ANIMAL PHYSIOLOGY COURSE SYLLABUS

ACADEMIC YEAR: 2013-2014

1. SUBJECT DESCRIPTION

Degree:	**Biothecnology**
Course:	**Animal Physiology**
Module:	**Fundamentals of Biology, Microbiology and Genetics**
Department:	**Physiology, Anatomy and Cellular Biology**
Academic Year:	**2013-14**
Term:	**First Semester**
Total Credits:	**6**
Year:	**Year Three**
Type of Course:	**Compulsory Subject**
Course Language:	**English**

Teaching Model	**A2**
a. Lectures (General Background):	**70%**
b. Labs and experimental procedures:	**15%**
c. Guided Academic Activities:	**15%**

ANIMAL PHYSIOLOGY COURSE SYLLABUS

ACADEMIC YEAR: 2013-2014

2. Teaching Staff

2.1. Course Coordinator: Antonio Prado

2.2. Lecturers	
Name:	**Antonio Prado Moreno**
School:	**Experimental Sciences**
Departament:	**Physiology, Anatomy and Cellular Biology**
Academic Area:	**Physiology**
Category:	**TU**
Tutorials:	**Friday: 10:00 a 14:30** **On line: 24/7 (through the virtual classroom)**
Office (Building/Floor/Door):	**22 / 1st / 4**
E-mail:	**apramor@upo.es**
Telephone:	**+34 954 348 936 (internal: 48936)**

2.2. Lecturers	
Name:	**Javier Márquez Ruiz**
School:	**Experimental Sciences**
Departament:	**Physiology, Anatomy and Cellular Biology**
Academic Area:	**Physiology**

ANIMAL PHYSIOLOGY COURSE SYLLABUS

ACADEMIC YEAR: 2013-2014

Category:	**Contratado Doctor**
Tutorials:	**Thursday: 16:00 – 18:30** **Friday: 16:00 a 18:00** **On line: 24/7 (through the virtual classroom)**
Office **(Building/Floor/Door):**	**22 / 1st / 2**
E-mail:	**jmarquez@upo.es**
Telephone:	**+34 954 978 054 (internal: 78054)**

3. ACADEMIC CONTEXT

3.1. Course Description and Objectives

This course is an introduction to concepts and basic issues in Animal Physiology, Students will master the basic principles of physiology and use these to understand and interpret the operation of the physiological systems, as well as the structural design that allows this operation. At the end of the semester, the student:

- Meet the nomenclature and the basics in animal physiology and processes that allow the operation of physiological systems, particularly, their regulation and interaction.
- Understands and can efficiently handle texts and manuals of Animal Physiology.
- Able to develop experiments animal physiology laboratory under supervision.
- Can solve problems based on the diversity of the physiological processes of different animal groups.

3.2. Contributions to the training plan

Among the main contributions of the subject "Animal Physiology" to the Graduate Training Plan in Biotechnology, knowledge and understanding of the physiological mechanisms underlying animal life, has to be noted. The subject uses a comparative and multidisciplinary approach and devotes special attention to the regulatory mechanisms.

- Throughout the course, students become familiar with the basic terminology in Physiology.
- Students will acquire the right knowledge about the basic principles of the discipline.
- The course should provide students an integrated view of the functioning of biological systems animals.
- Upon completion of the course students must know the functions of the organs and systems and their control, and have a clear idea about the physiological mechanisms developed by different groups of animals to survive in their habitat.
- While exploring the content mentioned, students will strengthen several transferable skills and they should be able to apply the fundamental concepts of physics and chemistry in their understanding of physiological phenomena.
- Students will improve their ability to verbally articulate themselves to a group during guided academic activities.

3.3. Recommended or required prior knowledge

- General knowledge of biology.
- Understanding and familiarity of the essential concepts of physics and chemistry
- Good English (spoken and written)
- Managing the WebCT platform is of great interest to follow the course.

