1)	0

Who can access the final exam:

Students who obtained 35-70 grade points during classes are obligated to access the final multiple-choice questions (MCQ) test, where they can obtain additional grade points.

- **Students who obtained less than 35 grade points during classes or were absent for more than 30% of classes** are not allowed to access the final exam.

III. The final grade represents the sum of all grade points obtained during classes and at the final exam. It is based on the absolute redistribution according to the following scale:

A (90-100%)	excellent (5)
B (75-89,9%)	very good (4)
C (60-74,9%)	good (3)
D (50-59,9%)	sufficient (2)
(student who has solved less than 50% of the test at the final exam)	insufficient (1)

COURSE SCHEDULE for the academic year 2020/2021

Date	Lectures (time and place)	Seminars (time and place)	Practicals (Time and place)	Lecturer
01/10/2020	L1 (10.15 – 12.00) Lecture room 8 On-line			Z. Trobonjača, MD, PhD, Full Professor
01/10/2020	L2 (12.15 – 14.00) Lecture room 8 On-line			T. Grubić Kezele, MD, PhD, Assistant Professor
05/10/2020	L3 (10.15 – 12.00) Lecture room 15 On-line			Z. Trobonjača, MD, PhD, Full Professor
08/10/2020		S1B(8,00-11,00) Seminar room - Dept. of Physiol. and Immunol. On-line		B. Ćurko-Cofek, MD, PhD, Postdoctoral Research Assistant
08/10/2020		S1A(12,00-15,00) Seminar room - Dept. of Physiol. and Immunol. On-line		Silvija Lukanović Jurić, dr. med., Assistant
13/10/2020	L4 (8.15 – 10.00) Lecture room 1 On-line			Z. Trobonjača, MD, PhD, Full Professor
15/10/2020		S2B(8,00-11,00) Seminar room - Dept. of Physiol. and Immunol. On-line		V. Barac-Latas, MD, PhD, Full Professor
15/10/2020		S2A(12,00-15,00) Lecture room 5 On-line		Silvija Lukanović Jurić, dr. med., Assistant
20/10/2020	L5 (08.15 – 10.00) Lecture room 1 On-line			Z. Trobonjača, MD, PhD, Full Professor
22/10/2020		S3B(9,00-12,00) Lecture room 15 On-line		G. Blagojević Zagorac, MD, PhD, Full Professor
22/10/2020		S3A(12,00-15,00) Lecture room 15 On-line		Kristina Grabušić
26/10/2020	L6 (9.15 – 11.00) Lecture room 8 On-line			H. Jakovac, MD, PhD, Full Professor
27/10/2020	L7 (8.15 – 10.00) Lecture room 1 On-line			Z. Trobonjača, MD, PhD, Full Professor
29/10/2020		S4B(9,00-12,00) Lecture room 8 On-line		Z. Trobonjača, MD, PhD, Full Professor

29/10/2020		S4A (12.00 -15.00) Lecture room 8 On-line		Kristina Grabušić
03/11/2020	L8 (8.15 – 1.00) Lecture room 1 On-line			Z. Trobonjača, MD, PhD, Full Professor
05/11/2020		S5B (9.00-12.00) Lecture room 8 On-line		V. Barac-Latas, MD, PhD, Full Professor
05/11/2020		S5A (12.00 -15.00) Lecture room 8 On-line		V. Pavišić, MD, Teaching Assistant
06/11/2020			P1A (9.15-13.00) P1B (8,15-12.00) Practical room - Dept. of Physiol. and Immunol.	G. Blagojević Zagorac, MD, PhD, Full Professor H. Mahmutefendić-Lučin, PhD, Associate Professor
09/11/2020			P1C (8.15-12.00) P1D (9,15-13.00) Practical room - Dept. of Physiol. and Immunol.	B. Ćurko-Cofek, MD, PhD, Postdoctoral Research Assistant H. Mahmutefendić-Lučin, PhD, Associate Professor
10/11/2020	L9 (08.15 – 10.00) Lecture room 1 On-line			Z. Trobonjača, MD, PhD, Full Professor
12/11/2020		S6B (9,00-12,00) Lecture room 15 On-line		H. Mahmutefendić-Lučin, PhD, Associate Professor
12/11/2020		S6A (12,00-15,00) Lecture room 15 On-line		Kristina Grabušić
13/11/2020			P2A (9.15-13.00) P2B (8,15-12.00) Practical room - Dept. of Physiol. and Immunol.	H. Jakovac, MD, PhD, Full Professor H. Mahmutefendić-Lučin, PhD, Associate Professor
16/11/2020			P2C (8.15-12.00) P2D (9,15-13.00) Practical room - Dept. of Physiol. and Immunol.	T. Grubić Kezele, MD, PhD, Assistant Professor H. Mahmutefendić-Lučin, PhD, Associate Professor
17/11/2020	L10 (08.15 – 10.00) Lecture room 1 On-line			V. Barac-Latas, MD, PhD, Full Professor
19/11/2020		S7B (9,00-12,00) Lecture room 7 On-line		V. Barac-Latas, MD, PhD, Full Professor

