

Degree programme	Type	Course
Veterinary Medicine	FB	2

Contact lecturer

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Group languages

You can consult this information at the [end](#) of the document.

Prerequisites

It is assumed that the student has a sufficient baggage of physics and chemistry, to enable the understanding of physiological functions.

It is essential to have completed the first year of the degree and to have acquired knowledge of Cell Biology, Biochemistry, Morphology I and Structure and Function of the Nervous System.

It is important to attend simultaneously subjects such as Morphology II, some of which are complementary to those of the Physiology course.

Objectives

The objective of the subject is to achieve sufficient knowledge of the functions of the different organs and systems and to be able to understand and explain how they work coordinately to cope with the challenges the animals face. The specific objectives are to know and understand.

1 - The functions of blood, hemostasis, hemodynamics and regulation of the cardiovascular system.

2 - The functions of the respiratory system and the renal system and their relation to the regulation of pH of

physiological fluids and hydroelectrolytic equilibrium.

3 - The functions of the endocrine system as a regulator of the energy and intermediate metabolism and of the adaptations of the organism in the mid and long terms.

4 - The reproductive function in males and females and its regulation.

5 - The digestive function and the adaptations of the digestive system to dietary conditions and to the presence of microbiota.

6 - The immune system, the tolerance of self-structures and the innate and adaptive defensive responses of the organism.

This subject should provide the basis for detecting, evaluating, understanding and treating the pathological situations that the clinical veterinarian faces in his/her professional activity. It should also be the basis for understanding concepts that will be explained later, such as those related to nutrition and animal production, and the basis of pharmacological action.

Learning outcomes

1. Analyse, synthesise and resolve problems and make decisions.
2. Draft and present satisfactory professional reports, always maintaining the required confidentiality.
3. Apply scientific method to professional practice, including medicine
4. Demonstrate knowledge of English to communicate both orally and in writing in academic and professional contexts.
5. Explain the basic concepts of the mechanisms of functional regulation in each system.
6. Explain the interrelation between the different organs and systems, and their hierarchical organisation.
7. Recognise the magnitude and time dimension of the physiological changes that take place in the adaptation of an animal to its surroundings.
8. Foresee the qualitative and quantitative repercussions of disorder in a particular mechanism for the organism as a whole.
9. Use physiological concepts to solve problems related with clinical and experimental situations or related with the productive field.
10. Use correct and suitable physiological terminology.
11. Recognise the mechanisms through which the environment induces changes in animals' functions.
12. Identify the variables that enable evaluation of the functions of each system.
13. Explain the main physical, chemical and molecular bases that ensure the correct functioning of the organism.
14. Define the properties of innate and adaptive immune response and defend clonal selection theory: a lymphocyte, an antigen receptor.
15. Explain the mechanisms for activating and regulating cellular and humoral immune response.
16. Analyse the relation between the type of immune response that develops and the characteristics of the pathogen: the method and anatomical place of entry, the effector mechanisms of the response and the evasion mechanisms.

Contents

Lectures (62h)

Presentation of the subject

BLOCK IMMUNOLOGY

1- Functions of the immune system (resp. J.R Palacio) 2 ECTS

1.1. Elements of the immune system. Innate immunity Cells and proteins. The complement system. / Theme of Self-Learning (AAP).

1.2. Structure of immunoglobulins (Igs) Antigen-antibody interaction. TCR and BCR

1.3. Organization of immunoglobulin genes: Recombination mechanisms. The T cell receptor (TCR). Complex CD3: TCR signaling complex. TCR / MHC / antigen trimolecular interaction.

1.4. Major Histocompatibility Complex (MHC) Class I and Class II. Structural characteristics and function. Restriction of T response by MHC. Polymorphism and peptide binding. MHC-peptide complex: interactions, conformational changes, recognition surface, molecular mimicry

1.5. Antigenic processing and recognition. Synthesis of molecules of MHC class I and class II. Processing paths. "Cross priming". Presentation of antigens: requirements, signals accessories. Recognition of the antigen by the T cells: immunological synapse.

1.6. T Lymphocytes . Ontogeny and maturation of T cells. Positive and negative clonal selection. Restriction for MHC and self tolerance. T cell populations : TCRab and TCRgd. Functional subpopulations: Helper (Th), cytotoxic (Tc) and regulatory (Treg) T cells. NKT cells. Memory T cells.

1.7. B Lymphocytes. Ontogeny and maturation of the B lymphocytes. Phenotypic and functional differences in B cells. Effector functions of B cells: antibody production and antigen presentation (APC). Subpopulations of B cells: B-1 and B-2 cells. T-dependent and T-independent antigens.

