

## 28408 - Animal Physiology

### Información del Plan Docente

Academic Year	2017/18
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**

#### **1.1.Introduction**

#### **1.2.Recommendations to take this course**

#### **1.3.Context and importance of this course in the degree**

#### **1.4.Activities and key dates**

### **2.Learning goals**

#### **2.1.Learning goals**

#### **2.2.Importance of learning goals**

### **3.Aims of the course and competences**

#### **3.1.Aims of the course**

#### **3.2.Competences**

### **4.Assessment (1st and 2nd call)**

#### **4.1.Assessment tasks (description of tasks, marking system and assessment criteria)**

### **5.Methodology, learning tasks, syllabus and resources**

#### **5.1.Methodological overview**

**The learning process that is designed for this subject is based on the following:**

The subject is structured in 10 thematic blocks and each of them includes the study of the Physiology of one organ system. They are 50 topics that are given in 76 hours of participatory lectures. The program is complemented with 38 hours of laboratory practices or in the computer classroom. They are 23 practices distributed in 10 practical sessions that they will be adjusted over time, where possible, to the developed concepts in the lectures. The 6 hours of programmed

## 28408 - Animal Physiology

seminars will serve to reinforce and to discuss part of physiological concepts developed throughout the course.

### 5.2. Learning tasks

The program offered to the student in helping to achieve the expected results includes the following activities ...

- **Theoretical classes** : 78 hours of theoretical classes will be given. They included a first class of introduction and presentation of the subject. They will be given in the classroom, with the students divided in two groups.

- **Seminars**: 4 hours of seminars will be given also in the classroom in the same groups of theoretical classes.

- **Practical classes** : A total of 34 hours of practical classes will be given in the Laboratory of Physiology or in the Computer classroom. They will be distributed in 11 sessions of 3 to 4 hours in the groups programmed by the Faculty. Each practical class will start with an explanation of the session and then students will perform the practice under continuous supervision by teachers. The obtained results will be analyzed at the end of the practical session. Guide notes and specific materials for its understanding and fulfilment will be available for the students.

### 5.3. Syllabus

#### A) Lectures

Theoretical classes are distributed in 10 thematic blocks, with a chronology and assignment of hours that is described in detail below.

I Introduction to Animal Physiology (1 h).

II General Physiology (7 h).

III Physiology of the Nervous System (10 h).

IV Internal environment: Blood (3 h).

V Cardiovascular Physiology (9 h).

VI Gastrointestinal Physiology (12 h).

VII Respiratory Physiology (6 h).

VIII Renal Physiology (6 h).

IX Endocrinology (12 h).

X Reproduction (12 h).

## 28408 - Animal Physiology

Thematic blocks I to VI will be included in the first partial exam of the subject, whereas sections VII to X will constitute the second partial exam.

### I. Introduction to Animal Physiology (1 h)

- **Topic 0.** Concept of Animal Physiology. Objectives. Relation to other sciences. The Physiology in the context of the Veterinary Degree. Bibliographical sources.

### II. General Physiology (7 h)

- **Topic 1.** Homeostasis. Internal environment and biological fluids.

- **Topic 2.** Physiology of excitable tissues. Resting membrane potential. Action potential. Transmission of the nerve impulse.

- **Topic 3.** Synapse: Chemical synapse. Postsynaptic potentials. Electrical synapse. Neurotransmitters. Neuromuscular transmission.

- **Topic 4.** Skeletal muscle, cardiac muscle and smooth muscle: Action potentials. Excitation-contraction coupling.

### III. Physiology of the Nervous System (10 h)

- **Topic 5.** Sensory receptors. Transduction of sensory stimuli. Adaptation of receptors.

- **Topic 6.** Somatovisceral sensitivity. Cutaneous mechanoreception, proprioception and kinesthesia. Thermal and pain sensitivity. Somatovisceral sensitivity transmission and cortical integration.

- **Topic 7.** Chemical Senses. Taste. Smell.

- **Topic 8.** Hearing. Range of hearing in several species. Phonoreceptors. Sense of Equilibrium: Functions of the vestibular system.

