COURSE DATA

DATA SUBJECT

Code: 36840
Name: Animal Physiology
Cycle: Undergraduate Studies
ECTS Credits: 10.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1106 - Degree in Biology	Facultat de Ciències Biològiques	3	Annual

SUBJECT-MATTER

Degree	Subject-matter	Character
1106 - Degree in Biology	Biología Animal	COMPULSORY

COORDINATION

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SANCHO AGUILAR ENCARNACION

SUMMARY

The course "**ANIMAL PHYSIOLOGY**" is part of the "Animal Biology" subject area within the Biology Degree at the University of Valencia and is taken in the third year. The course is worth 10.5 ECTS credits (approximately 262.5 hours of student work), including both face-to-face and independent activities. It is a synthesis course in which students must understand the functional relationships between the different parts of the animal, as well as the coordination mechanisms among them, which are essential for the animal to function as an integrated whole. Emphasis is placed on the comparative study of physiological functions across different animal groups and on the physiological adaptations of animals to their environment.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

There are no specified enrollment restrictions with other subjects of the curriculum.

Subjects such as Physics, Chemistry, Cell Biology, and the Tree of Life, together with Molecular and Genetic Bases of Living Beings, are key for acquiring the necessary prior knowledge. The courses Zoology I & II provide the structural foundations of animal organization in order to understand how animals function

COMPETENCES / LEARNING OUTCOMES

1106 - Degree in Biology

(CB3) Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.

Ability to analyze data obtained in different biological experiments, using appropriate statistical software.

Design and conduct experiments by using scientific techniques and instruments appropriately and complying with laboratory safety regulations.

Organise, plan and manage information in a manner that allows the individual to analyse, synthesise and develop critical reasoning that can be applied to solve problems, make decisions and carry out work.

Que los estudiantes hayan desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía

Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.

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Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.

To assimilate the process of constructing scientific knowledge: laboratory experimentation and field studies, data acquisition, handling and analysis, and writing scientific documents. Use of information and communication technologies (ICTs).

Understanding the morphological and functional diversity of living beings. Understanding their functions, the basic underlying mechanisms from an integrative point of view, and their adaptations to the environment throughout their life history.

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Use ICTs, apps and other computer tools to manage and disseminate information in both educational and professional environments.

Use scientific language, both oral and written, and be able to adapt the register to the target audience and/or readers. Use the most common foreign languages in each discipline as a vehicle for communication in a globalised system.

DESCRIPTION OF CONTENTS

THEORY IN THE CLASSROOM

1. FUNDAMENTALS OF PHYSIOLOGY

Item 1.- Importance of the study of Animal Physiology. - The integrating nature of animal physiology. - Function and mechanism. - Homeostasis: basic mechanisms. - Regulation by negative feedback. - Non-homeostatic regulatory changes. - Organization of regulatory systems.

2. ENERGY AND TEMPERATURE

Item 2.- Flow of energy through the animal.- Sources and distribution of energy: biosynthesis, maintenance and external work.- Metabolic rate.- Factors that affect the metabolic rate.

Item 3.- Temperature and heat.- Heat transfer between animals and their environment: conduction, convection and evaporation.- Thermal relations.- Endothermy and thermoregulation: poikilothermia and homeothermia.

3. INTEGRATING SYSTEMS 1

Item 4- Organization and evolution of nervous systems.- Central and peripheral nervous systems.- Autonomic nervous system.

Item 5- Nervous signals.- Cell excitability: resting membrane potential.- The action potencial.- Propagation of action potentials: myelination.

Item 6- Synaptic transmission.- Electrical and chemical synapses.- Synaptic potentials: temporal and spatial summation.- Synaptic transmission mechanisms.- Synaptic plasticity. Examples.

Item 7- Sensory processes and organization of the sensory systems.- Classification of receptors.- Sensory reception: receptor functions.- Strech receptors as a model.- Receptor adaptation.

Item 8. Photoreception.- The vertebrate camera eye.- Retina: cones and rods.- Visual sensory processing.-

Arthropods compound eyes.

Item 9. Mechanoreception.- Proprioceptors: the muscle spindle.- Equilibrium receptors.- Audition- Vertebrate auditory receptors.- Insect audition.

Item 10. Chemoreception.- Contact and distance receptors in insects.- Vertebrate taste and olfaction. - Electroreception.

Item 11- Skeletal muscle.- Isometric and isotonic contractions.- Summation and tetanus.- Neural Control of skeletal muscle.- Vertebrate motor units model.- - Arthropod polyneuronal innervation.

Item 12. Control of the movement.- Reflex acts: strech reflex in humans.- Control and coordination of vertebrate movement.- Central control.

4. INTEGRATING SYSTEMS 2

Item 13. Endocrine and neuroendocrine physiology.- Hormones and other chemical signals.- Concentration of hormones in blood.- Types of endocrine glands and cells.