19/11/2020		S7A (12,00-15,00) Lecture room 9 On-line		B. Ćurko-Cofek, MD, PhD, Postdoctoral Research Assistant
20/11/2020			Midterm exam I On-line	
23/11/2020	L11 (12.15 – 14.00) Lecture room 15 On-line			V. Barac-Latas, MD, PhD, Full Professor

24/11/2020	L12 (08.15–10.00) Lecture room 1 On-line			H. Jakovac, MD, PhD, Full Professor
26/11/2020		S8B (9,00-12,00) Seminar room - Dept. of Physiol. and Immunol. On-line		Z. Trobonjača, MD, PhD, Full Professor
26/11/2020		S8A (12,00-15,00) Seminar room - Dept. of Physiol. and Immunol. On-line		H. Jakovac, MD, PhD, Full Professor
27/11/2020			P3A (09.15-13.00) P3B (08,15-12.00) Practical room - Dept. of Physiol. and Immunol.	V. Pavišić, MD, Teaching Assistant H. Mahmutefendić-Lučin, PhD, Associate Professor
30/11/2020			P3C (08.15-12.00) P3D (09,15-13.00) Practical room - Dept. of Physiol. and Immunol.	I. Mrakovčić Šutić, MD, PhD, Full Professor H. Mahmutefendić-Lučin, PhD, Associate Professor
01/12/2020	L13 (08.15–10.00) Lecture room 1 On-line			G. Blagojević Zagorac, MD, PhD, Full Professor
03/12/2020		S9B (9,00-12,,00) Lecture room 15 On-line		Z. Trobonjača, MD, PhD, Full Professor
03/12/2020		S9A (12,00-15,,00) Lecture room 15 On-line		G. Blagojević Zagorac, MD, PhD, Full Professor
07/12/2020	L14 (12.15–14.00) Lecture room 8 On-line			V. Barac-Latas, MD, PhD, Full Professor
07/12/2020 14:15	L15 (14.15–16.00) Lecture room 8 On-line			I. Mrakovčić Šutić, MD, PhD, Full Professor
10/12/2020		S10B (8,00-11.00) Lecture room 9 On-line		Silvija Lukanović Jurić, dr. med., Assistant
10/12/2020		S10A (12,00-15.00) Lecture room 5 On-line		I. Mrakovčić Šutić, MD, PhD, Full Professor
10/12/2020			P4A (16.15-20.00) P4B (15,15-19.00) Practical room - Dept. of Physiol. and Immunol.	B. Čurko-Cofek, MD, PhD, Postdoctoral Research Assistant H. Mahmutefendić-Lučin, PhD, Associate Professor

14/12/2020			P4C (08.15-12.00) P5D (09,15-13.00) Practical room - Dept. of Physiol. and Immunol.	H. Mahmutefendić-Lučin, PhD, Associate Professor
15/12/2020	L16(08.15-10.00) Lecture room 1 On-line			G. Laškarin, MD, PhD, Full Professor

