COURSE DATA

DATA SUBJECT

Code: 33050
Name: Animal physiology
Cycle: Undergraduate Studies
ECTS Credits: 10
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1100 - Degree in Biology	Facultat de Ciències Biològiques	3	Annual, Sin determinar

SUBJECT-MATTER

Degree	Subject-matter	Character
1100 - Degree in Biology	Animal biology	COMPULSORY

COORDINATION

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SUMMARY

DUE TO THE IMPLEMENTATION OF THE NEW CURRICULUM FOR THE BACHELOR'S DEGREE IN BIOLOGY, THIS SUBJECT IS BEING DISCONTINUED FROM THE OLD CURRICULUM AND IS THEREFORE OFFERED EXCLUSIVELY AS A NON-TEACHING (ND) COURSE IN THAT CURRICULUM. THIS MEANS THAT IT WILL NOT HAVE ANY FACE-TO-FACE TEACHING ACTIVITIES ASSOCIATED WITH IT AND THAT THE SUBJECT WILL BE ASSESSED SOLELY THROUGH A THEORETICAL AND PRACTICAL EXAM.

STUDENTS WHO DO NOT PASS THIS COURSE IN ANY OF THE 2025-26 OR 2026-27 ACADEMIC YEARS WILL BE REQUIRED TO ADAPT TO THE NEW CURRICULUM TO CONTINUE THEIR BACHELOR'S DEGREE IN BIOLOGY.

The subject **ANIMAL PHYSIOLOGY** is part of Animal biology from the biology degree from the University of Valencia and is located in the third grade. The course consists of 10 credits ECTS (about 250 hours of student work), which include face-to-face and remote activities. It is a subject of synthesis, in which the students must understand the functional relationships which exist between the different parts of the

animal, as well as coordination actions that occur between them, and which are necessary for the animal to work as a whole. Emphasize the comparative study of the functions in different animal groups and physiological adaptations of animals to the 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

Subjects such as "Physics", "Chemistry", the "Cell Structure" and the "The Tree of Life", along with "Molecular and Genetic Bases of the living" will be key in the required previous knowledge acquisition. The subject of Zoology, puts the structural bases of animal organization to understand the functioning of the animal. Overcoming Animal physiology is required to have passed the exams: structure of the Cell, Biology, and The Tree of Life.

COMPETENCES / LEARNING OUTCOMES

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Adquirir conciencia del valor de la ética profesional.

Capacidad de análisis, síntesis y razonamiento crítico.

Capacidad de aprendizaje autónomo y cooperativo.

Capacidad de manejar el inglés científico.

Capacidad de resolución de problemas.

Comprender el funcionamiento del animal como el de un todo integrado, reforzando el papel de los sistemas de coordinación e integración.

Comprender las funciones animales y los mecanismos básicos subyacentes.

Comprender los mecanismos implicados en las adaptaciones de las funciones animales al medio.

Conocer el manejo de la instrumentación científica básica propia de la Biología Animal.

Develop the capacity for organisation and planning.

Familiarización con la elaboración, exposición y defensa pública de trabajos.

Manejar correctamente la terminología científica y familiarizarse con las metodologías y fuentes de información de Biología Animal.

DESCRIPTION OF CONTENTS

1. FUNDAMENTALS OF PHYSIOLOGY (theory in classroom)

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 (theory in classroom)

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 (theory in classroom)

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.

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:

4. INTEGRATING SYSTEMS 2 (theory in classroom)

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

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 (theory in classroom)

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.

