VNIVERSITAT DE VALÈNCIA

Course Guide
33050 Animal physiology

COURSE DATA

Data Subject	
Code	33050
Name	Animal physiology
Cycle	Grade
ECTS Credits	10.0
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
1100 - Graduado/a en Biología	Faculty of Biological Sciences	3	Annual

Subject-matter

Degree	Subject-matter	Character
1100 - Graduado/a en Biología	9 - Animal biology	Obligatory

Coordination

Name	Department
GARCERA ZAMORANO, MARIA DOLORES	23 - BIOLOGÍA FUNCIONAL Y ANTROPOLOGÍA FÍSICA
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SUMMARY

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.

OUTCOMES

1100 - Graduado/a en Biología

- Capacidad de análisis, síntesis y razonamiento crítico.
- Capacidad de resolución de problemas.
- Capacidad de aprendizaje autónomo y cooperativo.
- Familiarización con la elaboración, exposición y defensa pública de trabajos.
- Capacidad de manejar el inglés científico.
- Develop the capacity for organisation and planning.
- Manejar correctamente la terminología científica y familiarizarse con las metodologías y fuentes de información de Biología Animal.
- Conocer el manejo de la instrumentación científica básica propia de la Biología Animal.
- Comprender las funciones animales y los mecanismos básicos subyacentes.
- Comprender el funcionamiento del animal como el de un todo integrado, reforzando el papel de los sistemas de coordinación e integración.
- Comprender los mecanismos implicados en las adaptaciones de las funciones animales al medio.
- Adquirir conciencia del valor de la ética profesional.

LEARNING OUTCOMES

- Obtain an integrated vision of the functioning of the animal, to understand the meaning of the acquired knowledge, interrelating them and implement them.

- Capacity for data analysis, choice of the appropriate method, evaluation and critical interpretation of experimental results in its various forms of expression (tables, graphs…)

- Having skill in the handling of laboratory animals.

- Ability to build a written text understandable and organized.

- Capacity for speaking to an auditorium audience, for example the class itself, through the presentation or the speech in a debate on an issue or controversial issue.

- Ability to argue from rational criteria, clearly differentiating what is opinion of what facts or accepted scientific evidence.

- Professional training. Acquisition of scientific and technical knowledge related to the physiology that will make it possible to exercise professions and civic responsibilities in a continuous increase in technological society.

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.

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.
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. (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.

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.
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, 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.
Item 28. Nitrogen disposition and excretion.- Amnotelic animals.- Urotelic animals - Uricotelic animals.

8. LABORATORY PRACTICES

Effect of temperature on the oxygen consumption of aquatic animals.
Spectrum of absorption of hemoglobin according to its degree of saturation with oxygen.
Regulation of color change in vertebrates.
Study, in the laboratory, of the effect of juvenile hormone treatment on insect larvae/nymphs.
Effect of temperature on the heartbeat in Daphnia.
Salinity and volume regulation in polychaete worms.
Study of sensory receptors in humans.
Electromyography (BIOPAC Student System) (EMG-I).
Electromyography (BIOPAC Student System) (EMG-II).
Electrocardiography.
Study of blood pressure in humans.
Spirometry Analysis of pulmonary volumes and capacities.
In situ observation of the chloride cells in Artemia.
Study, in the laboratory, of estral cycle in the albino mouse.

9. MODELS OF SIMULATION BY COMPUTER

- Simulation, by computer, in various physiological processes related to the endocrine system (metabolism and hormonas)
- Simulation, by computer, in various physiological processes related to the muscular system. Physiology of skeletal muscle.
- Simulation, by computer, in various physiological processes related to the circulatory system. Cardiovascular Physiology in frog
- Simulation, by computer, in various physiological processes related to the circulatory system. Cardiovascular Dynamic.
- Simulation, by computer, in various physiological processes related to the respiratory system. Mechanisms of the respiratory system.
- Simulation, by computer, in various physiological processes related to the digestive system. Physical and chemical processes of the digestion
- Simulation, by computer, in various physiological processes related to the renal system. Renal Physiology.

10. TUTORING (in classroom)

The tutorial sessions are an hour long and will be planned 6 sessions and they were raised additional works (individual or group) that help consolidate the skills of the subject

11. COMPLEMENTARY ACTIVITIES

- Questionnaires "on line" through "Aula Virtual".

