Sveučilište u Rijeci
University of Rijeka

Sveučilište u Rijeci • Fakultet dentalne medicine
University of Rijeka • Faculty of Dental Medicine

Krešimirova 40/42 • 51000 Rijeka • CROATIA
Phone : + 385 51 559 200; 559 202, 559 203

Course: Physiology and Pathophysiology III
Course Coordinator: Prof. Kristina Grabušić, PhD
Course Collaborators: Prof. Natalia Kučić, MD, PhD; Assistant Prof. Božena Ćurko-Cofek, MD, PhD; Marina Marcelić, PhD
Department: Physiology, Immunology and Pathophysiology, Faculty of Medicine in Rijeka
Study program: University Integrated Undergraduate and Graduate Study of Dental Medicine (in English)
Study year: II
Academic year: 2025/2026

SYLLABUS

Course description (a brief description of the course, general instructions, where and in what form the lessons are organised, necessary equipment, instructions for attendance and preparation for classes, student obligations, etc.):

This is a compulsory, 6.5 ECTS subject for second-year students of Dental Medicine. The course is scheduled for the winter semester and includes a total of **60 instructional hours**: 30 lecture hours and 30 seminar hours. Classes are held onsite at the Faculty of Medicine in Rijeka (Dpt. of Physiology - the library), with the option to move online (Microsoft Teams) if necessary.

The course is designed as a continuation of Physiology and Pathophysiology I and II. Its primary objective is to provide students with a comprehensive understanding of the **physiological and pathophysiological mechanisms** of the following systems and processes:

- **the nervous system:** the structure, function, and associated disorders of the nervous system.
- **the gastrointestinal and hepatobiliary systems:** their physiological functions and the pathophysiological mechanisms of disease.
- **metabolism and body temperature regulation:** the mechanisms that control these vital processes and their common disorders.
- **the endocrine system:** its role in the body and the causes of endocrinopathies.

Lectures offer an overview and fundamental principles, while seminars provide a more detailed approach through discussions and analyses. Students are expected to **prepare for seminars** based on lectures and provided literature, and to actively participate in discussions.

Students may be absent up to 30% of instructional hours (lectures and seminars combined). They are also required to take written exams during the course.

Assigned reading:

1. Guyton AC, Hall JE. Medical physiology, fourteenth edition
2. Gamulin S, Marušić M, Kovač Z et al. Pathophysiology, Medicinska naklada, eighth edition, Zagreb, 2018.

All content not covered by the required literature will be published through the Merlin system.

Optional/additional reading:

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COURSE TEACHING PLAN:

The list of lectures (with topics and descriptions):

PART I - THE NERVOUS SYSTEM

L1. Organisation of the Central Nervous System, Synapse, and Neurotransmitters

General plan and characteristics of the nervous system, neurons and glial cells. Types and structure of synapses. Neurotransmitters and their receptors.

L2. Sensory System

Overview of senses and sensory receptors. The modality of sensation and the principle of "marked line", the formation of receptor potential. Tonic and phase receptor, receptor adaptation. Transmission of somatic signals to the central nervous system. Somatosensory crust. Pain.

L3. Brain, Integrative and Higher Cerebral Functions)

Physiological structure of the cerebral cortex. Thalamocortical system. Specific cortical areas: association areas: parieto-occipito-temporal, prefrontal and limbic association areas. Wernicke's area. Dominant and non-dominant hemispheres. Brain function in communication (speech) and types of speech disorders. Callous corps. The concept of thought, consciousness and memory; positive and negative memory, mechanisms of memory formation. The role of the hippocampus in the memory process.

L4. Motor System

Motor types. Spinal cord. Alpha and gamma motoneurons, interneurons. Sensory and muscular innervation of the muscle spindle. Reflex arc. Reflex to stretching. Golgi tendon flexor reflex. Crossed extensor reflex. Reflex for body posture and gait. Motor function control: cortical level, brain stem, cerebellar level. Clinical disorders of the cerebellum.

L5. Autonomic Nervous System

Structure and characteristics of the sympathetic and parasympathetic nervous system. Their effects on the stimulation of individual organs. Cholinergic and adrenergic fibres and receptors. Autonomous reflexes and control of the ANS. Neurovegetative disorders. Circadian rhythm disorders. Psychosomatic diseases.