1.8. Professional Antigen Presentation Cells (APCs). Conventional and plasmacytoid dendritic cells: Function and anatomical location. Other cells: mast cells, eosinophils, basophils and NK cells..

1.9. Cytokines Properties. Functional redundancy. Families of cytokines. Receptors. Cytokines of innate and adaptive immunity. Chemokines, Chemotaxis and homing of leukocytes. Families of chemokines and their receptors. Specificity, properties and main effects.

Organization of the immune response.

1.10. Cellular immunity. From the innate to the adaptive response . Activation of T cells. TCR interaction, MHC and accessory molecules. Signal Transmission. Third activation signal: micro-environment of cytokines. Lymphocyte activation markers T: IL2R, Class II T cells and B memory. Phenotypic characteristics. Effector T

cells. Th1 and Th2. T cytotoxic lymphocytes. Mechanisms of cytotoxicity.

1.11. Humoral immune response. Activation of B lymphocytes. Antigen recognition. Second signal transduction. Th follicular cells (Tfh). Lymphoid follicles and germinal center formation. Somatic hypermutation. Maturation of affinity.

1.12. Isotype change and microenvironment in the lymph nodes. Humoral responses against T-independent and T-dependent antigens. Effector function of the antibodies. Anatomical distribution of antibodies.

1.13. Regulation of the immune response. Self-regulation. Immune Tolerance: central (clonal deletion) and peripheral (ignorance, anergy, deletion, suppression) tolerance. Mechanisms and elements of regulation during and after the immune response. Apoptosis (AICD). T regulatory lymphocytes: natural regulators (nTr), induced regulators (Tr1).

1.14. Immune response towards bacteria, fungi, parasites and viruses. Mechanisms of evasion of the immune response. Immune memory. Autoimmunity in response to viral infections. HIV infection.

Ineffective immune response

1.15. Hypersensitivity reactions. Concept of hypersensitivity. Type I. Type II. Type III. Type IV.

1.16. Autoimmunity. Tolerance and autoimmunity. Mechanisms.

BLOCK: PHYSIOLOGY

2-Functions of blood, circulation and respiration (resp. M.T. Martín) 1.7 ECTS

2.1 Blood functions. Cellular elements, proteins and other solutes. Hemostasis; adhesion and platelet aggregation. Coagulation and fibrinolysis. Tissue repair

2.2 Cardiac cycle (I). Phases of the heart cycle. Isovolumetric contraction and relaxation. Relationship between ECG, pressures and volumes of the different compartments.

2.3 Cardiac cycle (II). Cardiac sounds and murmurs. Systolic and diastolic sounds. Regulation of the heart cycle.

2.4 Hemodynamics of the arterial, capillary, venous and lymphatic circulation.

2.5 Regulation of blood pressure (I). Nervous mechanisms. Concept of baroreceptor. Nervous centers and afferent pathways. Neurotransmitters involved.

2.6 Regulation of blood pressure (II). Endocrine regulation. Role of the kidney in the regulation of blood pressure. Integration of the different mechanisms: pharmacological approach.

2.7 Regulation of local blood flow. Mechanisms of hyperemia and self - regulation. Local control factors.

2.8 Capillary circulation: mechanisms for exchange and dissemination.

2.9 Mechanics of respiration. Respiratory cycle. Volumes and pressures. Functions of the diaphragm.

2.10 Gas exchange. Oxygen and carbon dioxide exchange at the alveolar and peripheral level. Gas transport

2.11 Regulation of breathing. Central and peripheral mechanisms of breathing regulation. Breathing in birds.

3-Endocrine system and metabolic regulation (resp. S. Casabella) 2.5 ECTS

3.1. Chemical mechanisms of regulation. Concept of hormone and target tissue. Hormone receptors. Types of hormones and hormonal secretions. Factors that modify the response to hormones.

3.2. Mechanisms of action. Intracellular mediators: concept of second messenger. Relationship between mechanism of action and chemical characteristics of hormones. Paracrine mediators. Eicosanoids.

3.3. General organization of the endocrine system. Pituitary gland. Hypothalamic control of the adenohypophysis. Relationship of the hypothalamus with other higher structures. Hormones of the neurohypophysis. Hypothalamic-pituitary portal circulation.

3.4. Regulation of oxidative metabolism. Thyroid hormones. Synthesis, storage and secretion of thyroid hormones. Transport and metabolism. Receptors and effects. Regulation of thyroid secretion.