17/12/2020		S11B(8.00–11.00) Lecture room 5 On-line		Silvija Lukanović Jurić, dr. med., Assistant
17/12/2020		S11A(12.00–15.00) Lecture room 8 On-line		Ingrid Šutić, dr. med., Assistant
18/12/2020			P5A (09.15-13.00) P5B (08,15-12.00) Practical room - Dept. of Physiol. and Immunol.	G. Laškarin, MD, PhD, Full Professor H. Mahmutefendić-Lučin, PhD, Associate Professor
21/12/2020			P5C (08.15-12.00) P5D (09,15-13,00) Practical room - Dept. of Physiol. and Immunol.	V. Pavišić, MD, Teaching Assistant H. Mahmutefendić-Lučin, PhD, Associate Professor
08/1/2021	L17 (11.15-13.00) On-line			H. Jakovac, MD, PhD, Full Professor
25/1/2021			Midterm exam II On-line	

List of lectures, seminars, and practicals:

	LECTURES (topics)	Teaching hours	Place
L1	Gastrointestinal physiology: part I	2	Lecture Hall 2
L2	Gastrointestinal physiology: part II	2	Lecture Hall 2
L3	Pathophysiology of gastrointestinal system	2	Lecture Hall 2
L4	Metabolism of proteins and carbohydrates	2	Lecture Hall 2
L5	Lipid metabolism	2	Lecture Hall 2
L6	Liver physiology	2	Lecture Hall 2
L7	Disorders of hepatobiliary system: part I	2	Lecture Hall 2
L8	Disorders of hepatobiliary system: part II	2	Lecture Hall 2
L9	Disorders of exocrine pancreas function – acute and chronic pancreatitis	2	Lecture Hall 2
L10	Introduction to endocrinology, Pituitary hormones	2	Lecture Hall 2
L11	Thyroid Metabolic hormones	2	Lecture Hall 2
L12	Adrenocortical hormones	2	Lecture Hall 2
L13	Parathyroid Hormone, calcitonin, calcium and phosphate metabolism	2	Lecture Hall 2
L14	Insulin, glucagon, and diabetes mellitus	2	Lecture Hall 2
L15	Predictors and clinical implications of metabolic syndrome	2	Lecture Hall 2
L16	Reproductive functions and sex hormones	2	Lecture Hall 2
L17	Integral organismic reactions to noxious stimuli	2	Lecture Hall 2
	Total number of lecture hours	34	

	SEMINARS (topics)	Teaching hours	Place
S1	Gastrointestinal physiology	4	Seminar room, Lecture Hall 5
S2	Pathophysiology of gastrointestinal system	4	Seminar room, Lecture Hall 5
S3	Metabolism of proteins and carbohydrates	4	Seminar room, Lecture Hall 5
S4	Lipid metabolism	4	Seminar room, Lecture Hall 5
S5	Dietary Balances, regulation of feeding, metabolism, body temperature regulation	4	Seminar room, Lecture Hall 5
S6	Metabolism of specific metabolic substances	4	Seminar room, Lecture Hall 5
S7	General endocrinology, pituitary gland		Seminar room, Lecture Hall 5
S8	Thyroid and adrenal gland	4	Seminar room, Lecture Hall 5
S9	Parathyroid glands	4	Seminar room, Lecture Hall 5
S10	Endocrine pancreas, diabetes mellitus	4	Seminar room, Lecture Hall 5
S11	Reproductive functions and sex hormones	4	Seminar room, Lecture Hall 5
	Total number of seminar hours	45	

	PRACTICALS (topics)	Teaching hours	Place
P1	Digestive system and metabolism	5	Practical Room
P2	Physiology and pathophysiology of liver	5	Practical Room
P3	Sports physiology	5	Practical Room
P4	Endocrinology	5	Practical Room
P5	Reproduction	5	Practical Room
	Total number of practical hours	25	

	EXAM TERMS
1.	05/02/2020
2.	20/02/2020
3.	08/07/2020
4.	01/09/2020
5.	15/09/2020

Correction of midterm exams: between two exam terms in February 2020, in agreement with the students.