L6. Cerebral Blood Flow, Cerebrospinal Fluid, and Brain Metabolism

The principles and regulations of blood flow in the brain. Composition and roles of cerebrospinal fluid. Features and regulation of the brain metabolism

PART II - THE GASTROINTESTINAL SYSTEM

L7. Gastrointestinal tract I

Basic structure and functions of the gastrointestinal wall. Electric activity of smooth gastrointestinal muscle. Blood flow of the digestive tract. Functional movement of the digestive tract. Nervous control of the gastrointestinal tract (enteric nervous system

L8. Gastrointestinal tract II

Food intake, chewing and swallowing. Gastric function, movement of the small intestine and colon. General and local principles of secretion in the digestive tract. Digestion and absorption of different nutrients (carbohydrates, proteins and lipids).

L9. Metabolism and Nutrition

Physiology of protein metabolism. Etiological factors, mechanisms, and consequences of impaired protein metabolism. Causes and consequences of protein deficiency. Physiology of carbohydrate metabolism and adenosine triphosphate formation. Etiological mechanisms and consequences of impaired carbohydrate metabolism. Causes and effects of hyperglycemia and hypoglycemia. Disorders of glycogen metabolism. Physiology of lipid metabolism. Causes, mechanisms, and pathophysiological effects of lipoprotein and lipid deposition disorders.

L10. Liver and pancreas

Hepatic lobule. Blood flow through the liver and the hepatic macrophage system. The liver metabolism of carbohydrates, amino acids, and ammonia. The synthesis and degradation of proteins in the liver (glycoproteins, angiotensinogen, coagulation factors, hematopoietic factors, acute phase proteins). The detoxification mechanisms (drugs, toxic substances). Alcohol metabolism. Hormone metabolism. The bilirubin metabolism. The iron and vitamin storage in the liver. Physiological structure of the exocrine part of the pancreas.

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PART III - THE ENDOCRINE SYSTEM

L11. Overview of the endocrine system

The structure of the endocrine system. The mechanisms of hormonal synthesis and action; the control by the hypothalamus. The consequences of hormonal hypersecretion and hyposecretion.

L12. Thyroid, parathyroid and adrenal glands

Synthesis, secretion and physiologic functions of thyroid gland hormones. Synthesis, secretion and mechanisms of parathyroid hormone and calcitonin. Mechanisms of calcium and phosphate concentration maintenance. production, secretion, and physiological functions of adrenal cortex hormones

L13. Endocrine pancreas

Mechanisms of creation, secretion and metabolic effects of insulin, glucagon and somatostatin.

L14. Reproductive system

The chemical structure, secretion, metabolism, and effects of male sex hormones. The female sex hormone system, the monthly ovarian cycle and the function of gonadotropic hormones. The ovarian hormone functions, estradiol and progesterone. The interaction of ovarian and hypothalamic-pituitary hormones. Pregnancy, lactation, and the physiology of the fetus and newborn.

The list of seminars with descriptions:

The seminars will cover the same topics as the lectures, with an emphasis on the main pathophysiological mechanisms and disorders of the corresponding organ system, as well as case studies where applicable.

PART I - THE NERVOUS SYSTEM

S1. Organisation of the central nervous system, synapse, neurotransmitters
S2. Sensory system
S3. Brain, integrative and higher cerebral functions
S4. Motor system

PART II - THE GASTROINTESTINAL SYSTEM

S5. Gastrointestinal tract I
S6. Gastrointestinal tract II
S7. Metabolism and Nutrition
S8. Liver and pancreas

PART III - THE ENDOCRINE SYSTEM

S9. Hypothalamus and pituitary gland
S10. Thyroid, parathyroid and adrenal glands
S11. Endocrine pancreas
S12. Reproductive system

The list of practicals with descriptions:

The course comprises no practicals.

Students' obligations:

Students are required to attend classes and earn sufficient points throughout the course to gain access to the final exam. They must also demonstrate sufficient knowledge on the final exam to pass the course.

The final grade is based on a total of **100 points**, which is the sum of two components:

- points earned during the course - maximum 50 points;
- points from the final exam - maximum 50 points.

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I. POINTS DURING THE COURSE (maximum 50 points)

There will be **three partial tests** during the course - one for each of the three topic sections (neuro-, gastro- and endocrine sections). Each test will be held online via the Merlin platform and will consist of approximately 50 multiple-choice questions.

The point allocation for questions will be as follows:

- Questions with one correct answer: **1 point.**
- Questions with one or more correct answers: **3 points.**
  Partial credit is not awarded for these questions. A correct answer is awarded only if all correct options are selected. For example, if a question has five possible answers and three are correct, you will only score 3 points if all three correct answers are chosen.