WORKLOAD

ACTIVITAT	Hours	% To be attended
Theory classes	54.00	100
Laboratory practices	37.00	100
Tutorials	6.00	100
Computer classroom practice	3.00	100
Development of individual work	8.00	0
Study and independent work	22.00	0
Preparation of evaluation activities	68.00	0
Preparing lectures	40.00	0
Preparation of practical classes and problem	8.00	0
Resolution of online questionnaires	4.00	0
TOTAL	**250.00**	

TEACHING METHODOLOGY

The teaching methodology of different activities (face-to-face and remote) are described here.

- ***Theory classes***, with a total of 53 hours, and that they will be taught sequentially throughout the academic year, in a way that are integrated with the rest of activities proposals.

- ***Practical laboratory classes***. Total hours are divided into 10 sessions of three hours each. At each session, proposed activities are carried out by students (couples) after reading the instructions previously supplied. At the end of each session it will respond to a questionnaire that will be delivered, along with a comprehensive table of results to the teacher. This questionnaire may be delivered only at the end of the corresponding practical session.

- **Practical classes simulation**. Computer simulations based on PhysioEx 9.0 software for Human Physiology (see bibliography) is proposed. At the beginning of the semester **1 session** set aside to explain the importance of simulation in physiology and show the operation of PhysioEx 9. After completing the different simulations, and in order to evaluate the activity, the student should send, through virtual platform, the document with all the answers. A questionnaire was also done through virtual platform. This activity is **OPTIONAL**. Students who wish to apply with honors must necessarily carry out this activity.

- ***Classroom practices***. They will be held in a classroom with small groups in 3 sessions of 2 hours. Activities will be proposed (multimedia materials, questionnaires ...) to deepen certain topics of general interest for students.

- The ***tutorial sessions*** are an hour long and they can solve the doubts raised by the students on the topics already covered. Complementary works (individual or group) will be carried out in these tutorials to help the resolution of doubts.

- ***Questionnaires on line through Aula Virtual***. Throughout the year various questionnaires will be proposed through Aula Virtual. The qualifications that may be obtained in each one of them will be corrected by a factor depending on their degree of difficulty.

- ***Exams***. In the theoretical part you can choose between two partial or final. The evaluation of the contents of the theoretical program will be implemented through a final exam, which will consist of questions from different format (concepts, test, reasoning, etc. ...). The mark obtained will mean up to 50% of the final grade. The evaluation of the laboratory practices will be conducted by a practical examination in the laboratory and a test through virtual platform. The qualification obtained will up to 25% of the final grade.

(*) Important note: For any exam students must identify properly. During the test is not permitted the use of mobile phones, mp3 or similar.

EVALUATION

We proposed the following pattern on **a maximum of 100 points**

(You have to reach 50 points to pass the subject):

Theory: 2 partial exams or a final exam (*)	**50 points**
Practical exam	**25 points**
Resolution of practice quizzes	**5 points**
Assistance and deditation in tutories	**5 points**
Assistance and deditation in classroom practices	**5 points**
Online questionnaires on Aula Virtual	**10 points**
TOTAL	**100 points**
Simulations OPTIONAL	**10 points**

Particular conditions

- To pass the course, ***is necessary both passing the theory exam (for partial or final examination) and passing the practical exam***. Only in this case the qualifications obtained in the rest of activities will be added.

- If you do not achieve the minimum score in any of the two exams (theory and practice), the score of the other can save for a full academic year.

- If you do not pass the subject in the first round (May/June), will save the ratings for the "Questionnaires of practice", the "attendance and the tutorials", the "virtual classroom questionnaires" and, in your case, the "simulations" for a full academic year. If the student wishes to perform again, you must repeat all. Such activities can only be made in the period between September and May of each academic year.

- In the second round maximum scores for each section will be the same as in the first round.

REFERENCES

Basic

- 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. (2014) Fisiología Humana. Un enfoque integrado. 6e. Editorial Medica Panamericana. Madrid
- Zao, P., Stabler, T., Smith, L., Lokuta, A., Griff, E. (2012) PhysioEx 9.0. Simulaciones de laboratorio de Fisiología. Pearson Eduación. S.A. Madrid

Additional

- 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