Schedule of lectures

MATERIAL
<p>L1. Introductory lecture. General principles of the gastrointestinal wall structure. Electrical activity of the gastrointestinal smooth muscle. Blood circulation of the digestive system. Functional movements of the digestive system. Neural control of gastrointestinal functions (intestinal nervous system). Food intake, chewing, and swallowing. Gastric functions, small and large bowel movements. General and locally specific principles of secretion in the digestive system. Digestion and absorption of various nutrients (carbohydrates, proteins, fats) in certain segments of the digestive system.</p>
<p>L2. Disorders of the throat, esophagus, and stomach. Disorders of the exocrine pancreatic function. Disorders of the small and large intestine. Pathophysiological forms and consequences of diarrhea. Mechanism and consequences of vomiting. Causes and consequences of ileus.</p>
<p>L3. Eating disorders.</p>
<p>L4. Physiology of protein metabolism. Etiological factors, mechanisms, and consequences of impaired protein metabolism. Causes and consequences of protein deficiency. Mechanisms and effects of primary and secondary malnutrition. Physiology of carbohydrate metabolism and adenosine triphosphate formation. Etiological factors, mechanisms, and consequences of impaired carbohydrate metabolism. Causes and effects of hyperglycemia. Causes and effects of hypoglycemia. Disorders of glycogen metabolism.</p>
<p>L5. Physiology of lipid metabolism. Causes, mechanisms, and pathophysiological effects of lipoprotein disorders (primary and secondary hyperlipoproteinemia, other disorders of lipoprotein metabolism). Causes, mechanisms, and pathophysiological effects of lipid deposition disorders (lipidosis, atherosclerosis, obesity).</p>
<p>L6. Macromorphological and micromorphological structure of the liver. Basic function unit – hepatic lobule. Blood flow through the liver and the hepatic macrophage system. System of lymph glands in the liver. Liver metabolism of carbohydrates, amino acids, and ammonia. Synthesis and degradation of proteins in the liver (glycoproteins, angiotensinogen, coagulation factors, hematopoietic factors, acute phase proteins). Detoxification mechanisms (drugs, toxic substances). Alcohol metabolism. Hormone metabolism. Metabolism of lipids (fatty acids and triglycerides) and cholesterol. Bilirubin metabolism. Biliary tree and the creation, excretion, and role of bile in the digestion and absorption of fat. Iron and vitamin storage in the liver.</p>

<p>L7. Metabolic and infiltrative liver diseases (metabolic disorders of bilirubin, jaundice, fatty liver). Viral hepatitis (A, B, C, D, E), autoimmune hepatitis. Toxic and medicated damage to the liver. Alcoholic liver disease.</p>
<p>L8. Pathogenesis of alcoholic, posthepatic, primary biliary, secondary biliary and cardiac liver cirrhosis. Complications of liver cirrhosis (portal hypertension, ascites, spontaneous bacterial peritonitis, hepatic encephalopathy, hepatorenal syndrome, hepatopulmonary syndrome, hypersplenism, coagulopathy). Diseases of the biliary system (gallstones, cholangitis).</p>
<p>L9. Morphological structure of the exocrine part of the pancreas. Water and electrolyte secretion. Formation and secretion of pancreatic digestive enzymes. Control over pancreatic secretion. Cystic fibrosis of the pancreas. Etiopathogenic factors, course, and complications of (local, systemic) acute pancreatitis. Etiopathogenic factors, course, and complications of chronic pancreatitis.</p>
<p>L10. Structure of the endocrine system and the mechanisms of hormone activity. Mechanisms of adeno and neuro-pituitary hormone production, function, and their hypothalamic control. Causes and consequences of increased and decreased hormone secretion. Causes and consequences of disorders in the target tissue of the hormone. Disorders of hormone metabolism and regulation of hormonal systems. Pituitary function disorders.</p>
<p>L11. Thyroid functional morphology. Production and secretion of thyroid metabolic hormones. Thyroid function monitoring. Physiological functions of thyroid metabolic hormones. Thyroid function disorders: thyrotoxicosis, hyperthyroidism, hypothyroidism, goiter.</p>
<p>L12. Morphological structure of adrenal glands. Production, secretion, and physiological functions of adrenal cortex hormones. Causes, course, and consequences of primary or secondary hyperfunction of the adrenal cortex. Causes, course, and consequences of primary or secondary hypofunction of the adrenal cortex. Etiopathogenesis of disorders of the adrenal gland core.</p>
<p>L13. Production, secretion, and action of parathyroid hormone and calcitonin. Mechanisms for maintaining calcium and phosphate metabolism. Calcium, phosphate, and magnesium turnover disorders. Disorders with increased or decreased parathyroid hormone formation. Disorders with increased or decreased calcitonin formation.</p>
<p>L14. Mechanisms of production, secretion, and metabolic effects of insulin, glucagon, and somatostatin. Causes and consequences of impaired insulin, glucagon, and somatostatin action. Etiopathogenesis of various types of diabetes. Course and acute and chronic consequences of diabetes.</p>
<p>L15. Components of the metabolic syndrome. Inherited and acquired etiopathogenic factors of the metabolic syndrome. The role of obesity (adipokine production and release of nonesterified fatty acids from adipose tissue and their action and ectopic accumulation in muscle tissue, liver, and pancreas) in the development of the metabolic syndrome. Release of PAI-1, TNF, IL-6, and resistin, the role in the progression of the metabolic syndrome. The role of insulin resistance in the metabolic syndrome.</p>

