

## 28408 - Animal Physiology

### Syllabus Information

**Academic year:** 2023/24

**Subject:** 28408 - Animal Physiology

**Faculty / School:** 105 - Facultad de Veterinaria

**Degree:** 451 - Degree in Veterinary Science

**ECTS:** 12.0

**Year:** 2

**Semester:** Annual

**Subject type:** Basic Education

**Module:**

### 1. General information

Animal Physiology is a basic subject of the Health Sciences branch.

It is an annual course of 12 ECTS, taught in the second year of the degree. It deals with the study of the function of the animal organism as a whole and of each of its parts, especially focused on animals of veterinary interest with a view to its subsequent application to animal medicine and production.

Learning the subject provides training and competency to contribute to some extent to meeting Goal 3: Health and Well-being, included in the Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>).

### 2. Learning results

This subject will allow the student to understand the fundamental principles of animal physiology, as a basic subject, with a view to its application to the study of other subjects of the degree in the fields of nutrition, pharmacology and therapeutics, propedeutics, medicine and surgery, obstetrics and reproduction, animal health and production, among others.

Upon completion of the subject, the student will be able to:

- Know, understand and explain the physiological fundamentals of the different systems of the animal organism (nervous, endocrine, cardiovascular, respiratory, renal, digestive and reproductive), as well as the mechanisms for the maintenance of homeostasis and physiological adaptations.

- Interrelate different concepts and knowledge to describe the overall functioning of the organism and its regulation.

- Proper use of the scientific terminology of this subject.

- Handle basic scientific instrumentation and obtain data by performing physiological techniques in the laboratory, as well as to analyse such data to explain certain physiological phenomena.

- Perform certain functional tests on animals and interpret them.

### 3. Syllabus

Thematic blocks:

- I. Introduction to animal physiology.
- II. Fundamental physiological processes.
- III. Physiology of the nervous system.
- IV. Internal environment: Blood.
- V. Cardiovascular physiology.
- VI. Physiology of digestion.
- VII. Physiology of breathing.
- VIII. Renal physiology.
- IX. Physiology of the endocrine system.
- X. Physiology of reproduction.

The thematic blocks comprise the following subject matter:

I. Introduction to animal physiology (1 h)

- Item 0. Concept of animal physiology. Objectives. Relationship with other sciences. Physiology in the context of the Veterinary Degree. Bibliographic sources.

II. Fundamental physiological processes (7 h)

- Topic 1. Homeostasis. Internal environment and biological fluids.
- Topic 2. Physiology of excitable tissues. Membrane potential at rest. Potential for action. Propagation of the nerve impulse.
- Topic 3. Synapses: Chemical synapse. Postsynaptic potentials. Electrical synapse. Neurotransmitters. Neuromuscular transmission.
- Topic 4. Skeletal, cardiac and smooth muscles: Action potentials. Excitation-contraction coupling.

III. Physiology of the nervous system (10 h)

- Topic 5. Sensory receptors. Transduction of the sensory stimulus. Adaptation of the receptors.
- Topic 6. Somatovisceral sensitivity. Cutaneous mechanoreception, proprioception and kinesthesia. Thermal and pain sensitivity. Transmission of somatovisceral sensitivity and cortical integration.
- Item 7. Chemical senses. Taste sensitivity. Olfactory sensitivity.
- Item 8. Hearing sensitivity. Range of hearing in different species. Phonoreceptors. Sense of balance: Functions of the vestibular apparatus.
- Item 9. Visual sensitivity. Optics of the eye. Accommodation. Pupillary reflexes. Retina and photoreceptors. Chromatic vision. Visual field. Binocular vision. Visual way.
- Item 10. Motor activity. Spinal reflexes. Motor functions of the brainstem, cerebellum, basal ganglia and

cerebral cortex.

- Item 11. Autonomic nervous system. Sympathetic system. Parasympathetic system. Nerve centers regulating visceral function.