- **Topic 9.** Vision. Ocular optics. Accommodation. Pupillary reflexes. Retina and photoreceptors. Chromatic vision. Field of vision. Binocular vision. Visual pathways.

- **Topic 10.** Motor activity. Spinal reflexes. Motor functions of the brain stem, cerebellum, basal ganglia and cerebral cortex.

- **Topic 11.** Autonomic nervous system. Sympathetic system. Parasympathetic system. Nervous centers regulating visceral function.

### IV. Internal environment: Blood (3 h)

## 28408 - Animal Physiology

- **Topic 12.** General properties of blood. Components of blood. Hematopoiesis. Functions of erythrocytes and leukocytes.

- **Topic 13.** Platelets. Hemostasis. Blood coagulation. Fibrinolysis.

### V. Cardiovascular Physiology (9 h)

- **Topic 14.** Electrical activity of the heart. Pacemaker and conduction system of the cardiac impulse. Electrocardiography.

- **Topic 15.** Mechanical activity of the heart. Cardiac cycle. Cardiac output and work of the heart.

- **Topic 16.** Regulation of the cardiac activity. Intrinsic control: length-tension relationship. Extrinsic control: effects on frequency and contraction force.

- **Topic 17.** Systemic circulation. Blood pressure and vascular resistance. Circulation in arteries and arterioles. Venous circulation.

- **Topic 18.** Capillary circulation. Capillary dynamics. Lymphatic circulation.

- **Topic 19.** Mechanisms of neurohumoral regulation of the peripheral blood circulation. Local control of tissue blood flow. Regulation of the arterial pressure.

### VI. Gastrointestinal Physiology (12 h)

- **Topic 20.** Regulatory systems of the gastrointestinal functions. Regulation of food intake.

- **Topic 21.** Salivary secretion. Mastication. Swallowing. Functions of the esophagus.

- **Topic 22.** Functions of the stomach: Secretion, digestion and motility. Vomiting.

- **Topic 23.** Physiology of the ruminant forestomach. Functional characteristics of the preruminant animals. Motility of the forestomach and abomasum. Rumination and eructation. Fermentative digestion.

- **Topic 24.** Exocrine pancreatic secretion. Biliary secretion. Functions of the gallbladder.

- **Topic 25.** Functions of the small intestine. Secretion, motility, enzymatic digestion and absorption.

- **Topic 26.** Functions of the large intestine. Motility. Fermentative digestion. Secretion and absorption. Defecation.

- **Topic 27.** Avian digestion. Functions of the crop, muscular stomach, small intestine and cecum.

### VII. Respiratory Physiology (6 h)

## 28408 - Animal Physiology

- **Topic 28.** Pulmonary ventilation. Mechanics of pulmonary ventilation. Respiratory dead space. Ventilation and perfusion relationships.

- **Topic 29.** Exchange of gases ( $O_2$  and  $CO_2$ ) through the respiratory membrane. Gas transport in the blood.  $O_2$  y  $CO_2$  dissociation curves. Gas exchange between the blood and tissues.

- **Topic 30.** Regulation of respiration. The respiratory center. Neural and humoral control of respiration. Other functions of the respiratory system.

- **Topic 31.** Respiration in birds. Mechanics of breathing: lungs and air sacs. Gas exchange. Control of breathing.

### VIII. Renal Physiology (6 h)

- **Topic 32.** Functions of the kidney. Glomerular function. Glomerular filtration rate. Renal clearance. Renal autoregulation.

- **Topic 33.** Tubular functions: Tubular reabsorption and secretion.

- **Topic 34.** Mechanisms of urinary concentration and dilution.

- **Topic 35.** Regulation of acid-base balance. Renal mechanisms of pH control. Micturition.

### IX. Endocrinology (12 h)

- **Topic 36.** General characteristics of the endocrine system. Concept of hormone. Chemical nature of hormones. General process of hormone synthesis, transport and degradation. Mechanisms of hormone action. Regulation.