Mechanisms and the role of atherogenic dyslipidemia, hypertension, hyperglycemia, prothrombotic, and failure status in the development of cardiovascular diseases.

L16.

Functional structure of male genitalia.

Spermatogenesis and the male sexual act.

Chemical structure, secretion, metabolism, and effects of male sex hormones.

Disorders of male sexual functions.

Functional anatomy of female genitalia.

Female sex hormone system.

Monthly ovarian cycle and the function of gonadotropic hormones.

Ovarian hormone functions, estradiol and progesterone.

Interaction of ovarian and hypothalamic-pituitary hormones.

Female sexual act.

Pregnancy, lactation, and the physiology of the fetus and newborn.

L17.

Strategy of the systemic pathobiological response of the organism under noxious stimuli.

Stress – spontaneous systematic directing of reactivity.

Acute-phase response during an inflammatory process.

Systemic inflammatory response and multiple organ failure.

Immunological patterns of systemic response.

Healing and fibrosation processes and changes in tissue architecture (remodeling).

Schedule of seminars

MATERIAL

Seminar 1.

Textbook A:

Chapter 63. General Principles of Gastrointestinal Function – Motility, Nervous Control, and Blood Circulation (p. 797– 806).

Chapter 64. Propulsion and Mixing of Food in the Alimentary Tract (p. 807–816).

Chapter 65. Secretory Functions of the Alimentary Tract (p. 817–832).

Chapter 66. Digestion and Absorption in the Gastrointestinal Tract (p. 833–842).

Seminar 2.

Textbook B:

Chapter 31. Pathophysiology of the Gastrointestinal System (p. 1452–1491).

Seminar 3.

Textbook A:

Chapter 68. Metabolism of Carbohydrates and Formation of Adenosine Triphosphate (p. 853–862).

Chapter 70. Protein Metabolism (p. 875–880).

Textbook B:

Chapter 6. Disorders of Metabolism of Basic Substances (p. 250–265; 291–308).

Seminar 4.

Textbook A:

Chapter 69. Lipid Metabolism (str. 863 – 874)

Textbook B:

Chapter 6. Disorders of Metabolism of Basic Substances (str. 265-291)

Seminar 5.

Textbook A:

Chapter 72. Dietary Balances; Regulation of Feeding; Obesity and Starvation (p. 887–897).

Chapter 73. Energetics and Metabolic Rate (p. 903–909).

Chapter 74. Body Temperature Regulation and Fever (p. 911–922).

Textbook B:

Chapter 14. Disorders of Thermoregulation (p. 661–681).

Seminar 6.

Textbook A:

Chapter 71. Dietary Balances; Regulation of Feeding; Obesity and Starvation; Vitamins and Minerals (p. 897–902).

Textbook B:

Chapter 7. Disorders of Specific Metabolic Substances (p. 316–380).

Seminar 7.

Textbook A.

Chapter 75. Introduction to Endocrinology (p. 925–937).

Chapter 76. Pituitary Hormones and Their Control by the Hypothalamus (p. 939–950).

Textbook B.

Chapter 10. Endocrinopathies (p. 489–517).

Seminar 8.

Textbook A.

Chapter 77. Thyroid Metabolic Hormones (p. 951–964).

Chapter 78. Adrenocortical Hormones (p. 965–982).

Textbook B.

Chapter 10. Endocrinopathies (p. 517–526; 526–536).

Seminar 9.

Textbook A.