IV. Internal environment: Blood (3 h)

- Item 12. General properties of blood. Blood components. Hematopoiesis. Red blood cells and leukocytes functions.
- Item 13. Platelets. Hemostasis. Coagulation. Fibrinolysis.

V. Cardiovascular physiology (9 h)

- Item 14. Electrical activity of the heart. Cardiac impulse generation and conduction system. Electrocardiography.
- Item 15. Mechanical activity of the heart. Cardiac cycle. Cardiac output and work of the heart.
- Item 16. Regulation of cardiac activity. Intrinsic control: length-tension relationship. Extrinsic control: effects on contraction frequency and force.
- Item 17. Systemic circulation. Blood pressure and vascular resistance. Circulation in arteries and arterioles. Venous circulation.
- Item 18. Capillary circulation. Capillary dynamics. Lymphatic circulation.
- Item 19. Nervous and humoral regulation of peripheral circulation. Local control of tissue blood supply. Blood pressure regulation.

VI. Physiology of digestion (12 h)

- Item 20. Regulatory systems of gastrointestinal functions. Intake control.
- Item 21. Salivary secretion. Chewing. Swallowing. Functions of the esophagus.
- Item 22. Stomach functions: Secretion, digestion and motility. Vomiting.
- Item 23. Physiology of ruminant pre-stomachs. Functional characteristics in the preruminant. Pre-stomach and abomasal motility. Rumination and eructation. Fermentative digestion.
- Item 24. Exocrine pancreatic secretion. Biliary secretion. Gallbladder functions.
- Item 25. Functions of the small intestine. Secretion, motility, enzymatic digestion and absorption.
- Item 26. Functions of the large intestine. Motility. Fermentative digestion. Secretion and absorption. Defecation.
- Item 27. Digestive function in birds. Functions of the crop, muscular stomach, small intestine and cecum.

VII. Physiology of breathing (6 h)

- Item 28. Pulmonary ventilation. Mechanics of pulmonary ventilation. Dead space. Ventilation-perfusion relationship.
- Item 29. Exchange of gases (O<sub>2</sub> and CO<sub>2</sub>) across the respiratory membrane. Transport of gases through the blood. O<sub>2</sub> and CO<sub>2</sub> dissociation curves. Exchange of gases between blood and tissues.

- Item 30. Breathing control. Respiratory center. Chemical and nervous control of respiration. Other non-respiratory functions of the respiratory system.
- Item 31. Breathing of birds. Respiratory mechanics: lungs and air sacs. Gas exchange. Breathing control.

#### VIII. Renal Physiology (6 h)

- Item 32. Kidney functions. Glomerular function. Glomerular filtration rate. Renal depuration. Renal autoregulation.
- Item 33. Tubular functions: Tubular reabsorption and secretion.
- Item 34. Urine concentration and dilution mechanisms.
- Item 35. Regulation of acid-base balance. Renal buffering systems. Physiology of urination.

#### IX. Physiology of the endocrine system (12 h)

- Item 36. General characteristics of the endocrine system. Concept of hormone. Chemical nature of hormones. General processes of synthesis, transport and degradation. Mechanisms of hormonal action. Regulation.
- Item 37. Hypothalamic hormones. Hypothalamic-pituitary system.
- Item 38. Adenohypophyseal hormones. Somatotropes, corticotropes, gonadotropes, lactotropes, thyrotropes. Biosynthesis. Function and regulation. Intermediate portion of the pituitary gland: Melanocyte-stimulating hormone.
- Item 39. Neurohypophyseal hormones: Vasopressin or antidiuretic and oxytocin.
- Item 40. Thyroid hormones: Synthesis, physiological effects and regulation.
- Item 41. Hormones involved in calcium and phosphate metabolism: Parathyroid hormone, calcitonin and active vitamin D metabolites. Synthesis, functions and regulation.
- Item 42. Pancreatic hormones: Insulin, glucagon, somatostatin and pancreatic polypeptide. Synthesis, functions and regulation.
- Item 43. Adrenal gland. Hormones of the adrenal cortex: Mineralocorticoids, glucocorticoids and other steroid hormones. Adrenal medulla hormones: Adrenaline and noradrenaline. Synthesis, functions and regulation.
- Item 44. Pineal gland or epiphysis. Melatonin. Synthesis, functions and regulation.

