



Course: Physiology and Pathophysiology III

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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: 2026/2027

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.):

Physiology and Pathophysiology III is a compulsory course worth **6.5 ECTS** credits for second-year students of the Dental Medicine study program. The course is delivered during the summer semester and comprises a total of **60 academic hours**: 30 hours of lectures and 30 hours of seminars. Classes are held predominantly on the premises of the Faculty of Medicine in Rijeka. Only exceptionally (e.g., in cases of classroom unavailability) will classes be conducted online via Microsoft Teams.

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 are permitted to miss up to **20% of lecture hours** (6 hours, i.e., 3 lectures) and up to **20% of seminar hours** (6 hours, i.e., 3 seminars). Students are also required to take all partial (midterm) tests scheduled during the semester.

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:



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 cortex. Pain.

L3. Brain, Integrative and Cognitive 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 language disorders. Corpus callosum. Concepts 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

Types of motor control; spinal cord motor functions. Alpha and gamma motor neurons, interneurons. Sensory and motor innervation of the muscle spindle. Reflex arc, stretch reflex, Golgi tendon 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

Organization of the autonomic nervous system (ANS). 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 regulation 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. Electrical activity of gastrointestinal smooth muscle. Blood flow of the digestive tract. Functional movement of the digestive tract. Neural control of the gastrointestinal tract (enteric nervous system).

L8. Gastrointestinal tract II

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

L9. Metabolism and Body Temperature Regulation

Physiology of protein metabolism. Etiology, mechanisms, and consequences of impaired protein metabolism and protein deficiency. Physiology of carbohydrate metabolism and adenosine triphosphate formation. Etiology and pathophysiology of glycemic dysregulation (hyperglycemia, hypoglycemia, glycogen storage disorders). Physiology of lipid metabolism; pathophysiology of dyslipidemias, lipoprotein disorders, and abnormal lipid deposition. Body temperature regulation and thermal balance.

L10. Liver and pancreas

Functional anatomy of the hepatic lobule; hepatic microcirculation and the reticuloendothelial (macrophage) system. Hepatic metabolism of carbohydrates, amino acids, and ammonia. Hepatic protein synthesis and degradation (glycoproteins, angiotensinogen, coagulation factors, acute-phase reactants). Hepatic detoxification pathways (drugs, xenobiotics, alcohol, hormones, bilirubin metabolism). Hepatic storage of iron and vitamins. Structure and physiological secretion of the exocrine pancreas.



PART III - THE ENDOCRINE SYSTEM

L11. Overview of the endocrine system

General organization of endocrine communication. Mechanisms of hormone synthesis, secretion, transport, and cellular action; hypothalamic control. Pathophysiological consequences of endocrine hyposecretion and hypersecretion. Hypothalamic-pituitary axis.

L12. Thyroid and adrenal glands

Synthesis, release, regulation, and target actions of thyroid hormones. Synthesis, secretion, regulation, and systemic physiological effects of adrenocortical and adrenomedullary hormones.

L13. Parathyroid Hormone, Calcitonin, and Mineral Balance

Synthesis, secretion, regulation, and mechanisms of action of parathyroid hormone (PTH) and calcitonin. Physiological homeostasis and regulation of extracellular calcium and phosphate concentrations.

L14. Endocrine Pancreas and Diabetes Mellitus

Biosynthesis, secretion, and systemic metabolic effects of insulin, glucagon, and somatostatin. Etiopathogenesis, classification, and pathophysiology of diabetes mellitus and related acute/chronic metabolic complications.

L15. Reproductive system

Biosynthesis, transport, metabolism, and physiological effects of male sex hormones (androgens). Female reproductive endocrinology: ovarian cycle, menstrual cycle, actions of gonadotropins (FSH, LH), estrogens, and progesterone. Hypothalamic-pituitary-ovarian regulatory feedback. Physiology of pregnancy, lactation, and basic fetal/neonatal physiology.

The list of seminars with descriptions:

Seminars run parallel to the lecture series, emphasizing relevant **pathophysiological mechanisms, clinical correlations, and case presentations**. At the end of each thematic section, an **integrative seminar** is held to synthesize key physiological and pathophysiological concepts in preparation for the final examination.

PART I - THE NERVOUS SYSTEM

S1. Organisation of the nervous system, synapses, and neurotransmitters

S2. Sensory system

S3. Brain, integrative and higher cerebral functions

S4. Motor system

S5. Integrative Seminar 1: Comprehensive Nervous System Physiology & Pathophysiology

PART II - THE GASTROINTESTINAL SYSTEM

S6. Gastrointestinal tract I

S7. Gastrointestinal tract II

S8. Metabolism, nutrition, and temperature regulation

S9. Liver and pancreas

S10. Integrative Seminar 2: Comprehensive GI & Metabolic Physiology & Pathophysiology

PART III - THE ENDOCRINE SYSTEM

S11. Hypothalamus and pituitary gland

S12. Thyroid and adrenal glands

S13. Parathyroid glands, PTH, calcitonin, and calcium-phosphate balance

S14. Endocrine functions of the pancreas and reproductive system

S15. Integrative Seminar 3: Comprehensive Endocrine Physiology & Pathophysiology

The list of practicals with descriptions:

The course comprises no practicals.



Students' obligations:

Students are required to attend classes regularly and obtain the necessary credits/points during the semester to qualify for the final exam.

The **final examination is oral** and consists of **three comprehensive exam questions**. To achieve a passing grade, the student must demonstrate a satisfactory level of knowledge and understanding of foundational physiological and pathophysiological concepts in **all three exam questions**. Refusal to answer or failure to demonstrate minimum required knowledge on any of the three main exam questions will result in an automatic failing grade (F) for the entire course.

The final grade is based on a cumulative total of **100 points**, combining two components :

- **In-class continuous assessment points:** Maximum of **50 points**;
- **Final oral exam points:** Maximum of **50 points**.

I. In-Class Continuous Assessment (Max. 50 Points)

During the course, **three partial (midterm) tests** are administered online via the Merlin platform - one corresponding to each thematic section (Nervous, Gastrointestinal, and Endocrine Systems). Each test consists of approximately 40 multiple-choice questions:

- Questions with one correct answer: 1 point.
- Questions with one or more correct answers: 3 points (no partial points; all correct options must be selected to receive points).

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

% Success on Midterm 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 Midterm 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



Prerequisites for Taking the Final Exam:

- Attendance of at least 80% of lectures and 80% of seminars.
- Participation in all three midterm tests and earning points on each.
- Earning a minimum of **25 continuous assessment points** during the course.

Students lose the right to take the final exam if they have unjustified absences exceeding 20% of lectures or seminars, fail to take any of the midterm tests, or accumulate 24 points or fewer during the semester.

II. FINAL EXAM (Max. 50 points)

The final exam is exclusively oral. The list of oral exam topics/questions will be published on Merlin. Students draw question cards covering the three thematic blocks. Excellent demonstration of knowledge across all questions earns up to 50 points.

III. FINAL GRADING SCALE (Max. 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 2026/2027)

Date	Lectures (time and place)	Seminars (time and place)	Instructor
07 Jan 2027 (Thu)	L1 (8:15 - 10:00, Phys. Sem.)		Prof. K. Grabušić
		S1 (10:15 - 12:00, Phys. Sem.)	Prof. N. Kučić
	L2 (13:30 - 15:00, P15)		Prof. K. Grabušić
08 Jan 2027 (Fri)		S2 (8:15 - 10:00, P03)	Ass. Prof. B. Ćurko-Cofek
	L3 (10:15 - 12:00, P03)		Prof. N. Kučić
		S3 (13:15 - 15:00, P03)	Prof. K. Grabušić
11 Jan 2027 (Mon)	L4 (9:15 - 11:00, Phys. Sem)		Prof. K. Grabušić
		S4 (11:30 - 13:00, P09)	Ass. Prof. B. Ćurko-Cofek
	L5 (13:30 - 15:00, Phys. Sem)		Prof. K. Grabušić
12 Jan 2027 (Tue)	L6 (8:15 - 10:00, Phys. Sem)		Prof. K. Grabušić
		S5 (10:15 - 12:00, P03)	Prof. K. Grabušić
13 Jan 2027 (Wed)	Midt. I (8:15 - 9:00, P15)		Prof. K. Grabušić
	L7 (9:15 - 11:00, P15)		Prof. K. Grabušić
		S6 (11:15 - 13:00, Phys. Sem)	Ass. Prof. B. Ćurko-Cofek
14 Jan 2027 (Thu)	L8 (8:15 - 10:00, Phys. Lib.)		Ass. Prof. B. Ćurko-Cofek
		S7 (10:15 - 12:00, P08)	Ass. Prof. B. Ćurko-Cofek
	L9 (13:15 - 15:00, P15)		Prof. K. Grabušić
15 Jan 2027 (Fri)		S8 (8:15 - 10:00, P07)	C. Rožmanić
	L10 (10:15 - 12:00, P07)		Prof. K. Grabušić
		S9 (13:15 - 15:00, P06)	Ass. Prof. D. Kveštak
18 Jan 2027 (Mon)		S10 (11:00 - 12:30, P15)	Prof. K. Grabušić
	Midt. II (12:45 - 13:30, P15)		Prof. K. Grabušić
	L11 (14:00 - 16:00, P15)		Prof. K. Grabušić
19 Jan 2027 (Tue)		S11 (8:15 - 10:00, Phys. Sem)	C. Rožmanić
	L12 (10:15 - 12:00, Phys. Sem)		Prof. K. Grabušić
		S12 (13:15 - 15:00, Phys. Sem)	Ass. Prof. D. Kveštak
20 Jan 2027 (Wed)	L13 (8:15 - 10:00, Phys. Sem)		Ass. Prof. B. Ćurko-Cofek
		S13 (10:15 - 12:00, Phys. Sem)	C. Rožmanić
	L14 (13:15 - 15:00, Phys. Sem)		Prof. K. Grabušić
21 Jan 2027 (Thu)	L15 (8:15 - 10:00, Phys. Sem)		Ass. Prof. D. Kveštak
		S14 (10:15 - 12:00, Phys. Sem)	C. Rožmanić
		S15 (13:15 - 15:00, Phys. Sem)	Prof. K. Grabušić
22 Jan 2027 (Fri)	No classes scheduled		
25 Jan 2027 (Mon)	Midterm III. - Endocrine (Merlin online)		