Chapter 80. Parathyroid Hormone, Calcitonin, Calcium and Phosphate Metabolism, Vitamin D, Bone, and Teeth (p. 1001–1019).

Textbook B.

Chapter 8. Disorders of Water Electrolytes Metabolism (p. 424–446).

Chapter 10. Endocrinopathies (p. 536–539).

Seminar 10.

Textbook A.

Chapter 79. Insulin, Glucagon, and Diabetes Mellitus (p. 983–999).

Textbook B.

Chapter 10. Endocrinopathies (p. 536).

Seminar 11.

Textbook A:

Chapter 81. Reproductive and Hormonal Functions of the Male (and Function of the Pineal Gland) (p. 1021–1035).

Chapter 82. Female Physiology Before Pregnancy and Female Hormones (p. 1037–1054).

Chapter 83: Pregnancy and Lactation (p. 1055–1070).

Required reading:

A) Guyton, A.C., Hall, J.E. Medicinska fiziologija [Medical Physiology], (13th edition). Medicinska naklada, Zagreb, 2017.

B) Gamulin, S., Marušić, M., Kovač, Z. Patofiziologija [Pathophysiology], (7th edition). Medicinska naklada, Zagreb, 2011.

C) Kovač, Z., Gamulin, S. **Study guide algorithms – problem solver (Book two)**. Medicinska naklada, Zagreb, 2011.

D) Rukavina, D., Radošević Stašić, B., Lučin, P., Ćuk, M. **Priručnik za vježbe iz fiziologije, neurofiziologije i imunologije [Handbook for Practicals in Physiology, Neurophysiology, and Immunology]**, Katedra za fiziologiju, imunologiju i patološku fiziologiju [Department of Physiology, Immunology, and Pathological Physiology], Medicinski fakultet Rijeka, listopad, 2001.

Additional reading:

1. Ganong, W.F. **Review of Medical Physiology**, (21st edition). Lange Medical Books / McGraw-Hill, Medical Pub. Division, New York, 2004.

2. Vrhovac B. et al. **Interna medicina [Internal Medicine]**, (4th edition). Naklada Ljevak, Zagreb, 2008.

3. McPhee, S.J., Ganong, W.F. **Pathophysiology of Disease. An introduction to Clinical medicine**, (5th edition). Lange Medical Books / McGraw-Hill, Medical Pub. Division, New York, 2006.

Schedule of practicals

MATERIAL

Practical I: DIGESTIVE SYSTEM AND METABOLISM

I. Theoretical part:

Lecture content: L 1., L 2., L 3., L 4.

Seminar content: S 1., S 2., S 3., S 4., S 5.

II. Practical part:

Textbook D:

Practical 50. Effects of Vagus Stimulation and Histamine Injection on Gastric Secretion (p. 186–187).

Textbook C:

Problem 22. Molecular-cellular Pathogenesis of Familial Hypercholesterolemia (p. 103–106).

Problem 2. Etiopathogenesis of Cystic Fibrosis (p. 5–8).

Problem 117. Pathophysiology of Gluten Sensitive Enteropathy (p. 530–533).

Problem 118. Pathogenesis of Diarrhea in the Cholera Syndrome (p. 534–537).

Problem 119. Pathophysiology of Peptic Disease in the Course of Gastrinoma (Zollinger-Ellison syndrome) (p. 538–541).

Practical II: PHYSIOLOGY AND PATHOPHYSIOLOGY OF LIVER

I. Theoretical part:

Lecture content: L 5., L 6., L 7., L 8., L 9.

Textbook A:

Chapter 71. The Liver as an Organ (p. 881–886).

Textbook B:

Chapter 32. Disorders of Hepatobiliary System (p. 1492–1533).

II. Practical part:

Textbook D:

Practical 52. Consequences of Ligation of the Ductus Choleductus (p. 190–191).

Textbook C:

Problem 122. Pathophysiology of Liver Cirrhosis (p. 550–554).

Problem 124. Pathophysiology of the Obstructive Icterus Caused by Cholelithiasis (p. 561–564).

Problem 125. Pathophysiology of Acute Cholecystitis (p. 565–568).

Problem 126. Pathophysiology of Acute Liver Failure in Hepatitis B (p. 569–573).