- **Topic 37.** Hypothalamic hormones. The hypothalamic-pituitary axis.

- **Topic 38.** Hormones of the adenohypophysis. Prolactin-growth hormone family, corticotropin, gonadotropins, and thyrotropin. Biosynthesis. Function and regulation. Intermediate lobe of the hypophysis: melanocyte-stimulating hormone

- **Topic 39.** Hormones of the neurohypophysis: vasopressin or antidiuretic hormone and oxytocin.

- **Topic 40.** Thyroid hormones: synthesis, physiological effects and regulation.

- **Topic 41.** Hormones involved in the metabolism of calcium and phosphate: Parathyroid hormone, calcitonin, and active metabolites of vitamin D. Synthesis, functions and regulation.

- **Topic 42.** Pancreatic hormones: Insulin, glucagon, somatostatin and pancreatic polypeptide. Synthesis, functions and regulation.

- **Topic 43.** The adrenal gland. Hormones from the adrenal cortex: Mineralocorticoids, glucocorticoids and other steroid

## 28408 - Animal Physiology

hormones. Hormones from the adrenal medulla: Adrenaline and noradrenaline. Synthesis, functions and regulation.

- **Topic 44.** The pineal gland. Melatonin. Synthesis, functions and regulation.

### X. Reproduction (12 h)

- **Topic 45.** Physiology of the male reproductive system. Functions of testis: spermatogenesis and steroidogenesis. The hypothalamic-pituitary-gonadal axis. Actions of androgens. Functions of epididymis, vas deferens and accessory sex glands. Erection and ejaculation.

- **Topic 46.** Physiology of the female reproductive system. Ovarian functions: oogenesis, folliculogenesis and steroidogenesis. The hypothalamic-pituitary-gonadal axis. Estrogens and progesterone effects. Effects of other hormones from the ovarium. Ovulation. The estrous cycle. Functions of oviduct, uterus and vagina.

- **Topic 47.** Physiology of the female reproductive system in domestic animals. Estrous cycles. Seasonal variations.

- **Topic 48.** Physiological changes in pregnancy. Hormones of pregnancy. Function of placenta. Parturition. Maternal and fetal mechanisms. Physiological induction of the parturition.

- **Topic 49.** Physiology of lactation. Mammogenesis. Lactogenesis. Milk ejection. Galactopoiesis. Mammary gland involution.

- **Topic 50.** Avian reproduction: ovarian hormones. Functions of oviduct. Ovulation and oviposition. Mating in birds.

### B) Practical program

It will consist in 34 hours of practical activities, distributed in 11 sessions.

#### Session 1. Study of the action potential. (3 h)

- **Practice 1.** Study of the resting membrane potential and the action potential in a nervous fiber through a simulation computer program.

#### Session 2. Electromyography. (3 h)

- **Practice 2.** Computer acquisition and analysis of the electrical and mechanical activity in the skeletal muscle

#### Session 3. Sensorial physiology. (3 h)

- **Practice 3.** Sensitivity

#### Session 4. Blood analysis I: Red blood cells. (3 h)

## 28408 - Animal Physiology

- **Practice 4.** Red blood cells count.
- **Practice 5.** Determination of hemoglobin concentration.
- **Practice 6.** Determination of hematocrit value.
- **Practice 7.** Determination of globular resistance.

### **Session 5. Blood analysis II: White blood cells. Determination of proteins in plasma and serum (4 h)**

- **Practice 8.** White blood cells count.
- **Practice 9.** Blood smear evaluation.
- **Practice 10.** Serum and plasma preparation. Total proteins determination in serum and plasma. Determination of concentration of albumin, globulins and fibrinogen.

### **Session 6. Electrocardiogram, blood pressure and arterial pulse (4 h)**

- **Practice 11.** Electrocardiography and arterial pulse in humans and dogs.
- **Practice 12.** Measurement of blood pressure and blood flow in the dog using Doppler ultrasound system.