Item 14. Control of endocrine systems: the vertebrate pituitary gland.- The neurohypophysis.- The adenohypophysis: neurosecretory control.- Stress response: the autonomic nervous system and hypothalamo-pituitary-adrenal (HPA).- Endocrine control of nutrient metabolism.- Insulin and glucagon: Control of glucose in the blood.- Insect metamorphosis.

Item 15. Endocrine control of reproduction in placental mammals: ovulation.- Endocrine control of uterine and ovarian cycle.- Testicular function: endocrine control of male reproduction.- Pregnancy and birth in mammals.- Lactation.

5. TRANSPORT OF OXYGEN, CARBON DIOXIDE AND SUBSTANCES INTERNAL.

Item 16. Respiratory gases.- Gas transport in animals: convection and difussion.- The physical properties of air and water and its importance in the breathing.

Item 17. Transport of oxygen and carbon dioxide: respiratory pigments.- General model: oxygen transport in human.- Dissociation curves.- The oxygen affinity of pigments.- Factors affecting the affinity: Bohr effect or other effects.- Carbon dioxide transport.- Haldane effect.

Item 18. Physiology of breathing.- External respiration: ventilation.- Gas respiratory exchange.- Breathing by fish.- Breathing by amphibians.- Breathing by mammals.- The control of ventilation.- Breathing in birds: Parabronchi.- Tracheal breathing by insects.

Item 19. Circulation.- The heart as a pump: the heart cycle.- Heartbeat origin: myogenic and neurogenic hearts.- Heart electrical activity: electrocardiogram (ECG).- Hormonal, nervous and intrinsic controls of

heart.

Item 20.- Open and closed circulation.- Circulatory model in mammals and birds.- Blood pressure.- Regulation of the circulation.- Exchange at capillary level.- Circulation in fish.- Circulation in amphibians and reptiles.- Invertebrates with closed circulatory systems.- Invertebrates with open circulatory systems: crustaceans.

6. NUTRITION, FEEDING AND DIGESTION

Item 21. Concept of nutrition, feeding and digestion.- Symbiosis with microbes plays key roles in the animal feeding and nutrition.- Ruminant mammals and some other herbivores as example of fermenters.

Item 22- Digestion and absorption.- Plans: vertebrates, arthropods and molluscs.- Gastrointestinal motility.- Mucosa, biliary and salivary secretion.- Regulation of the digestion.- Enteric nervous system.- Hormonal control.- Digestion phases: cephalic, gastric and intestinal.- Intestinal absorption.

7. WATER, SALTS AND EXCRETION

Item 23.- Hydrosaline relationships of animals according to their environment: freshwater animals. Animals in the ocean: Invertebrates.- Teleost fish.- Reptiles, birds, and marine mammals.- Elasmobranch fish.

Item 24.- Terrestrial animals: fundamental physiological principles.- Water loss through evaporation.- Control of hydrosaline balance in terrestrial animals.- Antidiuretic hormone; renin-angitensin-aldosterone system and atrial natriuretic peptide.

Item 25.- Nitrogen disposition and excretion.- Ammoniatelic animals.- Ureotelic animals.- Uricotelic animals.

Item 26- Kidneys and excretion.- The nephron: basic mechanisms of renal function: gomerular filtration, reabsorption and tubular secretion.- Hormonal and nervous regulation: self-regulation.- Urine formation in amphibians.- Antidiuretic hormone (ADH).- Urine formation in mammals: production of concentrated urine.- Control of kidney function in mammals.- pH regulation: buffer systems.- Respiratory ventilation.- Renal function and pH.

Item 27. Urine formation in other vertebrates: fish, reptiles and birds.- Urine formation in decapod crustaceans and molluscs.- Urine formation in insects.- The Malpighian tubules.

LABORATORY PRACTICES

- Effect of temperature on the oxygen consumption of aquatic animals.
- Absorption spectrum of haemoglobin depending on its degree of saturation with oxygen.
- Study of the effect of juvenile hormone treatment on insect larvae / nymphs.
- Effect of temperature on heartbeat in *Daphnia*.

- Salinity and volume regulation in polychaete worms.
- Study of sensory receptors in humans.
- Electromyography (BIOPAC Student System).
- Electrocardiography (BIOPAC Student System).
- Human blood pressure study.
- Spirometry Analysis of lung volumes and capacities (BIOPAC Student System).
- In situ observation of chloride cells in *Artemia*.
- Anatomical-functional study of the vertebrate heart
- Pancreatic function: endocrine pancreas and glycemia. Exocrine pancreas and digestion.

TUTORIAL AND PROBLEM SESSIONS

Six one-hour tutoring sessions and three two-hour problem sessions will be planned. In these sessions, complementary works that help to consolidate the competences of the subject will be presented and solved.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	6,00
Theory	63,00
Laboratory	30,00
Classroom practices	6,00
Total hours	**105,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	157,50
Preparation of lessons	0,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**157,50**

TEACHING METHODOLOGY

The teaching methodologies of the different activities (face-to-face and non-face-to-face) are described here.

