COURSE PROGRAM

Identification and characteristics of the course				
Code	500188		ECTS Credits	6
Course name (English)	Vertebrate Zoology			
Course name (Spanish)	Zoología de Vertebrados			
Degree programs	Biology			
Faculty/School	Faculty of Sciences			
Semester	3	Type of course	Compulsory	
Module	Animal Biology			
Matter	Zoology			
Lecturer/s				
Name		Office	E-mail	
José Luis Pérez Bote		Margarita Salas building, 3rd floor, DZ8	jlperez@unex.es	
Jorge Sánchez Gutiérrez (laboratory)		Margarita Salas building, 3rd floor, DZ6	jsgutierrez@unex.es	
Subject Area	Zoology			
Department	Anatomy, Cellular Biology and Zoology			
Coordinating Lecturer (If more than one)	José Luis Pérez Bote			

Competencies/Learning Outcomes
Basic Competencies
CB1: Students should be able to show that they know and understand facts and contents in a field of study which, based on a previous general secondary school level, have been extended to those included in advanced textbooks and, in some respects, come from the front line of their field of study.
CB2: Students should be able to apply their knowledge professionally in their future jobs or tasks and should have the competencies to develop and defend arguments and solve problems in their field of study.
CB3: Students should be able to collect and interpret relevant data (typically within their field of study) to give an educated opinion about relevant social, scientific, or ethical issues.
CB4: Students should be able to communicate information, ideas, problems, and solutions to both specialized and non-specialized audiences.
CB5: Students should develop the learning skills required to undertake further studies with a high degree of independence.
General Competencies
CG1: To train biologists with general and specific competencies, capable of undertaking tasks in all fields of biology, developing their activities in public or private companies and institutions or creating their own companies.

CG2: To provide the students with the skills to successfully pursue the postgraduate courses that will enable them specifically to work in the fields of education, research, or other professions.
CG3: To provide the graduate students with the ability to independently generate, acquire and process information related with Biology.
CG4: To enable them to plan, carry out and critically analyse processes of knowledge in the realm of their activity.
CG5: The final aim is to train graduate students capable to undertake the tasks officially stipulated for professional biologists, as defined in the directive of April 5, 2006, of the Presidential office of the Regional Government of Extremadura (DOE April 20, 2006).
Transversal Competencies
CT1: To apply the knowledge acquired during the degree in a correct and professional manner, and to perform confidently in the laboratory.
CT2: To use and apply Information and Communications technologies (ICTs) on training and professional field.
CT3: To know and understand the information in advanced textbooks and to have access to the knowledge coming from the front line of their field of study.
CT4: To develop the learning, organization, and planning skills, necessary both to continue with further studies with a high degree of independence and to perform professionally.
CT5: To interpret, analyse and synthesise relevant data and information that will enable the student to develop ideas, solve problems and give critical arguments about important social, scientific, or ethical issues.
CT6: To transmit effectively results and conclusions to specialized and non-specialized audiences.
CT7: To express oneself correctly orally and in writing in the native language, as well as master a foreign language, preferably in English.
CT8: To lead or work on a team positively adapting to different contexts or situations.
CT9: To respect the fundamental rights and equality of men and women, and to acquire an ethic compromise of respect to life and natural environment.
Specific Competencies
CE3: To know and understand the structure, morphology, organization and development of living beings.
CE4: To know the functions of living beings, its regulation and integration, and to analyse and interpretative their functional adaptations to the environment.
CE5: To distinguish different organization levels of living beings, from molecular to community of organisms, as well as the interaction between them and the environment.
CE7: To understand the origin and evolution of life, identifying the evolutionary processes and mechanisms, including systematics, phylogeny, and biogeography of the modern and extinct living beings.
CE8: To be able to perform, analyse and evaluate studies on biodiversity, as well as to conserve, manage and restore biodiversity.