5. Skills

4.1 Degree skills developed in the course

General skills and cross-cutting

- Based on the expertise of a level secondary education, to know and to understand completely the basic facts, concepts, principles and theories related with the study of living organisms and their interplay with human activities.
- Being able to transmit information to other professionals both their work area or related areas, such as to a lay audience, and make judgments that include reflection on relevant social, scientific or ethical.
- Develop methods of acquisition, interpretation and analysis of information with a critical understanding of the appropriate contexts for use, to apply their knowledge in a professional manner and demonstrate their skills by developing and sustaining arguments and solving problems within their field of study.
- Develop learning skills adequate to undertake, with a high level of autonomy, later studies.
- Knowledge and understanding of general biological processes from a molecular standpoint, cellular, physiological and, where appropriate, of communities, of living beings.
- Know and understand the information obtained from biological processes and their adjustment to the theoretical framework of each of the subjects taught.
- Use rigorous terminology, nomenclature and classification systems in each of the subjects taught.
- To acquire basic experimental skills appropriate to each of the issues taught by the description, quantification, analysis and critical evaluation of the experimental results obtained independently.
- Use the leading scientific and technical literature, acquiring the ability to perceive clearly the current developments and possible future developments.
- Assimilate, from multidisciplinary source, relevant knowledge and deliver insights and judgments based on the integration of that knowledge.
- Be able to demonstrate the ability of responsible initiative in the workplace.
- Be aware of the importance of teamwork and empowerment of critical discussion of common goals.
- Develop creativity and innovation that results in the identification of analogies between situations that allow the application of known solutions to new problems.
- Be able to engage in the on-going development of biotechnology and its applications, as well as philosophical and ethical issues involved.
- Knowledge of methodologies and technologies appropriate for the proper presentation and communication of the different aspects that affect biotechnology (data analysis, biostatistics, etc.).
- Ability to analyse, synthesize and use critical thinking in science.
- Understand the scientific method.
- To work properly in a biological, chemical or biochemical laboratory, knowing and applying the rules and techniques related to health and safety, handling of laboratory animals and waste management.

- Understand and apply the tools, techniques and experimental protocols in the laboratory.
- Acquire, develop and apply the main techniques of preparation, staining and observation of biological samples.
- Acquire the skills of observation and interpretation of the results.

Specific skills

- Know the common characteristics of physicochemical transport processes: diffusion, osmosis, electrophoresis, etc.
- Identify and describe the different animal and plant tissues in histological preparations and distinguish the various structures and functions of animal tissues and organs and vegetables.
- Know how to design and run a laboratory experimental methodology in order to solve real problems using for this genetic model organisms and techniques and materials typical of a basic experimental level.
- Have a good understanding of the concept of measurement in science, including the correct use of units and systems of meaning and management involved in any measurement errors.
- Correctly calculate the relevant parameters of a process or experiment by manual representation of experimental data and mathematical functions on graph paper, semilog and double log.
- Be familiar with some trials of physiological activities (transport, chemotaxis), and be able to understand and interpret experimental results aimed at elucidating the functioning of various microbial physiological processes, and propose biotechnological applications of some of these processes.

4.2. Module Competencies developed in the course

- Distinguish the different structures and functions of animal tissues and organs and vegetables.
- Being able to find good quality and specialized scientific literature in databases using different criteria. Start reading and understand scientific articles.

4.3. Specific skills of the subject

- Know and understand the physiological mechanisms that underlie animal life and understand the fundamental physiological differences between the different animal groups.
- Understand the principles and mechanisms of regulation in animal physiology, and the relationship between structure and function in physiology.
- Be able to integrate and explain the concepts acquired during the study of physiology, in particular the interactions between the different systems and feedback mechanisms.

6. COURSE CONTENT (COURSE TOPICS)

I. INTRODUCTION. PRINCIPLES OF PHYSIOLOGY

Topic 1. Introduction to Animal Physiology.

Concept of Physiology. Basic characteristics of living organisms. Fundamentals of issues of Physiology. Contents of the course. Discussion and literature program.

Topic 2. Central principle of physiology. Concept medium

Central principle of physiology. Organizational levels. The external environment as determinant of physiological processes. The internal environment and constancy. Homeostasis and regulation. Integration of biological functions. Levels of adaptation.

II. NEURONAL FUNCTION

Topic 3. General organization of the nervous system

General Organization of the Nervous System. General principles from an evolutionary perspective. Invertebrate nervous system. Sensory neurons. Motoneurons. Centralization and cephalization. Segmentation. Basic elements of the vertebrate nervous system.

Topic 4. Central Nervous System and Autonomic Nervous System

Central Nervous System. Elements of the Brain. Peripheral Nervous System. Overview of the Nervous System. Autonomic Nervous System. Sympathetic and parasympathetic divisions. Spinal and cranial nerves. Coordination of sympathetic and parasympathetic systems.