#### X. Physiology of reproduction (12 h)

- Item 45. Physiology of reproduction in the male. Function of the testis: spermatogenesis and steroidogenesis. Accessory glands. Hypothalamic-adenohypophyseal-gonadal

axis. Actions of androgens. Functions of the epididymis, vas deferens and accessory sex glands. Erection and ejaculation.

- Item 46. Physiology of reproduction in the female. Ovarian functions: oogenesis, folliculogenesis and steroidogenesis. Hypothalamic-adenohypophyseal-gonadal axis. Estrogen and progesterone actions. Effects of other hormones of ovarian origin. Ovulation. Estrous cycle. Functions of the oviduct, uterus and vagina.
- Item 47. Physiology of reproduction in domestic females. Estrous cycles. Seasonality.
- Item 48. Physiological changes in gestation. Gestational hormones. Placental function. Labour. Maternal and foetal mechanisms of labour. Physiological induction of labour.
- Item 49. Lactation physiology. Mammogenesis. Lactogenesis. Milk ejection. Galactopoiesis. Involution of the mammary gland.
- Item 50. Reproduction in birds. Female reproductive system: ovarian hormones. Functions of the oviduct. Ovulation and oviposition. Male reproductive system. Mating in birds.

#### A) Seminars

Four hours of classroom seminars will be scheduled, consisting of:

- Collaborations with external professionals to deepen in different topics, with special interest in practical aspects and application of physiology.
- Deepening some contents of the theoretical program.

Practical sessions:

1. Study of skeletal muscle contraction.
2. Study of the action potential.
3. Physiology of the senses.
4. Hematologic study I: Red blood cells.
5. Hematologic study II: Leukocytes. Plasma and serum protein determinations.
6. Electrocardiogram, blood pressure and pulse.
7. Blood pressure and blood vessel physiology.
8. Intestinal absorption of sugars and estrous cycle of the rat.

9. Respiratory function.
10. Urinalysis and biochemical tests in serum and plasma.
11. Exercise physiology.

Breakdown of practical sessions:

Session 1. Study of skeletal muscle contraction. (3 h)

- Practice 1. Computer capture and analysis of electrical and mechanical activity of skeletal muscle.

Session 2. Study of the action potential. (3 h)

- Practice 2. Study of the resting membrane potential and action potential of a nerve fibre by computer simulation.

Session 3. Physiology of the senses. (3 h)

- Practice 3. Auditory function analysis.
- Practice 4. Study of eye movements

Session 4. Hematologic study I: Red blood cells. (3 h)

- Practice 5. Red blood cell count.
- Practice 6. Determination of hemoglobin level.
- Practice 7. Determination of hematocrit value.
- Practice 8. Blood groups.

Session 5. Hematologic study II: Leukocytes. Plasma and serum protein determinations (3 h)

- Practice 9. Leukocyte count.
- Practice 10. Leukocyte formula.
- Practice 11. Serum and plasma collection. Determination of total proteins in serum and plasma. Determination of albumin, globulin and fibrinogen levels.

Session 6. Electrocardiogram, blood pressure and arterial pulse (3 h)

- Practice 12. Electrocardiography and arterial pulse.
- Practice 13. Measurement of blood pressure and blood flow, by doppler, is it maintained?

Session 7. Blood pressure and physiology of blood vessels (3 h)

- Practice 13. Interactive computer study of blood vessel physiology and blood pressure control.
- Practice 14. Blood pressure measurement by sphygmomanometer.