3.5. Regulation of intermediary metabolism (i): Control of glycemia in postprandial and fasting situations.

Endocrine secretions of the pancreas. Insulin: Secretion, transport and effects. Glucagon: Effects. Somatostatin. Effects. Other pancreatic hormones. Regulation of pancreatic hormone secretion. Entero-insular axis.

3.6.Regulation of intermediary metabolism (ii): Control of glycemia in emergency situations. Medullary-adrenal hormones. Biosynthesis and metabolism. Fight or flight responses.

3.7.Regulation of intermediary metabolism (iii): Response to chronic adverse situations. Glucocorticoids. Effects on metabolism. Effects on the immune system. Other effects. Control of glucocorticoid secretion. Stress and its relationship with the secretions of the adrenal cortex and medulla.

3.8. Regulation of intermediary metabolism (iv): Growth hormone. Direct effects. Indirect effects. Insulin-like growth factors. Regulation of their secretion. Tissue repair. Aging.

3.9. Energy metabolism. Energy balance. Endocrine functions of adipose tissue: Leptin and adipokines. Actions on intermediary metabolism, energy metabolism and intake.

3.10 Thermoregulation. Mechanisms of heat generation and loss. Fever, heat stroke, acclimatization, hibernation, lethargy. Hypothermia.

3.11. Chronobiology. Rhythmicity in animal function and its adaptive value. Circadian rhythms and their nervous regulation. Pineal gland. Infradiurnal rhythms and their regulation.

4: Digestive system (M. Martin resp.) 1.1 ECTS

4.1. Gastrointestinal functions. Control of gastrointestinal functions. Enteric nervous system. Gastrointestinal hormones and peptides. Gastrointestinal defensive responses.

4.2. Gastrointestinal secretions: salivary, gastric, pancreatic and biliary. Functions, components and mechanisms of regulation.

4.3. Swallowing; gastric filling and emptying. Motor patterns and regulation.

4.4. Small intestine motility: interdigestive and postprandial patterns. Segmentation and peristaltic movements. Migratory motor complexes. Mechanisms of regulation.

4.5. Large intestine: Functions and motor patterns. Mechanisms of regulation. Defecation.

4.6. Intestinal digestion. Absorption and secretion of nutrients, water and electrolytes in the intestine.

4.7. Digestive adaptations in ruminants and other herbivores. Digestion by symbionts.

5-Renal system and water and salt balance (Resp. Sergi Casabella) 0.9 ECTS

5.1. Hormones regulating calcium and phosphate homeostasis. Parathyroid hormone, vitamin D and calcitonin. Physiology of the bone. Bone mechanosensory system.

5.2. Homeostasis of Sodium and Potassium. Renin-angiotensin-aldosterone system. Kallikrein-kinin system. Atrial natriuretic factor.

5.3. Vasopressin. Actions, control of its secretion. Relationship with other hormones involved in the regulation of water and salt balance.

5.4. Kidney function. The nephron. Renal circulation, glomerular filtration and its regulation. Tubulo-glomerular feed back. Renal Clearance. Estimating glomerular filtration rate.

5.5. Tubular functions. Tubular reabsorption mechanisms. Tubular secretion. Mechanisms of urine concentration and dilution.

5.6. Regulation of the acid-base balance. Blood and tissue buffer systems. Metabolic, respiratory and renal influences

5.7. Micturition. Mechanisms and neural pathways involved. Excretory function in birds.

6-Reproduction (M. Martin resp.) 0.8ECTS

6.1. Sex biology Sexual differentiation. Sexual steroids.

6.2. Testicular function. Testicular compartments. Regulation and organization of spermatogenesis.

6.3. Ovarian function and ovarian cycle. Phases of follicular development. Ovulation luteogenesis. Luteolysis

6.4. Regulation of the ovarian cycle. Regulation of gonadotrophin secretion. Types of cycles: Menstrual cycle; Estrous cycle; Polyestral and monoestral females.

6.5. Environmental influences on reproduction. Effects of the photoperiod: seasonal and non-seasonal animals. f Sexual intercourse-induced ovulation. Effects of social interaction.

6.6. Androgen functions in adults. Secretions of the male reproductive system. Function of estrogens and progestagens in the female reproductive system. Changes in the oviduct, uterus, cervix and vagina during the

ovarian cycle. Genital reflexes: Erection, ejaculation.

6.7. Pregnancy: Endocrine recognition and support in domestic mammals. Hormonal changes related to parturition. Functions of oxytocin. Restoration of cycles after parturition.

6.8. Development of the mammary gland. Mechanism of milk secretion. Lactation. Milk ejections. Influence of lactation on ovarian function.