- **Theory classes, of a masterly type,** will be taught sequentially throughout the academic year, so that they are integrated with the rest of the proposed activities.

- **Practical laboratory**. The total face-to-face laboratory hours are divided into 10 sessions of three hours each. In each session the students, in pairs, carry out the proposed activities after having read the instructions previously provided. It is necessary to attend at least 70% of the face-to-face laboratory classes in order to take the practical exam.

- **Problems in the classroom**. They will be carried out in the classroom with small groups in 3 sessions lasting 2 hours. Activities (multimedia materials, questionnaires ...) will be proposed to delve into certain topics of general interest to students. These subjects are susceptible of being evaluated in the theoretical evaluation tests.

- In the **Tutorials sessions** works (individual or group) will be proposed that help to consolidate the competences of the subject. These subjects are susceptible of being evaluated in the theoretical evaluation tests.

EVALUATION

Theory evaluation

In the first call, only the theory of the subject will be approved by means of continuous evaluation (multiple-choice and short questions). There will be 4 multiple-choice tests, each one at the end of the corresponding blocks of the syllabus. The evaluation of these multiple-choice questions will be added to the evaluation of the written exams (short questions) that will take place in two parts and on the dates set aside in January and May-June

Evaluation of the practices

In the January exam session, the practical laboratory exam will consist of solving two in situ case studies. At the same time, students will complete a multiple-choice questionnaire with questions related to the laboratory sessions.

The distribution over a maximum of 100 points will be as follows (50 POINTS MUST BE REACHED TO PASS THE SUBJECT):

THEORY (continuous evaluation)	**60 %**
Written exams	30 points
Test questionnaires	30 points

PRÁCTICAS	**30 %**
Practical cases	20 points
Laboratory practice questionnaire	10 points
TUTORÍAS Y PROBLEMAS	**10 %**
Assistance and use of tutoring and problems	10 points
TOTAL	**100 PUNTOS**

Particular conditions

In order to pass the course, **it is a necessary condition to pass both theory and practice**. Only in this case will the grades obtained in the rest of the activities be added. In case of not reaching the minimum score in one of the two parts (theory or practice), the other's score may be saved during a complete academic year. In case of not passing the subject in the first call (May/June), the marks corresponding to the continuous assessment activities (tutorials, classroom problems ...) will be saved.

The second call for the theoretical part will consist of a single exam with test questions and reasoning questions. The continuous evaluation of the theoretical part has no value in this call. In the second call, the practical exam will be similar to that of the first call, but in a single session.

IMPORTANT NOTE: To access any exam the student must identify himself/herself properly. The use of cell phones, mp3 or similar devices will not be allowed during the tests

REFERENCES

Basics

- Hill, R.W., Wyse, G.A. y Anderson, M. (2006) Fisiología Animal: Adaptación y ambiente. Editorial Medica Panamericana. Madrid

- Hill, R.W.; Cavanaugh, D.J. and Anderson, M. Animal physiol. 5th ed. (2021) Oxford University Press

- Moyes, D.C.; Schulte, P.M. 2016. Principles of Animal Physiol. 3rd Ed. 2016. Ed Pearson, Toronto, Canada.

- Sherwood, L (2013) Animal Biology, 2 Edition. Brooks/Cole Cengage Learning

- Silverthorn, D.E. (2019) Fisiología Humana. Un enfoque integrado. 8ed. Editorial Médica Panamericana. Madrid (Disponible on line Universitat de València).

Complementary

- Randall, D. Burggren, W. y French, K. (2002). Eckert Animal Physiology: Mechanisms and Adaptations. 5a Edición. W.H. Freeman and Company, New York

- Willmer, T., Stone, G.N. y Johnston, I.A. (2004). Environmental Physiology of Animals. Blackwell Science, Oxford, U.K.

- Withers, P.C (1992). Comparative Animal Physiology. Saunders College Publishing.

- Fox, S.I (2013). Fisiología Humana. 13a Edición. Mc Graw Hill. Madrid

- Fox, S.I. (2022). Human Physiology. 16tn Edition. Mc Graw Hill. New York

- Koeppen, BM y Stanton, B.A. (Eds) (2009). Berne y Levy Fisiologia. 6a Edición. Elsevier España, Barcelona.

- Stanfield, C.L. (2011). Principios de Fisiología Humana. 4a Edición. Addison Wesley (Pearson). Madrid

- Stanfield, C.L. (2017). Principles Human Physiology. 6th Edition. Pearson Education. Harlow. UK

- Guyton, A.C. (2021). Tratado de fisiología médica. 14a Edición. Elsevier.