Item 23.- Introduction to water and salt physiology.- Hidric compartments.- Osmotic concentration: types of regulation and conformity.- Water regulation and urine: U/P volume ratio.- Cell volume maintenance.
Item 24. Water and salt relations of animals in their environments: animals in freshwater.- Animals in the Ocean: invertebrates.- Teleost fish.- Reptiles, birds and marine mammals.- Elasmobranch fishes.
Item 25.- Animals on Land: fundamental physiological principles.- Evaporative water loss.- Control of water and salt balance on land animals.- Antidiuretic hormone (ADH): Renin-angiotensin-aldosterone system and atrial natriuretic peptide.
Item 26- Kidneys and excretion.- The nephron: basic mechanisms of renal function: gomerular filtration,

7. WATER, SALTS AND EXCRETION (theory in classroom)

Item 23.- Introduction to water and salt physiology.- Hidric compartments.- Osmotic concentration: types of regulation and conformity.- Water regulation and urine: U/P volume ratio.- Cell volume maintenance.
Item 24. Water and salt relations of animals in their environments: animals in freshwater.- Animals in the Ocean: invertebrates.- Teleost fish.- Reptiles, birds and marine mammals.- Elasmobranch fishes.reabsorpti on 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.
Item 28. Nitrogen disposition and excretion.- Amnotelic animals.- Urotelic animals - Uricotelic animals.

8. LABORATORY PRACTICES

Laboratory exercises

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.
Human blood pressure study.
Spirometry Analysis of lung volumes and capacities.
In situ observation of chloride cells in Artemia.
Study of the estrous cycle in the albino mouse.

Simulation exercises

Computer simulation of various physiological processes related to the endocrine system (metabolism and hormones).
Computer simulation of various physiological processes related to the muscular system. Skeletal muscle physiology.
Computer simulation of various physiological processes related to the circulatory system. Frog cardiovascular physiology.
Computer simulation of various physiological processes related to the circulatory system. Cardiovascular dynamics.
Computer simulation of various physiological processes related to the respiratory system. Mechanisms of the respiratory system.
Computer simulation of various physiological processes related to the digestive system. Physical and chemical processes of digestion.
Computer simulation of various physiological processes related to the excretory system. Renal physiology.
Computer simulation of various physiological processes related to the nervous system. Neuro-physiology of nerve impulses.

10. 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.

11. OPTIONAL COMPLEMENTARY ACTIVITY

An oral/written presentation of some theoretical content of the subject may be proposed by the teaching staff. This activity will value up to an additional 10%.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	6,00
Theory	58,00
Laboratory	30,00
Classroom practices	6,00
Total hours	**100,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	8,00
Independent study and work	22,00
Preparation of lessons	48,00
Preparation for assessment activities	72,00
Resolution of case studies	0,00
Total hours	**150,00**

TEACHING METHODOLOGY

NOT APPLICABLE DUE TO THE IMPLEMENTATION OF THE NEW STUDY PLAN

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 and simulation classes**. 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. The practical simulation classes will be carried out in person. Computer simulations based on PhysioEx 10.0 software for Human Physiology will be proposed (see bibliography).

- **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

NOT APPLICABLE DUE TO THE IMPLEMENTATION OF THE NEW STUDY PLAN

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 call, the practical laboratory examination will be carried out with the resolution of two practical cases *in situ*. In parallel, a test questionnaire will be carried out with questions corresponding to the laboratory sessions. In the May-June call, there will be a test questionnaire corresponding to the simulation practices.

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 point
PRACTICES 35%
Practical cases 20 points
Laboratory and simulation practice questionnaire 15 point
TUTORING AND PROBLEMS 5%
Assistance and use of tutoring and problems 5 points

TOTAL **100 POINTS**

OPTIONAL ACTIVITY up to 10 POINTS

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.

REFERENCES

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

- Hill, R.W., Wyse, G.A. y Anderson, M. (2016) Animal Physiology. 4th Edition. Sinauer Associates, Inc, Sunderland, Massachusetts

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

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

- Zao, P., Stabler, T., Smith, L., Lokuta, A., Griff, E. (2012) PhysioEx 9.0. Simulaciones de laboratorio de Fisiología. Pearson Eduación. S.A. Madrid

- 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

- 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

- Guyton, A.C. (2016). Tratado de fisiología médica. 13a Edición. Elsevier

- Zao, Peter; Stabler, Timothy; Smith, Lori; Lokuta, Andrew; Griff, Edwin. (2020) PhysioEx 10.0: Laboratory Simulations in Physiology. Pearson