6.9. Reproduction in birds.

Practical works (10.5 h):

- Hematology: Blood cell counts, hematocrit and leukocyte formula

- Separation and functional evaluation of lymphocytes

- *ECG in the dog**

- Structure and function of lymphoid organs

- *Renal function tests in the dog.**

**practical works with live animals in small groups*

Seminars (10 h):

1- Case studies on circulation and respiration

2- Case studies on endocrine functions.

3- Testing renal function. Calculating renal function parameters, significance and interpretation.

4- Adaptations of the digestive system. and case studies on reproductive physiology

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Practical works	10.5	0.42	2, 5, 8, 10, 11, 13, 14, 15, 16
Lectures	62	2.48	1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16
Individual work and study	109.5	4.38	1, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
Autonomous work on Case Reports/mentoring sessions	24	0.96	1, 2, 3, 4, 5, 8, 10, 11, 12, 13, 14, 15, 16
Seminars	8	0.32	2, 3, 5, 8, 10, 11, 12, 13, 14, 15, 16

The teaching methodology will involve theoretical classes, in face-to-face format if there are no extraordinary circumstances.

We will hold mandatory face-to-face practical classes in the laboratory and in the microscopy room. Mandatory practical seminars will also be held in which the resolution of cases and problems and the interpretation of data in small groups will be addressed, in order to bring the students closer to clinical or experimental situations, enhance analytical skills and promote a holistic approach to practical applications and inference of physiological concepts. During the seminars, students will have to carry out short assessable activities.

The continuous assessment tests will not be individually reassessable.

People who opt for the single assessment system are not exempt from attending the practicals and seminars, although they will not have to do the assessment activities planned for the rest of students in these sessions.

In this course, the use of Artificial Intelligence (AI) technologies is not permitted in any of its phases. Any assignment, case resolution, or exam that includes fragments generated with AI will be considered a breach of academic integrity and may result in a partial or total penalty in the grade of the activity, or more severe sanctions in serious cases.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Test block immunology	25%	2	0.08	6, 7, 8, 9, 10, 11, 14, 15, 16
2nd TEST BLOCK PHYSIOLOGY (Digestion, Renal Function and Reproduction. Integration))	40%	2	0.08	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13
1st TEST BLOCK PHYSIOLOGY (Circulation Respiration & Endocrinology)	25%	2	0.08	1, 3, 7, 8, 9, 10, 11, 12
CLASROOM EVALUATING ACTIVITIES ABOUT CONTENTS OF THE PHYSIOLOGY BLOCK	10%	5	0.2	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

A multifactorial evaluation system has been proposed in order to:

- Guarantee the achievement of a good level of knowledge and skills.
- Assess the continuous work throughout the course through various tests and tasks
- Stimulate a continuous work on the subject (many tasks, each with a small contribution to the final score).
- Provide students with useful tools to integrate the knowledge and opportunity to be aware of how good is their progress in learning.
- Make it possible to test all the skills that must be evaluated.

Important: EACH BLOCK -IMMUNOLOGY AND PHYSIOLOGY- MUST BE SEPARATELY APPROVED, AND THE GRADE CAN ONLY BE COMPENSATED IF THE MINIMUM GRADE PER EACH BLOCK IS ACHIEVED.

Assessable item	Grade	Minimum requirements to pass the assessable item	Observations	Reassessment
Exam immunology (test)	25%	To answer the 70% of the questions and reaching a minimum grade of 5/10		Yes
First partial exam of the physiology block (circulatory, respiratory and endocrine) (test)	25%	To answer the 70% of the questions and reaching a minimum grade of 5/10		Yes
Second partial exam of the physiology block (digestive, renal and reproductive) (test and hypothetical cases)	40%	Part 1: test: To answer the 70% of the questions and reaching a minimum grade of 5/10 Part 2: hypothetical cases: Reaching a minimum grade of 5/10	This partial exam will also assess the content covered in the first partial exam (circulatory, endocrine and respiratory)	Yes, only the part (test or hypothetical cases, or both) in which the minimum grade required to pass has not been obtained
Continuous assessment tests of the physiology block	10%			No

In the physiology block, concepts already assessed in the course of Estructura i Funció del Sistema Nerviós (EFSN) can be asked.

Attendance at practical classes and seminars is mandatory, both for students in the continuous assessment modality and in the single assessment modality.

The reassessment tests will be similar to those carried out previously. If, due to special or personal circumstances, tests had to be taken outside the dates scheduled in the calendar, oral exams would be the preferred option.