### **SESSION 7. Blood pressure and physiology of the blood vessels (3 h)**

- **Practice 13.** Study of the physiology of the blood vessels and the control of blood pressure using an interactive computer program.
- **Practice 14.** Measurement of blood pressure using a sphygmomanometer.

### **Session 8. Intestinal absorption of carbohydrates and the estrous cycle in the rat. (4 h)**

- **Practice 15.** Study of the intestinal absorption of carbohydrates in anesthetized rat.
- **Practice 16.** Study of the estrous cycle in the rat. Vaginal cytology.

### **Session 9. Respiratory function. (4 h)**

- **Practice 17.** Spirometry.

### **Session 10. Analysis of the urine and biochemical determinations in plasma and serum. (4 h)**

## 28408 - Animal Physiology

- **Practice 18.** Qualitative analysis of the urine. Study of the urinary sediment.
- **Practice 19.** Biochemical assays: urea and creatinine.
- **Practice 20.** Biochemical assays: glycaemia.
- **Practice 21.** Biochemical assays: bilirubin and alanine aminotransferase (ALT).

### Session 11. Exercise physiology. (3 h)

- **Practice 22.** Study of the physiological adaptations to exercise using an interactive computer program.

### C) Seminars

4 hours of seminars will be programmed in the classroom, and they will consist in:

- To collaborate with external professionals in order to study more in depth some topics, with special interest in practical aspects and with application in physiology.
- To study more in depth some topics of the program.

## 5.4.Course planning and calendar

### Calendar of attendance sessions and presentation of works

The schedule and milestones of this subject are described in detail with the remaining subjects of the Degree of Veterinary Medicine, in the web page of the Faculty of Veterinary Medicine (link: <http://veterinaria.unizar.es/>). This link will be updated at the beginning of each academic course.

## 5.5.Bibliography and recommended resources

[BB: Bibliografía básica / BC: Bibliografía complementaria]

- [BB] Dukes Fisiología de los animales domésticos / editor William O. Reece. Zaragoza : Acribia, 2010
- [BB] Fisiología veterinaria / [coordinadores] A. García Sacristán [et al.] . 1a ed., 1a reimp. Madrid : McGraw-Hill-Interamericana, D. L. 1996
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- [BC] Fisiología veterinaria / editores : Wolfgang v. Engelhardt, Gerhard Breves ; [traducción a cargo de Lorenzo Serrahima...(et al.)] . Zaragoza : Acribia, D. L. 2004
- [BC] O'Malley, Bairbre. Anatomía y fisiología clínica de animales exóticos : estructura y función de mamíferos, aves,



## 28408 - Animal Physiology

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- [BC] Silverthorn, Dee Unglaub. Fisiología humana : un enfoque integrado / Dee Unglaub Silverthorn ; con la colaboración de Bruce R. Johnson y William C. Ober, coordinador de ilustraciones, Claire W. Garrison, ilustradora, Andrew C. Silverthorn, consultor crítico . 6ª ed. Buenos Aires ; Madrid [etc.] : Editorial Médica Panamericana, cop. 2014 [Para acceder al texto completo mirar URL]
  - [BC] Tortora, Gerard J.. Principios de anatomía y fisiología [13ª ed.] / Gerard J. Tortora, Bryan Derrickson . 13ª ed. Buenos Aires ; Madrid [etc.] : Editorial Médica Panamericana, cop. 2013

### Listado de URL

- Pubmed [<http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed>]
- Silverthorn, Dee Unglaub. Fisiología humana : un enfoque integrado / Dee Unglaub Silverthorn [<http://www.medicapanamericana.com/visorebookv2/ebook/9786079356224#{%22Pagina%22:%221%22,%22Vista%22:%22>]
- Web de la Sociedad Española de Ciencias Fisiológicas [<http://www.secf.es/>]
- Web de la Unidad de Fisiología y de la asignatura [[http://www.unizar.es/depfarfi/unidad\\_fisiologia/](http://www.unizar.es/depfarfi/unidad_fisiologia/)]
- Web dedicada a los premios Nobel de Fisiología y Medicina [<http://www.almaz.com/nobel/medicine/>]