

UNIVERSITY OF ZAGREB  
FACULTY OF VETERINARY MEDICINE  
Heinzelova 55, 10000 Zagreb  
Tel. 01/2390-183  
Division: Basic and Preclinical Sciences  
Organizational unit: Pathophysiology  
E-mail of the course leader: r Turk@vef.unizg.hr  
Register No of the organisational unit:  
Zagreb, 20/02/2023

### **COURSE SYLLABUS**

Course name: Pathophysiology II

Academic year 2022/2023

Course leader: Full Prof. Romana Turk  
Deputy course leader: Prof. Maja Belić

Teachers: Full Prof. Mirna Robić; Full Prof. Romana Turk; Prof. Maja Belić; teaching assistant Siniša Faraguna, DVM

Associate: Sandra Kunštek, M.Sc. Biotech.

First day of classes: 17/04/2023

Last day of classes: 16/6/2023

Timetable for LECTURES academic year 2022/2023

<b>LECTURES</b>				
<b>Date</b>	<b>Methodological unit</b>	<b>Teacher</b>	<b>Location / Time</b>	<b>Literature</b>
17/4/2023 1 <sup>st</sup> lecture	Metabolic disturbances: blood glucose homeostasis, hyperglycemia, hypoglycemia of piglets, ketosis	Full Prof. Mirna Robić	Lecture Room Physiology 12pm-14pm	See obligatory and optional literature list
20/4/2023 2 <sup>nd</sup> lecture	Metabolic disturbances: starvation, disturbances in fatty acids, triglycerides and cholesterol metabolism	Full Prof. Mirna Robić	Lecture Room Physiology 8am-10am	See obligatory and optional literature list
25/4/2023 3 <sup>rd</sup> lecture	Metabolic disturbances: lipids in blood and mechanisms of atherosclerosis development, Monday morning disease pathogenesis	Full Prof. Mirna Robić	Lecture Room Physiology 8am-9am	See obligatory and optional literature list
25/4/2023 4 <sup>th</sup> lecture	Liver and biliary system: disturbances in biotransformation mechanisms in liver, disturbances in bilirubin metabolism, mechanisms of icterus development	Full Prof. Romana Turk	Lecture Room Physiology 9am-10am	See obligatory and optional literature list
28/4/2023 5 <sup>th</sup> lecture	Liver and biliary system: mechanisms of fatty liver development	Full Prof. Romana Turk	Practical Hall Pathophysiology 10am-12pm	See obligatory and optional literature list
4/5/2023 6 <sup>th</sup> lecture	Liver and biliary system: mechanisms of ascites development	Full Prof. Romana Turk	Lecture Room Physiology 12pm-14pm	See obligatory and optional literature list
9/5/2023 7 <sup>th</sup> lecture	Disturbances in forestomach digestion; disturbances in ruminal microflora balance, pathogenesis of ruminal acidosis and alkalosis	Assoc. Prof. Maja Belić	Lecture Room Physiology 12pm-14pm	See obligatory and optional literature list
10/5/2023 8 <sup>th</sup> lecture	Disturbances in forestomach digestion; pathogenesis of traumatic reticuloperitonitis, disturbances in	Assoc. Prof. Maja Belić	Lecture Room Physiology 12pm-14pm	See obligatory and optional literature list