26 Jan 2027 (Tue)	No classes scheduled		
27 Jan 2027 (Wed)	FINAL EXAM Phys. Library		Prof. K. 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	Faculty of Med., Dpt. of Phys. / Seminar room
L2	Sensory System	2	Faculty of Med. / P15
L3	Brain, Integrative and Higher Cerebral Functions	2	Faculty of Med. / P03
L4	Motor System	2	Faculty of Med., Dpt. of Phys. / Seminar room
L5	Autonomic Nervous System	2	Faculty of Med., Dpt. of Phys. / Seminar room
L6	Cerebral Blood Flow, Cerebrospinal Fluid, and Brain Metabolism	2	Faculty of Med., Dpt. of Phys. / Seminar room
L7	Gastrointestinal tract I	2	Faculty of Med. / P15
L8	Gastrointestinal tract II	2	Dpt. of Phys. / The library
L9	Liver and pancreas	2	Faculty of Med. / P15
L10	Metabolism and Temperature regulation	2	Faculty of Med. / P07
L11	Overview of the endocrine system	2	Faculty of Med. / P15
L12	Thyroid and adrenal glands	2	Faculty of Med., Dpt. of Phys. / Seminar room
L13	PTH and calcitonin	2	Faculty of Med., Dpt. of Phys. / Seminar room
L14	Endocrine pancreas and diabetes	2	Faculty of Med., Dpt. of Phys. / Seminar room
L15	Reproductive system	2	Faculty of Med., Dpt. of Phys. / Seminar room
	TOTAL TEACHING HOURS	30	

	SEMINARS (Topics)	Teaching hours	Location/Lecture room
S1	Organisation of the Central Nervous System, Synapse, and Neurotransmitters	2	Faculty of Med., Dpt. of Phys. / Seminar room
S2	Sensory System	2	Faculty of Med. / P03



S3	Brain, Integrative and Higher Cerebral Functions	2	Faculty of Med. / P03
S4	Motor System	2	Faculty of Med. / P09
S5	Integrative seminar I - neurophysiology	2	Dpt. of Phys. / The library
S6	Gastrointestinal tract I	2	Faculty of Med., Dpt. of Phys. / Seminar room
S7	Gastrointestinal tract II	2	Faculty of Med. / P08
S8	Liver and pancreas	2	Faculty of Med. / P07
S9	Metabolism and Temperature regulation	2	Faculty of Med. / P06
S10	Integrative seminar II - digestion and metabolism	2	Faculty of Med. / P15
S11	Overview of the endocrine system	2	Faculty of Med., Dpt. of Phys. / Seminar room
S12	Thyroid and adrenal glands	2	Faculty of Med., Dpt. of Phys. / Seminar room
S13	PTH and calcitonin	2	Faculty of Med., Dpt. of Phys. / Seminar room
S14	Reproductive system and diabetes	2	Faculty of Med., Dpt. of Phys. / Seminar room
S15	Integrative seminar III - endocrinology	2	Faculty of Med., Dpt. of Phys. / Seminar room
TOTAL TEACHING HOURS		30	

	FINAL EXAM DATES
1.	27 January 2027
2.	10 February 2027
3.	24 February 2027
4.	03 September 2027
5.	17 September 2027

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