Session 8. Intestinal absorption of sugars and estrous cycle of the rat. (4 h)

- Practice 15. Study of intestinal absorption of sugars in anesthetized rats.
- Practice 16. Analysis of the estrous cycle of the rat. Vaginal smear.

Session 9. Respiratory function. (3 h)

- Practice 17. Spirometry and respiratory cycle.

Session 10. Urinalysis and biochemical tests in serum and plasma. (3 h)

- Practice 18. Qualitative analysis of urine. Urinary sediment study.
- Practice 19. Biochemical tests: urea and creatinine.
- Practice 20. Biochemical tests: blood glucose.
- Practice 21. Biochemical tests: bilirubin and alanine aminotransferase (ALT).

Session 11. Exercise physiology. (3 h)

- Practice 22. Interactive study of physiological adaptations in exercise, by means of computer simulation.

Clinical cases:

- Session 1. It will be held at the beginning of the second semester.
  
- Session 2. It will be held at the end of the second semester.

## 4. Academic activities

The subject is structured in 10 blocks, each one covering the physiology of an organ system. In 78 hours, 50 topics will be developed, complemented with 4 hours of seminars to reinforce the physiological concepts of the subject.

The practical program includes 34 hours of laboratory or computer classroom practice. There are 25 practices distributed into 11 sessions, which will be coordinated as possible with the concepts of the theoretical classes.

The practical program also includes 2 sessions of clinical cases (2 hours per session), which will serve to reinforce theoretical and practical knowledge.

## 5. Assessment system

The theoretical classes will be evaluated by means of written tests consisting of 30 multiple-choice questions and 12 short open-answer questions.

1.

1.

1. Multiple choice questions (1 correct answer out of 4 possible options): Incorrect answers will not be penalized with negative points. This test will be evaluated on 10 final points and in order to obtain the grade equivalent to 5, it will be necessary to reach 60% of the maximum grade.
2. Short questions. This test will be evaluated on 10 final points and in order to obtain the grade equivalent to 5, 50% of the maximum grade must be reached.

Test 1. First midterm exam. It will include the thematic blocks I to VI of the theoretical program. It will account for 40% of the final grade.

Test 2. Second midterm exam. It will include the thematic blocks VII to X of the theoretical program. It will account for 40% of the final grade.

In order to pass the theoretical part of the subject, the two written exams must be passed: Tests 1 and 2.

The final grade of the written exam will be calculated by the weighted sum of the two parts, with 40% corresponding to the multiple-choice questions and 60% to the short questions.

A minimum grade of 5 points is required to pass each midterm exam. However, if a student has a grade of 4.7 or higher in a midterm exam, it is possible to compensate for the missing part up to 5 points if the student has achieved a grade that exceeds the difference in the other midterm exam.

In each of the official calls, the student may sit for one or both mid-term exams, according to their own criteria. In addition, students will be given the option of taking the first exam (first midterm exam) at the end of the first four-month period, without using up a call.

Midterm exams that are passed will be saved and counted only during the current academic year.

Test 3. Practical exam. In order to pass the practical part of the subject, the student must first demonstrate that they have acquired the necessary skills and abilities for the correct execution of the practical sessions. This will be done through direct observation of the student's work by the teacher during the different practical sessions. A passing grade in this part will be given to the student who demonstrates that they have acquired these skills. In case it is not demonstrated in this way, a test will be carried out in each of the official calls, consisting of the execution and oral explanation in the laboratory of a practice included in the syllabus or the resolution of questions related to clinical cases.

Additionally, all students will take an exam consisting of 10 short questions on the contents of the practical program (practices and clinical cases). Each question will be valued with a maximum of 1 point. A minimum of 5 out of 10 points must be obtained to pass this exam.

It will account for 20% of the final grade of the subject.

The passing of the practices and its qualification will be maintained for successive calls of the subject in subsequent years, within the Degree.