CE12: To sample, characterize, preserve, and manage populations and ecosystems, and to analyse the behaviour of living beings, being able to evaluate the environmental impact.
CE14: To provide Biology education according to law regulations.
Contents
Course outline
It is intended that students know the defining characteristics of Vertebrates, as well as their origin, evolution, classification, and relationship with other animal groups, considering their anatomical, physiological, and behavioural adaptations to the different environments.
Course syllabus
Unit 1. Evolution, diversity, and classification of Vertebrates. Introduction. The Vertebrate Story. Classification of vertebrates. Earth history and vertebrate evolution.
Unit 2. What is a vertebrate? Introduction. Vertebrates in relation to other Metazoans. Characteristics of Chordates. What distinguishes a vertebrate? Basic vertebrate structures and systems.
Unit 3. Living in water. Introduction. The aquatic environment. The sensory perception of vertebrates in the aquatic environment. The internal environment of vertebrates. Exchange of water and ions. Vertebrates in different aquatic environments.
Unit 4. Jawless vertebrates and the origin of jawed vertebrates. Introduction. First evidence of vertebrates. Extinct agnates: Ostracoderms. The extant agnates: Cyclostomes. The origin of jaws. The origin of neck. The origin of paired appendages. Extinct Palaeozoic jawed fishes.
Unit 5. Chondrichthyes. Introduction. Radiation and classification of chondrichthyans. Morphology of extant chondrichthyans. Selachii. Batoidea. Holocephali.
Unit 6. Osteichthyes. Introduction. The origin of bony fishes. Actinopterygians: the ray-finned fish. Evolution of the Actinopterygians. Swimming and reproduction in bony fishes. Teleosts in different environments. Sarcopterygians: lobe-finned fishes. Evolution of the Sarcopterygians.
Unit 7. Living on land. Introduction. Support and locomotion on land. Eating on land. Breathing air. Pumping blood. Sensory systems. Conserving water in a dry environment. Controlling body temperature in a changing environment: ectothermy, endothermy and heterothermy.
Unit 8. Origin and radiation of Tetrapods. Introduction. Tetrapod origins. Moving onto land. Radiation and diversity of non-amniote tetrapods. Amniotes.

Unit 9. Lissamphibians. Introduction. Urodeles. Caecilians. Anurans. Exchange of water and gases in lissamphibians. Toxins, venoms, and other defence mechanisms.
Unit 10. Sauropsids and Synapsids: two approaches to terrestrial life. Introduction. The conflict between locomotion and respiration. Limb-powered locomotion. Increased gas exchange. Excretion: the role of the kidneys.
Unit 11. Turtles. Introduction. External anatomy. Internal anatomy. Reproductive biology. Social behaviour, communication, and courtship. Navigation and migration. Classification.
Unit 12. Lepidosaurs. Introduction. Classification. Rhynchocephalians: biology of tuatara. Radiation of squamates. Foraging modes. Skull kinesis. Feeding specializations of snakes. Predator avoidance and defence. Social behaviour. Reproduction modes. Thermal ecology.
Unit 13. Crocodylians. Introduction. Anatomy. Diversity of extant crocrodylians. Predatory behaviour and diet of extant crocrodylians. Communication and social behaviour. Reproduction and parental care.
Unit 14. Mesozoic diapsids: dinosaurs and others. Introduction. Diversity of Mesozoic diapsids. Lepidosaurmorphs: Marine diapsids. Pterosaurs: The first flying vertebrates. The structure and function of dinosaurs. Ornithischians dinosaurs. Herbivorous saurischians. Carnivorous saurischians.
Unit 15. The origin and radiation of birds. Introduction. Avian characters in non-avian theropods. The mosaic evolution of birds.
Unit 16. Extant birds. Introduction. Skeleton. The flight. Feet. Feeding and digestion. Sensory systems. Reproduction. Social behaviour. Orientation and navigation. Migration. Classification.
Unit 17. Synapsids: the evolution of Mammals. Introduction. The origin of Synapsids. The diversity of non-mammalian synapsids. Evolutionary trends in synapsids. The first mammals. Main characters derived from mammals.
Unit 18. Extant mammals. Introduction. Major lineages of mammals. Prototheria. Metatheria. Eutheria.
Unit 19. Primate evolution. Introduction. Evolutionary trends and diversity in Primates. Hominoidea. Origin and evolution of humans. Derived hominins: The genus *Homo*.