Topic 5. General physiology of excitable cells

Concept of excitability. The neuron as excitable cell model. Cell types in the nervous system. Nerve cells. Glia. Electrical properties of excitable cells. Ion Channels. Concept of local potential. Action potential. Action potential propagation.

Topic 6. Signaling in the nervous system

Concept of synapses. Synaptic transmission. Cholinergic synapses. Synaptic regulatory mechanisms. Chemical nature of neurotransmitters. Functional classification. Molecular classification. Neuromodulators. Integration at synapses.

III. SENSORY RECEPTION

Topic 7. Sensory mechanisms. General physiology of sensory receptors

General properties of sensory reception. Concept of sensory receptor. Sensory transduction. Interpretation of sensory information.

Topic 8. Vision

The vision. Electromagnetic radiation. Structure and components of the vertebrate eye. Retina. Photoreceptors. Visual pigments and phototransduction. Basic mechanisms of vision. Visual perception. Vision in invertebrates. Detection of polarized light.

Topic 9. Mechanoreception and Hearing.

Mechanoreceptors. Organization of sensory pathways. Touch receptors. Proprioceptors. Baroreceptors. Basics of sound and hearing. Hair cells. Lateral line in fish and amphibians. Body balance. Ear.

Topic 10. Chemoreception. Termorrecepción. Nociception.

Chemoreception: taste and smell. Mechanisms of taste reception. Gustatory chemoreception. Olfaction. Thermoreceptors. Nociceptors.

IV. EFFECTOR SYSTEMS

Topic 11. Concept and types of effectors. Muscular fiber structure

Effector systems. Muscle tissue. Skeletal muscle. Structural basis of muscular contraction. Sliding filament theory. Regulation of muscle contraction.

Topic 12. Excitation-contraction coupling

Excitation contraction coupling. The relaxation contraction cycle. Metabolism. Skeletal fiber types. Heart muscle. Smooth muscle.

V. ENDOCRINE SYSTEMS

Topic 13. Introduction to the study of endocrine systems

The concept of homeostasis. The endocrine system and the nervous system work together. Anatomy of the endocrine system. General types of chemical messengers. Mechanisms of hormone action.

Topic 14. The hypothalamic-pituitary axis.

The hypothalamus. The hypophysis or pituitary gland. Types of cells secreting pituitary. Classification of pituitary hormones. Hhypophysiotropic hypothalamic hormones. Preproopiomelanocortin derived hormones. Growth hormone or somatotropin. Prolactin. Oxytocin. Vasopressin.

Topic 15. Pineal gland. Intermediate pituitary.

Pineal gland and melatonin. Functions of melatonin. The intermediate pituitary. MSH physiological roles. Functions of colour in animals. Stimuli that induce colour changes. Effector pigment cells. Neural and hormonal regulation of the color changes. Hormonal action mechanisms in physiological color changes. Hormonal actions in morphological changes colour. Control MSH secretion.

Topic 16. The thyroid and thyroid hormones. Parathyroid hormone.

The thyroid gland. Thyroid hormone biosynthesis and secretion of hormones. Mechanisms of action of thyroid hormones. Regulating the secretion of thyroid hormones. Physiological actions. Parathyroid hormone. Functional importance and calcium homeostasis. Bone tissue. Types of bone. Ostheogenesis and bone remodelling. Hormonal regulation of bone cell activity

Topic 17. Adrenal glands

Adrenal glands. Hormones of the adrenal cortex. Mechanisms of action of intracellular receptors. Mineralocorticoids. Glucocorticoids. Adrenal medulla. The adrenal sympathetic system. Neurotransmitters of the sympathetic-adrenal. Catecholamines. Adrenergic receptors and mechanisms of action. Physiological effects of hormones on the bone.

Topic 18. Endocrine pancreas

Functional anatomy of the endocrine pancreas. Physiological importance of glucose homeostasis. Insulin. Mechanisms of insulin secretion. Regulation of glucose transport by insulin, the insulin receptor. Actions of insulin. Glucagon. Somatostatin. Pancreatic polypeptide.

Topic 19. Determination and sexual differentiation. Sex hormones.

Determination, differentiation and sexual development. Gonadal differentiation. Somatic or genital differentiation. Reproductive organs. Sex hormones. Male reproductive system. Testicular function. Spermatogenesis. Secretion, metabolism and action of androgens. The female reproductive system. Ovarian function.