Practical III: SPORTS PHYSIOLOGY

I. Theoretical part:

Textbook A:

Chapter 44. Aviation, High Altitude, and Space Physiology (p. 561–568).

Chapter 45. Physiology of Deep-Sea Diving and Other Hyperbaric Conditions (p. 569–574).

Chapter 85. Sports Physiology (p. 1085–1095).

II. Practical part:

Textbook D:

Practical 48. Biological Feedback (biofeedback) (p. 176–178).

Practical 49. Physiology of Aerobic Exercise (p. 179–185).

Practical IV: ENDOCRINOLOGY

I. Theoretical part:

Lecture content: L 10., L 11., L 12., L 13., L 14.

Seminar content: S 8., S 9., S 10., S 11.

II. Practical part:

Textbook D:

Practical 53. The Effect of Thyroid Hormone on Oxygen Consumption (p. 192–195).

Practical 54. Induction of Hypocalcemic Tetany in Rats (p. 196–197).

Practical 55. Thorn Test in Rats (p. 198–199).

Practical 57. Glucose Tolerance Test (p. 202–204).

Practical 58. Insulin Hypoglycemia in Rats (p. 205–206).

Textbook C:

Problem 36. Pathophysiology of Hyperfunctioning Thyroid Adenoma Caused by a Point Mutation in the Thyrotropin Receptor (p. 168–172).

Problem 38. Pathophysiology of Hyperosmolar Syndrome in the Course of Newly Diagnosed Diabetes Mellitus (p. 178–182).

Problem 20. Pathogenesis of Diabetes Mellitus Related Chronic Complications (p. 93–97).

Problem 39. Pathogenesis of Primary Aldosteronism (Conn's syndrome) (p. 183–186).

Problem 40. Pathophysiology of Cushing's Disease (p. 187–190).

Practical V: REPRODUCTION

I. Theoretical part:

Lecture content: L 16.

Textbook A:

Chapter 81. Reproductive and Hormonal Functions of the Male (and Function of the Pineal Gland) (p. 1021–1034).

Chapter 82. Female Physiology Before Pregnancy and Female Hormones (p. 1037–1054).

Chapter 83: Pregnancy and Lactation (p. 1055–1070).

Chapter 84. Fetal and Neonatal Physiology (p. 1071–1084).

II. Practical part:

Textbook D:

Practical 59. Demonstration of chorionic gonadotropin in urine of pregnant women with the Ascheim-Zondek test (p. 207–208).

Practical 60. Effect of sex hormones on cytologic findings of the vaginal smear in female rats (p. 209–210).

Textbook C:

Problem 71. Pathogenesis of Fetal Erythroblastosis (p. 330–333).

Problem 37. Pathophysiology of Adrenocortical Insufficiency Syndrome (p. 173–177).

Required reading:

A) Guyton, A.C., Hall, J.E. Medicinska fiziologija [Medical Physiology], (12th edition). Medicinska naklada, Zagreb, 2012.

B) Gamulin, S., Marušić, M., Kovač, Z. Patofiziologija [Pathophysiology], (7th edition). Medicinska naklada, Zagreb, 2011.

C) Kovač, Z., Gamulin, S. Study guide algorithms – problem solver (Book two). Medicinska naklada, Zagreb, 2011.

D) Rukavina, D., Radošević Stašić, B., Lučin, P., Ćuk, M. Priručnik za vježbe iz fiziologije, neurofiziologije i imunologije [Handbook for Practicals in Physiology, Neurophysiology, and Immunology], Katedra za fiziologiju, imunologiju i patološku fiziologiju [Department of Physiology, Immunology, and Pathological Physiology], Medicinski fakultet Rijeka, listopad, 2001.

Additional reading:

1. Ganong, W.F. Review of Medical Physiology, (21st edition). Lange Medical Books / McGraw-Hill, Medical Pub. Division, New York, 2004.

2. Vrhovac B. et al. Interna medicina [Internal Medicine], (4th edition). Naklada Ljevak, Zagreb, 2008.

3. McPhee, S.J, Ganong, W.F. Pathophysiology of Disease. An introduction to Clinical medicine, (5th edition). Lange Medical Books / McGraw-Hill, Medical Pub. Division, New York, 2006.