	eructation and pathogenesis of ruminal tympany			
11/5/2023 9 <sup>th</sup> lecture	Disturbances in stomach digestion: disturbances in gastric peristaltic and secretion, gastric ulcer, acute gastric dilatation in dogs and horses	Assoc. Prof. Maja Belić	Lecture Room Physiology 12pm-14pm	See obligatory and optional literature list
12/5/2023 10 <sup>th</sup> lecture	Disturbances in motoric function of small intestine, malabsorption, diarrhea, constipation	Assoc. Prof. Maja Belić	Lecture Room Physiology 8am-10am	See obligatory and optional literature list
15/5/2023 11 <sup>th</sup> lecture	Disturbances in intestinal passage, ileus, enteritis, disorders in pancreatic juice secretion, intestinal digestion in horses	Assoc. Prof. Maja Belić	Lecture Room Physiology 14pm-16pm	See obligatory and optional literature list
17/5/2023 12 <sup>th</sup> lecture	Hematopoietic system: complete blood count, classification of anemias, hemolytic anemia	Assoc. Prof. Maja Belić	Lecture Room Physiology 14pm-16pm	See obligatory and optional literature list
22/5/2023 13 <sup>th</sup> lecture	Hematopoietic system: nutritional deficiency anemia, anemia of inflammatory disease, anemia of renal disease, anemia caused by primary bone marrow diseases	Assoc. Prof. Maja Belić	Lecture Room Physiology 11pm-13pm	See obligatory and optional literature list
23/5/2023 14 <sup>th</sup> lecture	Disturbances in heart function: hemodynamics and regulatory factors, disturbances in impulses generation in heart, pathogenesis and forms of bradycardia and tachycardia, extrasystoles	Full Prof. Mirna Robić	Lecture Room Physiology 8am-10am	See obligatory and optional literature list
24/5/2023 15 <sup>th</sup> lecture	Disturbances in heart function: valvular heart disease, cardiac hypertrophy, dilatation and decompensation, heart failure	Full Prof. Romana Turk	Lecture Room Physiology 13pm-15pm	See obligatory and optional literature list
25/5/2023 16 <sup>th</sup> lecture	Disturbances in heart function: valvular heart disease, cardiac hypertrophy, dilatation and decompensation, heart failure	Full Prof. Romana Turk	Lecture Room Physiology 10am-11am	See obligatory and optional literature list

25/5/2023 17 <sup>th</sup> lecture	Pathophysiology of shock	Full Prof. Mirna Robić	Lecture Room Physiology 11am-12pm	See obligatory and optional literature list
26/5/2023 18 <sup>th</sup> lecture	Disturbances in fluid and circulation transportation, cardiogenic and non-cardiogenic pulmonary edema, atelectasis, disturbances in breathing frequency and volume	Full Prof. Mirna Robić	Lecture Room Physiology 8am-10am	See obligatory and optional literature list
31/5/2023 19 <sup>th</sup> lecture	Pulmonary volumes and capacities, protective mechanisms of respiratory tract, disturbances in alveolar ventilation, asthma, chronic bronchitis, lung emphysema	Full Prof. Mirna Robić	Lecture Room Physiology 10am-11am	See obligatory and optional literature list
31/5/2023 20 <sup>th</sup> lecture	Pathophysiology of renal diseases: regulation of renal mechanisms, classification of prerenal, renal and postrenal diseases. Prerenal disorders of kidney function	Full Prof. Romana Turk	Lecture Room Physiology 11am-12pm	
1/6/2023 21 <sup>st</sup> lecture	Pathophysiology of renal diseases: glomerular, vascular and tubulointerstitial kidney diseases, acute and chronic kidney insufficiency, uremic syndrome, nephrotic syndrome	Full Prof. Romana Turk	Practical Hall Pathophysiology 10am-12pm	See obligatory and optional literature list
7/6/2023 22 <sup>nd</sup> lecture	Coagulation disorders: primary and secondary hemostasis disorders; thrombocytopenia, von Willebrandt disease, DIC	Full Prof. Romana Turk	Lecture Room Physiology 12pm-14pm	See obligatory and optional literature list

Timetable for SEMINARS academic year 2022/2023

SEMINARS					
Date	Methodological unit	Teacher	Group	Location / time	Literature
13/6/2023 1 <sup>st</sup> seminar	Individual presentation of selected themes	Full Prof. Mirna Robić	1,2,3	Lecture Room Physiology 8am-10am	Printed and electronic teaching materials
14/6/2023 2 <sup>nd</sup> seminar	Individual presentation of selected themes	Full Prof. Romana Turk	1,2,3	Lecture Room Physiology 14pm-16pm	Printed and electronic teaching materials
15/6/2023 3 <sup>rd</sup> seminar	Individual presentation of selected themes	Assoc. Prof. Maja Belić	1,2,3	Lecture Room Physiology 14pm-16pm	Printed and electronic teaching materials