Students who opt for single assessment will not take continuous assessment tests, but in the subject exam (100% of the grade) they will have to complete exercises that allow all the planned competences to be assessed. In this way, a single exam will be held that will combine questions from the entire syllabus and will be divided into 2 blocks: immunology (25%) and physiology (75%), each of which must be passed with a minimum grade of 5/10. The exam will include development questions and/or case resolution questions that allow the various competences related to discursive skills, the use of technical language, etc. to be assessed.

Bibliography

- Roitt's Essential Immunology, P.J. Delves, S.J. Martin, D. Burton, I. Roitt, Wiley-Blackwell Publ., 12th edition 2011
- Immunology, D. Male, J. Brostoff, I. Roitt, R. Mosby, 8th edition, 2018
- Cellular & Molecular Immunology, A.K. Abbas, A.H. Lichtman, S. Pillai, Saunders, 8th edition 2015
- Janeway's Immunobiology, K.M. Murphy, P. Travers, M. Walport. Garland Science, 8th edition 2012
- Kuby Immunology, J. Owen, J. Punt, S. Stranford, 7th edition 2012
- Fundamental Immunology, W.E. Paul, Lippincott, 7th edition 2013
- Introducción a la Inmunología humana, L. Fainboim, J. Gefner, Ed Médica 6ª edición. Editorial Medica Panamericana, 2011

Software

no programari

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	1	Catalan/Spanish	annual	morning-mixed
(PLAB) Practical laboratories	1	Catalan/Spanish	annual	morning-mixed
(SEM) Seminars	1	Catalan	annual	morning-mixed
(PLABs) Suport a les pràctiques de laboratori	1	Catalan/Spanish	annual	morning-mixed
(PAV) Pràctiques veterinàries	1	Catalan	annual	morning-mixed

amb animals vius i de sala de necròpsies					
(TE) Theory	2	Catalan/Spanish	annual	morning-mixed	
(PLAB) Practical laboratories	2	Catalan/Spanish	annual	morning-mixed	
(SEM) Seminars	2	Catalan	annual	morning-mixed	
(PLABs) Suport a les pràctiques de laboratori	2	Catalan/Spanish	annual	morning-mixed	
(PAV) Pràctiques veterinàries amb animals vius i de sala de necròpsies	2	Catalan	annual	morning-mixed	
(PLAB) Practical laboratories	3	Catalan/Spanish	annual	morning-mixed	
(SEM) Seminars	3	Catalan	annual	morning-mixed	
(PLABs) Suport a les pràctiques de laboratori	3	Catalan/Spanish	annual	morning-mixed	
(PAV) Pràctiques veterinàries amb animals vius i de sala de necròpsies	3	Catalan	annual	morning-mixed	
(PLAB) Practical laboratories	4	Catalan/Spanish	annual	morning-mixed	
(SEM) Seminars	4	Catalan	annual	morning-mixed	
(PLABs) Suport a les pràctiques de laboratori	4	Catalan/Spanish	annual	morning-mixed	
(PAV) Pràctiques veterinàries amb animals vius i de sala de necròpsies	4	Catalan	annual	morning-mixed	
(PLAB) Practical laboratories	5	Catalan/Spanish	annual	morning-mixed	
(SEM) Seminars	5	Catalan	annual	morning-mixed	
(PLABs) Suport a les pràctiques de laboratori	5	Catalan/Spanish	annual	morning-mixed	

(PAV) Pràctiques veterinàries amb animals vius i de sala de necròpsies	5	Catalan	annual	morning-mixed
(PLAB) Practical laboratories	6	Catalan/Spanish	annual	morning-mixed
(SEM) Seminars	6	Catalan	annual	morning-mixed
(PLABs) Suport a les pràctiques de laboratori	6	Catalan/Spanish	annual	morning-mixed
(PAV) Pràctiques veterinàries amb animals vius i de sala de necròpsies	6	Catalan	annual	morning-mixed
(PAV) Pràctiques veterinàries amb animals vius i de sala de necròpsies	7	Catalan	annual	morning-mixed
(PAV) Pràctiques veterinàries amb animals vius i de sala de necròpsies	8	Catalan	annual	morning-mixed
(PAV) Pràctiques veterinàries amb animals vius i de sala de necròpsies	9	Catalan	annual	morning-mixed
(PAV) Pràctiques veterinàries amb animals vius i de sala de necròpsies	10	Catalan	annual	morning-mixed
(PAV) Pràctiques veterinàries amb animals vius i de sala de necròpsies	11	Catalan	annual	morning-mixed
(PAV) Pràctiques veterinàries amb animals vius i de sala de necròpsies	12	Catalan	annual	morning-mixed