LABORATORY SESSIONS 1. External anatomy of bony fishes. Bony fish dissection. Determination of freshwater fishes. 2. Determination of sea fish. 3. External anatomy of cartilaginous fishes. Determination of Chondrichthyes.

4. External anatomy of lissamphibians and reptiles. Determination of lissamphibians and reptiles.
5. External anatomy of birds. Bird dissection.
6. External anatomy of mammals. Mammalian dissection.
7. Determination of mammals.

Educational activities

Student workload in hours by lesson		Lectures	Practical activities				Monitoring activity	Homework
Unit	Total	L	HI	LAB	COM	SEM	SGT	PS
1		2						1
2		2						2
3		2						3
4		2						4
5		2						4
6		2		2				7
7		2						5
8		2		2				5
9		2						5
10		3		2				7
11		2						4
12		2		2				5
13		2						5
14		3		2				5
15		1						5
16		3		2				5
17		3						7
18		3		3				7
19		3						4
Assessment		2						
TOTAL	150	45		15				90

L: Lectures (100 students)
HI: Hospital internships (7 students)
LAB: Laboratory or field practices (15 students)
COM: Computer room or language laboratory practices (30 students)
SEM: Problem classes or seminars or case studies (40 students)
SGT: Scheduled group tutorials (educational monitoring, ECTS type tutorials)
PS: Personal study, individual or group work and reading of bibliography

Teaching Methodologies

1. Explanation and discussion of contents.

2. Practical classes, such as labs, computer classes and field work.

3. Student personal work.

Learning outcomes

That the student knows and understands the fundamentals of the study of animal behaviour and the way in which behaviour contributes to maximizing the fitness of the individual, as well as understanding how behaviour is adaptive and the way in which ecology and sometimes genetics interact to determine behaviour. In addition, the student must know the organic systems in Vertebrates and their evolution from the simplest forms to Birds and Mammals, understand the different adaptations of animals to different habitats and types of life and know the origin and evolution of man as another vertebrate animal.

Assessment systems

Continuous Assessment

1. Theoretical Component (8 points – non-recoverable):

- The final written exam accounts for 6 points and consists of a multiple-choice test comprising 42 single-answer questions, each with four options. For every three incorrect answers, one correct answer will be subtracted.
- Follow-up activities conducted during class sessions contribute up to 2 points. These will consist of written questions posed by the lecturer and completed during the session. For these activities to be included in the final assessment, the student must complete and submit at least 80% of them throughout the course.

2. Laboratory Component (2 points – non-recoverable):

- Attendance at all laboratory sessions is compulsory. Unjustified absences will result in failure of the practical component.

A) Laboratory questionnaires represent 1 point of the total grade. A minimum score of 5 out of 10 is required to pass this section. Students who fail to attend a laboratory session will not be allowed to complete the corresponding questionnaire.

B) The practical identification test (*visu*) of Iberian and Extremaduran vertebrate fauna, based on photographic material, is worth 1 point.

To successfully complete the course, students must pass each of the individual assessment components described above.

Retention of Marks: Partial marks from passed components will be retained for a maximum of one academic year.

Global Assessment Option

Students who opt for the global assessment modality will be assessed as follows:

1. **Theoretical Exam** (7 points):

   A final exam consisting of 42 multiple-choice, single-response questions with four options. One correct answer will be deducted for every three incorrect or unanswered questions.

2. **Practical Exam** (3 points):

- A practical laboratory exam worth 2 points, including dissections and/or taxonomic identifications based on course content.
- A visual identification (*visu*) test on Iberian vertebrate fauna worth 1 point.

Bibliography (basic and complementary)

Benton, M. J. 1995. Paleontología y evolución. Ed. Perfiles, Madrid.

Carroll, R. L. C. 1988. Vertebrate Paleontology and Evolution. Ed. Freeman & Co. New York.

Carroll, R.L.C. 1997. Patterns and Processes of Vertebrate Evolution. Ed. Cambridge University Press. London.

Colbert, E. H. 2001: Evolution of the Vertebrates. A History of the Backbone Animals. Ed. Through Tima. 5º ed. Wiley, New York.

Díaz, J. A. y Santos T. 1998. Zoología. Aproximación evolutiva a la diversidad y organización de los animales. Ed. Síntesis. Madrid.

Gallego, L. 2006. Los Cordados, origen y diversificación. Club Universitario. Alicante.

Gallego, L. 2007. Los Cordados, funciones de control voluntario. Grafol, Vigo.

Grassé P. P., Poisson, R. A. y Tuzet, O. 1976. Zoología. Ed. Toray-Masson. Barcelona.

Hairston, N. G. 1994. Vertebrate zoology -an experimental field approach. Ed. Cambridge University Press.

Harvey Pough, F., Heiser, J.B. y McFarland, W.N. 1989. Vertebrate Life. 3rd ed. MacMillan, New York.

Hickman, C. P. Jr., Roberts, L. S., Larson, A., l'Anson, H. y Eisenhour, D. J. 2009. Principios integrales de Zoología. 14 edición en español. Ed. Mac-Graw- Hill · Interamericana. Madrid.

Kardong, K.V. 2007. Vertebrados. Anatomía Comparada, función y evolución. Cuarta Edición. McGraw –Hill. Interamericana. Madrid.

Kent, G.C. y Carr, R.K. 2000 Comparative Anatomy of the Vertebrates. McGraw-Hill, N.Y.

Kowalski, K. 1981. Mamíferos. Ed. Blume. Barcelona.

Müller, P.C. 1979. Introducción a la Zoogeografía. Ed. Blume. Barcelona.

Nadal, J. 2001. Vertebrados. Origen, organización, diversidad y biología. Ediciones de la Universidad de Barcelona y Ed. Omega, Barcelona.

Parker, T.J. y Haswell, W.A. 1991. Zoología. Cordados. 7ªEd. Reverté. Barcelona.

Pough, F.H. y Janis, Ch. M, 2019. Vertebrate Life, 10th edition. Oxford University Press, New York.

Ridley, M. 1996. Evolution. Ed. Blackwell Science, Cambridge (Mass.).

Romer, A.S. y Pearsons, T.J. 1986. Anatomía comparada. Ed. Interamericana. México.

Schmith-Nielsen, K. 1983. Fisiología Animal. Adaptación y Medio Ambiente. Ed. Omega. Barcelona.

Strichberger, M. 1990. Evolution. Jones & Bartlett, Eds.

Tellería, J. L. 1991. Zoología evolutiva de los Vertebrados. Ed. Síntesis. Colección Ciencias de la Vida, nº 9.

Vaughan, T.A. 1999. Mammalogy (4ª ed.). Ed. W.B. Saunders, Philadelphia.

Young, J. Z. 1985. La vida de los vertebrados. Ed. Omega. Barcelona.

Ziswiler, V. 1986. *Zoología especial. Vertebrados. Tomos I y II*. Ed. Omega. Barcelona.

Laboratory

Cupul Magaña, F.G. y Flores Guerrero, U.S. (coord.), 2015. Manual de prácticas biológicas de laboratorio y campo, III. Universidad de Guadalajara, Puerto Vallarta, Jalisco, México.

Hickman, F.M. y Hickman, C.P. 1991. Zoología, Manual de Laboratorio. McGraw-Hill, Madrid.

Hickman, C.P., Kats, L.B. y Keen, S.L. 2008. Laboratory studies in integrated principles of Zoology, 14th edition. McGraw-Hill, New York.

Pérez-Bote, J.L. 2000. Claves para la identificación de la fauna extremeña: Peces. Servicio de Publicaciones, Universidad de Extremadura. Cáceres.

Pérez-Bote, J.L. y Cascos Chaves, G. 2000. Claves para la identificación de la fauna extremeña: Mamíferos. Servicio de Publicaciones, Universidad de Extremadura. Cáceres.

Pérez-Bote, J.L.; Blasco, M. y Gómez de Berrezueta, J. 2002. Claves para la identificación de la fauna extremeña: Anfibios y Reptiles. Servicio de Publicaciones, Universidad de Extremadura. Cáceres.

Other resources and complementary educational materials