## Timetable for PRACTICALS academic year 2022/2023

PRACTICALS						
Date	Methodological unit	Teacher	Type of practical	Group	Location / time	Literature
21/4/2023 1 <sup>st</sup> practical	Disorders of lipid metabolism	Full Prof. Romana Turk	Clinical practicals	1,2,3	Practical Room Pathophysiology 10am-12pm	Printed and electronic teaching materials
26/4/2023 2 <sup>nd</sup> practical	Clinical enzymology: diagnostic significance of serum enzyme activities	Siniša Faraguna, DVM	Clinical practicals	1,2,3	Practical Room Pathophysiology 14pm-16pm	Printed and electronic teaching materials
4/5/2023 3 <sup>rd</sup> practical	Disorders of bilirubin metabolism: differential diagnostic of icterus, determination of serum bilirubin concentration	Assoc.Prof. Maja Belić	Clinical practicals	1,2,3	Practical Room Pathophysiology 14pm-16pm	Printed and electronic teaching materials
5/5/2023 4 <sup>th</sup> practical	Laboratory diagnostics of cerebrospinal fluid	Assoc.Prof. Maja Belić	Constructive practicals	1,2,3	Practical Room Pathophysiology 8am-10am	Printed and electronic teaching materials
9/5/2023 5 <sup>th</sup> practical	Urine analysis and interpretation	Siniša Faraguna, DVM	Clinical practicals	1,2,3	Practical Room Pathophysiology 8am-10am	Printed and electronic teaching materials
10/5/2023 6 <sup>th</sup> practical	Colloquium: diagnostic significance of serum and urine analysis Hematopoietic system: blood cell maturation in bone marrow	Full Prof. Mirna Robić	Constructive practicals	1,2,3	Practical Room Pathophysiology 14pm-16pm	Printed and electronic teaching materials REAGAN, W. J., T. G. SANDERS, D. B. DENICOLA (1998): Veterinary Hematology: Atlas of Common Domestic Species, Iowa State University Press.
11/5/2023 7 <sup>th</sup> practical	Hematological analyses and its application in	Siniša Faraguna, DVM	Clinical practicals	1,2,3	Practical Room Pathophysiology	Printed and electronic teaching materials

	disease recognition. Methods of blood cells counting, determination of erythrocyte number				12pm-14pm	
12/5/2023 8 <sup>th</sup> practical	Determination of erythrocyte sedimentation rate, hemoglobin concentration and PCV: diagnostic significance in pathophysiological conditions. Calculation of erythrocyte indices and morphological classification of anemia	Siniša Faraguna, DVM	Clinical practicals	1,2,3	Practical Room Pathophysiology 10am-12pm	Printed and electronic teaching materials
15/5/2023 9 <sup>th</sup> practical	Determination of reticulocyte count, its diagnostic significance, classification of regenerative and non-regenerative anemia	Full Prof. Romana Turk	Clinical practicals	1,2,3	Practical Room Pathophysiology 12pm-14pm	Printed and electronic teaching materials
16/5/2023 10 <sup>th</sup> practical	Leukopoiesis, function of leukocytes	Full Prof. Mirna Robić	Constructive practicals	1,2,3	Practical Room Pathophysiology 8am-10am	Printed and electronic teaching materials REAGAN, W. J., T. G. SANDERS, D. B. DENICOLA (1998): Veterinary Hematology: Atlas of Common Domestic Species, Iowa State University Press.
17/5/2023 11 <sup>th</sup> practical	Determination of total leukocyte count, diagnostic significance of changes in total leukocytes count	Siniša Faraguna, DVM		1,2,3	Practical Room Pathophysiology 10am-12pm	Printed and electronic teaching materials REAGAN, W. J., T. G. SANDERS, D. B. DENICOLA (1998): Veterinary

						Hematology: Atlas of Common Domestic Species, Iowa State University Press.
18/5/2023 12 <sup>th</sup> practical	Determination of absolute eosinophil count, diagnostic significance of changes of eosinophil count	Siniša Faraguna, DVM	Clinical practicals	1,2,3	Practical Room Pathophysiology 13pm-15pm	Printed and electronic teaching materials
19/5/2023 13 <sup>th</sup> practical	Differential leukocyte count, blood smear making and staining	Siniša Faraguna, DVM	Clinical practicals	1,2,3	Practical Room Pathophysiology 10am-12pm	Printed and electronic teaching materials REAGAN, W. J., T. G. SANDERS, D. B. DENICOLA (1998):Veterinary Hematology: Atlas of Common Domestic Species, Iowa State University Press.
22/5/2023 14 <sup>th</sup> practical	Determination of differential leukocyte count, diagnostic significance of qualitative and quantitative changes	Full Prof. Mirna Robić	Clinical practicals	1,2,3	Practical Room Pathophysiology 13pm-15pm	Printed and electronic teaching materials REAGAN, W. J., T. G. SANDERS, D. B. DENICOLA (1998):Veterinary Hematology: Atlas of Common Domestic Species, Iowa State University Press.
23/5/2023 15 <sup>th</sup> practical	Morphologic changes of RBC and their diagnostic significance	Full Prof. Romana Turk	Clinical practicals	1,2,3	Practical Room Pathophysiology 10am-12pm	Printed and electronic teaching materials REAGAN, W. J., T. G. SANDERS, D. B. DENICOLA (1998):Veterinary Hematology: Atlas of Common Domestic Species, Iowa State University Press.