Topic 20. Oogenesis. Placental Hormones

Oogenesis and ovarian follicle development. Hormonal patterns during the menstrual cycle hormonal regulation of oogenesis. Functioning of the corpus luteum. Hormonal regulation of reproductive tract function. Mechanisms of action and metabolism of ovarian steroids. Female puberty and menopause. Placental Hormones.

VI. CIRCULATORY SYSTEMS AND GAS EXCHANGE.

Topic 21. Overview circulatory systems.

Concept of circulation. General organization of the circulatory systems. Open and closed circulatory systems. The heart. Electrical properties of the heart. Mechanical properties of the heart. The vertebrate heart.

Topic 22. Gas transfers in animals.

Introduction. Physical gases. Respiratory pigments. Oxygen transport by the blood. Breath. Respiratory systems. Gases in water and in air. Features of breathing in the air environment. Respiration in aquatic environments. Control mechanisms.

VII. ION BALANCE AND OSMOTIC. EXCRETORY SYSTEM

Topic 23. Fluid compartments of organisms. Osmoregulation.

The importance of water. Compartmentalization of living beings. Cell membrane permeability. Osmosis. Functions excretion. Factors contributing to the compulsory exchange of ions and water. Osmoregulatory organs of invertebrates. Osmoregulatory organs of mammals. The kidney of mammals.

Topic 24. Urine formation

Urine formation. Urine concentration mechanism. Kidneys of non-mammalian vertebrates. Excretion of nitrogenous waste.

VIII. NUTRITION AND DIGESTION

Topic 25. Nutrition and digestion. The digestive system

Nutritional concepts digestion and metabolism. Biological significance of nutrition. Types of nutrition. Obtaining food. Feeding strategies. Nutritional requirements. Nutrient molecules. Digestion. Digestive hydrolysis. Energy metabolism and metabolic rate. The digestive system. Gut motility. Gastrointestinal secretions. Exocrine glands. Gastrointestinal secretions. Bile and digestive enzymes. Control of digestive secretions. Absorption of nutrients.

7. METHODOLOGY AND RESOURCES

The course described in this guide, "Animal Physiology" (6 credits, 150 hours), follows a course type A2: Basic Teachings 70%, 15% Teaching and Development Practices and Guided Activities 15%.

The course includes 30 hours of classes (on site) where we will develop the basics of the subject.

For the development of the basic teachings assigned classrooms will be used, with up to 60 people and equipped with computer for video projection, allowing presentations with images and animations for the presentation of concepts. In addition, all classrooms have slate for the detailed explanation of those concepts requiring additional explanations or detail.

Throughout the course, part of theoretical knowledge will be developed in five lab sessions of 2 hours duration.

Lab sessions are conducted primarily in the student's laboratory of Physiology, equipped with the necessary instrumental to perform different practices. Also, laboratories also have audio visual, simulation tools and consumables necessary for practice. When necessary the sessions will take place in a computer room for the complete development of practices that require it.

The Guided Activities will take place in small groups.

Four sessions will take place (two hours and a half each), in which lab groups splits into two. Students will have the opportunity to discuss videos related to the subject, scientific articles and their own approaches on issues of interest within the scope of the program.

Personal work.

The campus has the necessary resources (library fully equipped with library material in paper and on-line subscriptions), sufficient study rooms with flexible schedules, computer rooms open access, etc. This will allow the students, to develop work related to the subject without any lack.

Virtual Classroom

As well, at all times the student count with the virtual classroom course, which interactively with the teacher and their classmates. The student should visit this website regularly for further information, outlines, handouts, and links to other sites of interest.

The maximum total time dedicated to the evaluation of the course is 15 hours.

In total, the student is expected to spend 150 hours to pass the course, which would be broken down as follows:

- **Basic Teachings:** 30 hours
- **Labs and experimental procedures:** 15 hours
- **Student work and tutorials:** 90 hours (Study and development agenda: 60, problem sessions, practical and other activities: 30)
- **Assessment:** 15 hours

8. Assessment

The evaluation will be based on the levels shown in three different sections: practical sessions, exams and portfolio:

- **Practice (20%).** Is scored separately attendance and participation (5%) and a written report of the work (15%)
- **Performing tests (*) (40%).** The exam consists of two parts (multiple choice, 20%) and essay questions (20%)
- **Guided activities and portfolio for groups (40%)**. The score is composed as follows:
  - ✓ Attendance and participation: 5%
  - ✓ Making memories of activities: 5%
  - ✓ Presentation of a literature review of a topic related to the course chosen by the student: 20%
  - ✓ Summaries of the basic teachings: 10%

(*) Those students who do not pass the exam, to be held at the end of the semester (first evaluation), must (to pass the course) perform a second test ("second assessment"), to be held in months of June or July. In this second option, students will be evaluated by a test that can cover all the skills and abilities listed in this guide. So this test may be done in written, oral, or both at the discretion of the teacher of the course, according to regulations: June 29, 2012 of the Vice-rectorships Teaching and Teacher Planning and Student, Sport and Environment , which reports:

"Que los alumnos que se presenten a una 2ª convocatoria o siguientes deben tener la opción de obtener el 100% de la calificación, bien porque se consideran en la misma actividades realizadas durante el curso regular, bien porque se diseñan nuevas pruebas de evaluación que las contempla".

9. Literature

As general references following books are recommended. During the development of the course may suggest additional manuals for tracking specific topics. References marked with an asterisk (*), and some others, are available online.

Basic Literature:

- Richard W. Hill, Gordon A. Wyse, and Margaret Anderson (2012). **Animal Physiology***. 3rd edition . Sinauer Associates, Inc.
  * www.coursesmart.com/9780878935598
- Randall, D., Burggren, W. and French, K. (2002). **Eckert Animal Physiology***. 5th Ed. W.H. Freeman.
  * http://www.whfreeman.com/Catalog/product/eckertanimalphysiology-fifthedition-randall

Additional Bibliography:

- Hall J.E. (2012). **Guyton and Hall Textbook of Medical Physiology**. 12th Edition. Saunders.
- C.D. Moyes and P.M.Schulte (2007). **Principles of Animal Physiology: International Edition (2e)**. Pearson Higher Ed USA
- Eric R. Kandel, James H. Schwartz, Thomas M. Jessell and Steven A. Siegelbaum (2012). **Principles of Neural Science**, Fifth Edition. McGraw-Hill Companies Inc.
- Thomas W. Sadler (2010). **Langman's Medical Embryology** (11th Editon). Lippincott Williams and Wilkins.
- Kim E. Barrett, Susan M. Barman, Scott Boitano and Heddwen Brooks (2012). **Ganong's Review of Medical Physiology**, 24th Edition. McGraw-Hill Companies Inc.
- Hochachka Peter W. and Somero George N. (2002). **Biochemical adaptation: mechanism and process in physiological evolution.**

Laboratory Manuals:

- Dee U. Silverthorn, Bruce R. Johnson and Alice C. Mills (2005). **Lab Manual for Physiology**. Benjamin-Cummings Publishing Company.

Additional Internet Resources:

- The Physiology Place:
  (http://www.pearsonhighered.com/thephysiologyplace/)
- UTK Mathematical Life Sciences Page for Education
  (http://www.tiem.utk.edu/~gross/bioed/modulelist.html)
- Pat Brown's Path webpage Interactive Physiology
  (http://faculty.alverno.edu/bowneps/)
- Quantitative Literacy
  (http://faculty.alverno.edu/bowneps/new%20indexes/quantindex.html)
- Moyes and Schulte Animal Physiology Textbook
  (http://www.pearsonhighered.com/educator/product/Principles-of-Animal-Physiology-2E/9780321501554.page)
- Companion Website for Principles of Animal Physiology.
  (http://wps.aw.com/bc_moyes_animalphys_2/)
- Eckert Animal Physiology
  (http://www.whfreeman.com/Catalog/product/eckertanimalphysiology-fifthedition-randall)
- Eckert Animal Physiology. Student resources
  (http://www.whfreeman.com/Catalog/product/eckertanimalphysiology-fifthedition-randall/studentresources)
- Sherwood Animal Physiology Textbook
  (http://www.brookscole.com/cgi-wadsworth/course_products_wp.pl?fid=M20b&flag=student&product_isbn_issn=9780534554040&discipline_number=22)
- Physiology by Numbers Richard F. Burton Chapter 1: Introduction to Physiological Calculation
  (http://assets.cambridge.org/97805217/72006/sample/9780521772006wsc00.pdf)
- Physioviva Educational Videos
  (http://www.youtube.com/user/llkeeley?feature=mhee)