The percentage achieved on each partial test is assigned the following course points:

% Success on **Partial test I**	Points
97.23 - 100	18
94.45 - 97.22	17
91.67 - 94.44	16
88.89 - 91.66	15
86.12 - 88.88	14
83.34 - 86.11	13
80.56 - 83.33	12
77.78 - 80.55	11
75.01 - 77.77	10
72.23 - 75.00	9
69.45 - 72.22	8
66.67 - 69.44	7
63.89 - 66.66	6
61.12 - 63.88	5
58.34 - 61.11	4
55.56 - 58.33	3
52.78 - 55.55	2
50.00 - 52.77	1
0 - 49.99	0

% Success on **Partial test II and III**	Points
96.88 - 100	16
93.76 - 96.87	15
90.63 - 93.75	14
87.51 - 90.62	13
84.38 - 87.50	12
81.26 - 84.37	11
78.13 - 81.25	10
75.01 - 78.12	9
71.88 - 75.00	8
68.76 - 71.87	7
65.63 - 68.75	6
62.51 - 65.62	5
59.38 - 62.50	4
56.26 - 59.37	3
53.13 - 56.25	2
50.00 - 53.12	1
0 - 49.99	0

Final Exam Eligibility

To be eligible for the final exam, students must fulfil the following conditions :

- Attend at least **70%** of all classes (lectures and seminars combined).
- Take part in all three partial tests and earn points on each.
- Achieve a minimum of **25 points** during the course.

Students are ineligible for the final exam if they:

- Missed more than 30% of all classes.
- Did not take one or more partial tests.
- Achieved 24 or fewer points during the course.

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II. POINTS AT THE FINAL EXAM (maximum 50 points)

The final exam will be an **oral-only examination**. A list of questions for the oral exam will be published on Merlin. Students will draw cards containing questions. A maximum of 50 points is awarded for excellent knowledge in the answers to all three questions. An insufficient grade on the final exam results in a failing grade for the entire course. This exam assesses key, specific competencies determined for each course unit.

III. FINAL GRADE (maximum 100 points)

The final grade is the sum of the points obtained from the course and the final exam. The following scale applies:

Points	Grade	
90 - 100	**A**	**excellent (5)**
75 - 89.99	**B**	**very good (4)**
60 - 74.99	**C**	**good (3)**
50 - 59.99	**D**	**sufficient (2)**
0 - 49,99	**F**	**insufficient (1)**

A student who fails the final exam will receive an insufficient grade for the course regardless of their total points.

COURSE SCHEDULE (for the academic year 2025/2026)

Date	Lectures (time and place)	Seminars (time and place)	Instructor
07 Jan 2026 **(Wed)**	L1. Organisation of the Nervous System, Synapse, and Neurotransmitters (2) **8:15 - 10:00** **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
		S1. Organisation of the nervous system, synapse, neurotransmitters (3) **10:15 - 13:00** **Dpt. of Phys. - The library**	Prof. Natalia Kučić
08 Jan 2026 **(Thu)**	L2. Sensory System (2) **8:15 - 10:00** **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
		S2. Sensory system (3) **10:15 - 13:00** **Dpt. of Phys. - The library**	Prof. Božena Ćurko-Cofek
09 Jan 2026 **(Fri)**	L3. Brain, Integrative and Higher Cerebral Functions (2) **8:15 - 10:00** **Dpt. of Phys. - The library**		Prof. Natalia Kučić

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		S3. Brain, integrative and higher cerebral functions (3) **10:15 - 13:00** **Dpt. of Phys. - The library**	Prof. Kristina Grabušić
12 Jan 2026 (**Mon**)	L4. Motor System (2) 8:15 - 10:00 **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
		S4. Motor system (3) **13:15 - 16:00** **Dpt. of Phys. - The library**	Prof. Božena Ćurko-Cofek
13 Jan 2026 (**Tue**)	L5. Autonomic Nervous System (2) 8:15 - 10:00 **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
	L6. Cerebral Blood Flow, Cerebrospinal Fluid, and Brain Metabolism (2) **10:15 - 12:00** **Dpt. of Phys. - The library**		Prof. Natalia Kučić
14 Jan 2026 (**Wed**)	**Midterm I (Neuro)** 8.15 - 9.00 **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
	L7. Gastrointestinal tract I (2) 9.15 - 10.45 **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
		S5. Gastrointestinal tract I (2) 11.00 - 12.30 **Dpt. of Phys. - The library**	Prof. Božena Ćurko-Cofek
15 Jan 2026 (**Thu**)	L8. Gastrointestinal tract II (2) 8.15 - 10.00 **Dpt. of Phys. - The library**		Prof. Božena Ćurko-Cofek
		S6. Gastrointestinal tract II (2) 10.15 - 12.00 **Dpt. of Phys. - The library**	Prof. Božena Ćurko-Cofek
16 Jan 2026 (**Fri**)	L9. Metabolism and Nutrition (3) 13.15 - 16.00 **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
		S7. Metabolism and Nutrition (3) 8.15 - 11.00 **Dpt. of Phys. - The library**	Marina Marcelić, PhD
19 Jan 2026 (**Mon**)	L10. Liver and pancreas (2) 8.15 - 10.00 **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
		S8. Liver and pancreas (2) 10.15 - 12.00 **Dpt. of Phys. - The library**	Prof. Kristina Grabušić
20 Jan 2026 (**Tue**)	**Midterm II (Gastro)** 8.15 - 9.00 **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
	L11. Overview of the endocrine system (2) 9.15 - 11.00		Prof. Kristina Grabušić

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	Dpt. of Phys. - The library		
		S9. Hypothalamus and pituitary gland (2) 11.15 - 13.00 **Dpt. of Phys. - The library**	Prof. Kristina Grabušić
21 Jan 2026 **(Wed)**	L12. Thyroid, parathyroid and adrenal glands (3) 8.15 - 11.00 **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
		S10. Thyroid, parathyroid and adrenal glands (3) 11.15 - 14.00 **Dpt. of Phys. - The library**	Marina Marcelić, PhD
22 Jan 2026 **(Thu)**	L13. Endocrine pancreas (2) 8.15 - 10.00 **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
		S11. Endocrine pancreas (2) 10.15 - 12.00 **Dpt. of Phys. - The library**	Marina Marcelić, PhD
23 Jan 2026 **(Fri)**	L14. Reproductive system (2) 8.15 - 10.00 **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
		S12. Reproductive system (2) 10.15 - 12.00 **Dpt. of Phys. - The library**	Marina Marcelić, PhD
26 Jan 2026 **(Mon)**	**Midterm III. (Endocrine)** **Dpt. of Phys. - The library**		Prof. Kristina Grabušić
27 Jan 2026 **(Tue)**	**FINAL EXAM** **Dpt. of Phys. - The library**		Prof. Kristina Grabušić

List of lectures, seminars and practicals:

	LECTURES (Topics)	Teaching hours	Location/Lecture room
L1	Organisation of the Central Nervous System, Synapse, and Neurotransmitters	2	Dpt. of Phys. / The library
L2	Sensory System	2	Dpt. of Phys. / The library
L3	Brain, Integrative and Higher Cerebral Functions	2	Dpt. of Phys. / The library
L4	Motor System	2	Dpt. of Phys. / The library
L5	Autonomic Nervous System	2	Dpt. of Phys. / The library
L6	Cerebral Blood Flow, Cerebrospinal Fluid, and Brain Metabolism	2	Dpt. of Phys. / The library
L7	Gastrointestinal tract I	2	Dpt. of Phys. / The library
L8	Gastrointestinal tract II	2	Dpt. of Phys. / The library
L9	Metabolism and Nutrition	**3**	Dpt. of Phys. / The library
L10	Liver and pancreas	2	Dpt. of Phys. / The library
L11	Overview of the endocrine system	2	Dpt. of Phys. / The library

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L12	Thyroid, parathyroid and adrenal glands	**3**	Dpt. of Phys. / The library
L13	Endocrine pancreas	2	Dpt. of Phys. / The library
L14	Reproductive system	2	Dpt. of Phys. / The library
	TOTAL TEACHING HOURS	**30**	

	SEMINARS (Topics)	Teaching hours	Location/Lecture room
S1	Organisation of the Central Nervous System, Synapse, and Neurotransmitters	**3**	Dpt. of Phys. / The library
S2	Sensory System	**3**	Dpt. of Phys. / The library
S3	Brain, Integrative and Higher Cerebral Functions	**3**	Dpt. of Phys. / The library
S4	Motor System	**3**	Dpt. of Phys. / The library
S5	Gastrointestinal tract I	2	Dpt. of Phys. / The library
S6	Gastrointestinal tract II	2	Dpt. of Phys. / The library
S7	Metabolism and Nutrition	**3**	Dpt. of Phys. / The library
S8	Liver and pancreas	2	Dpt. of Phys. / The library
S9	Overview of the endocrine system	2	Dpt. of Phys. / The library
S10	Thyroid, parathyroid and adrenal glands	**3**	Dpt. of Phys. / The library
S11	Endocrine pancreas	2	Dpt. of Phys. / The library
S12	Reproductive system	2	Dpt. of Phys. / The library
	TOTAL TEACHING HOURS	**30**	

	FINAL EXAM DATES
1.	27 January 2026
2.	10 February 2026
3.	24 February 2026
4.	04 September 2026
5.	18 September 2026

	Lectures	**Seminars**	**Practicals**	**Total**
Total number	30	30	0	60
On-line	0	0	0	0
Percentage	0	0	0	0