24/5/2023 16 <sup>th</sup> practical	Interpretation of leukogram changes in different animal species	Full Prof. Mirna Robić	Clinical practicals	1,2,3	Practical Room Pathophysiology 8am-10am	Printed and electronic teaching materials
25/5/2023 17 <sup>th</sup> practical	Morphology changes of RBC and WBC in blood smear	Full Prof. Romana Turk	Constructive practicals	1,2,3	Practical Room Pathophysiology 12pm-14pm	Printed and electronic teaching materials
26/5/2023 18 <sup>th</sup> practical	Hematology of reptiles	Assoc.Prof. Maja Belić	Clinical practicals	1,2,3	Practical Room Pathophysiology 13pm-15pm	Printed and electronic teaching materials
31/5/2023 19 <sup>th</sup> practical	Hematology of birds	Assoc.Prof. Maja Belić	Clinical practicals	1,2,3	Practical Room Pathophysiology 12pm-14pm	Printed and electronic teaching materials
1/6/2023 20 <sup>th</sup> practical	Bone marrow smear examination	Siniša Faraguna, DVM	Clinical practicals	1,2,3	Practical Room Pathophysiology 12pm-14pm	Printed and electronic teaching materials
2/6/2023 21 <sup>st</sup> practical	Neoplastic diseases of hematopoietic system	Siniša Faraguna, DVM	Clinical practicals	1,2,3	Practical Room Pathophysiology 8am-10am	Printed and electronic teaching materials
5/6/2023 22 <sup>nd</sup> practical	Practical colloquium: recognition of blood cells and morphology changes of blood cells	Siniša Faraguna, DVM	Constructive practicals	1,2,3	Practical Room Pathophysiology 8am-10am	Printed and electronic teaching materials
6/6/2023 23 <sup>rd</sup> practical	Laboratory diagnostics of disorders of hemostasis	Siniša Faraguna, DVM	Clinical practicals	1,2,3	Practical Room Pathophysiology 8am-10am	Printed and electronic teaching materials
12/6/2023 24 <sup>th</sup> practical	Laboratory diagnostics of kidney diseases	Assoc.Prof. Maja Belić	Clinical practicals	1,2,3	Practical Room Pathophysiology 10am-12pm	Printed and electronic teaching materials
14/6/2023 25 <sup>th</sup> practical	Interpretation of hematological and biochemical laboratory findings Colloquium: diagnostic significance of qualitative and	Assoc.Prof. Maja Belić	Constructive practicals	1,2,3	Practical Room Pathophysiology 12pm-14pm	Printed and electronic teaching materials

	quantitative changes of hemogram					
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**STUDENT OBLIGATIONS**

Lecture attendance	Student must be present at least 20 hours of lectures to gain minimal 3 points. For each excused absence student will get back 0.154 points per hour. Maximal number of points for lecture attendance is 6 points.
Seminars attendance	Student must be present at least 5 hours of seminars to gain minimal four points. Each excused absence student can make up in agreement with seminar leader in written form and the points for attendance could be regained. Student can achieve maximum 6 points for seminar attendance.
Practicals attendance	Student must be present at least 40 hours of practicals to achieve minimal 5.2 points. Each excused absence within the limit (10 hours, i.e. 5 programs) student can make up in agreement with practical leader and 0.13 points per hour could be regain. Maximal number of points, which can be achieved from practical attendance, is 6 points.
Active participation in seminars and practicals	Each attended, written and signed practical results in 0.2 points, finally maximal 5 points (25 programs x 0.2 = 5). During practicals, short oral knowledge checking will be performed and that maximal 2.5 points can be gained. During seminars student should prepare oral presentation with PowerPoint presentation of given topics and that way can gain maximal 2.5 points.
Final exam	The final exam begins with result analysis of each evaluation element. For final exam attendance, student must gain minimum 16 points from attendance and activity on lectures, seminars and practicals, and minimal 20 points from continuous knowledge checking. Regardless to the final sumo of gained points until final exam, student must show sufficient knowledge at final exam. Minimal number of points which can be gained at final exam is 24, maximal is 40. If student did not show sufficient knowledge at final exam, she/he can access the exam in the next term. Final mark is formed based on total number of points from all elements of evaluation.
Examination requirements	Student requirements are defined in the Regulations on the Integrated Undergraduate and Graduate Study of Veterinary Medicine. Given the above, the student must acquire a minimum number of points from all assessment elements in order to take the final exam. <b>Article 45:</b> a student can justifiably be absent from up to 50 % of the lectures; 20 % of the seminars and 20 % of the practicals.

**GRADING AND EVALUATING STUDENT WORK**

Continuous knowledge-checking (colloquium)	<p>Three are 2 written and 1 practical colloquiums that will be performed in regular practicals terms:</p> <ol style="list-style-type: none"> <li>1. Written test from biochemical practicals contains 6 questions. Each correct answer is worth 2 points. Maximal 12 points can be achieved. Minimal 7 points are required.</li> <li>2. Written test from hematological practicals contains 16 questions. Each correct answer is worth one point. Maximal 16 points can be achieved. Minimal 10 points are required.</li> <li>3. Practical colloquium includes recognition blood cells and their morphology changes on the blood smear. Maximal 4 points can be achieved. Minimal 3 points are required.</li> </ol> <p>A total score from all 3 colloquiums is 32 points. Minimal 20 points are required.</p> <p>For students who do not achieve minimal number of points from each colloquium, three additional terms will be organized during the academic year. Students who do not pass colloquiums in current academic year will lose the possibility to attend the colloquiums and must re-enroll the course to gain sufficient knowledge and possibility to attend the colloquiums in the following academic year.</p> <p>Dates of colloquiums 10/5/23, 5/6/23, 14/6/23</p>
Final exams (dates)	28/6/2023, 10/7/2023, 7/9/2023, 22/9/2023
Form of final exam	oral

**LITERATURE**

Obligatory literature	<p>DUNLOP, R. H., C.-H. MALBERT (2004): Veterinary Pathophysiology, Blackwell Publishing, Ames, Iowa.</p> <p>FELDMAN, B. F., J. G. ZINKL, N. C. JAIN (2000): Schalm's Veterinary Hematology. Lippincott Williams and Wilkins, Philadelphia, Baltimore, New York, London, Buenos, Aires, Hong Kong, Sydney, Tokyo.</p> <p>SLAUSON, D. O., B. J. COOPER (2002): Mechanism of Disease. Mosby, St. Louis, London, Philadelphia, Sydney, Toronto.</p> <p>HANSEN, M. (1998): Pathophysiology. Foundations of disease and Clinical Intervention. Saunders company, USA.</p> <p>REAGAN, W. J., T. G. SANDERS, D. B. DENICOLA (1998): Veterinary Hematology: Atlas of Common Domestic Species, Iowa State University Press.</p> <p>E-learning materials</p>
Optional literature	

**OBJECTIVES AND LEARNING OUTCOMES**

Course objectives	<p>The course objective is gaining knowledge on mechanisms involved in development of pathophysiological processes in individual organs and organ systems on molecular and cellular level and tissue and organs levels which provides understanding the course of disease and basis for understanding clinical courses. Overall consideration of pathophysiological mechanisms enables students to develop sense for integrative approach to pathological process at the whole organism level. In addition, the objective of the course is to develop skills in laboratory diagnostic of pathological processes and interpretation of changes in laboratory findings that could help in diagnosis of diseases.</p>
Learning outcomes	<p>After successful mastering, student will be able to describe digestive system pathophysiology, describe disturbances in hepatic and biliary function, define disturbances in carbohydrate, fat and protein metabolism, describe renal diseases pathophysiology, describe disturbances in blood and hematological system functions and heart diseases, and describe disturbances in respiratory system functions. In addition, students will gain skills in performing biochemical and hematological laboratory diagnostics and</p>

interpretation of laboratory findings to be used in understanding the mechanisms and course of pathological process.

### **GRADING SCHEME**

<i>Points</i>	<i>Grade</i>
Up to 59	1 (F)
60-68	2 (E)
69-76	2 (D)
77-84	3 (C)
85-92	4 (B)
93-100	5 (A)

Course leader:

Full Prof. Romana Turk

Head of organizational unit:

Prof. Maja Belić

Note: The course leader is required to submit a Course Syllabus to all teachers and associates pertaining to the Course

Kolegij: