VNIVERSITAT DE VALÈNCIA

Course Guide
43246 Functional morphology of vertebrates

COURSE DATA

Data Subject	
Code	43246
Name	Functional morphology of vertebrates
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
2148 - M.D. in Biodiversity: Conservation and Evolution	Faculty of Biological Sciences	1	First term

Subject-matter

Degree	Subject-matter	Character
2148 - M.D. in Biodiversity: Conservation and Evolution	4 - Integral aspects of animal diversity	Optional

Coordination

Name	Department
AZNAR AVENDAÑO, FRANCISCO JAVIER	355 - Zoology
FERRER SUAY, MARIA DEL MAR	355 - Zoology

SUMMARY

"Functional Morphology of Vertebrates" is a subject of the Master: "Biodiversity: Evolution and Conservation", of 3 ECTS credits. In this subject, a functional approach to the external morphology of vertebrates is proposed; specifically fish, birds and mammals (herps -amphibians and reptiles- are dealt with separately in a specific subject). The underlying objective of "Functional Morphology of Vertebrates" is that the student assimilates an operational scheme of application of principles of functional interpretation that includes (1) the relationship between the determinants of organic form (functional, historical-phylogenetic and physical) and performance; (2) the relationship between performance and function; (3) the relationship between function and its ecological consequences (ecomorphology). From this scheme, major themes of application are presented, particularly in the external morphology of fish, birds and mammals (e.g., the structure of fins, beaks, or dentition).The aim of this organisation is not only for the student to know and understand the physical and functional principles and ecological consequences underlying certain elements of external morphology in vertebrates, but also to be able to use this knowledge and understanding to tackle new problems, i.e. to be

able to apply his or her knowledge. For this reason, problem solving is encouraged in the subject.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

It is recommended (although not essential) to have studied zoology or a related subject.

OUTCOMES

2148 - M.D. in Biodiversity: Conservation and Evolution

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- To acquire basic skills to develop laboratory work in biomedical research.
- Be able to access the information required (databases, scientific articles, etc.) and to interpret and use it sensibly.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Be able to access to information tools in other areas of knowledge and use them properly.
- Stimulate the capacity for critical reasoning and for argumentation based on rational criteria.
- Favour intellectual curiosity and encourage responsibility for one's own learning.
- Be able to communicate and disseminate scientific ideas.

LEARNING OUTCOMES

-To recognise the main structures of the external morphology and the fundamental anatomical aspects of vertebrates.

- To pose simple, but coherent and reasonable functional hypotheses on the external morphology of vertebrates based on basic biological data and principles.

- To analyse the structure of vertebrate communities according to the principles of ecomorphology.

DESCRIPTION OF CONTENTS

1. Presentation of the module

This unit describes the objectives of the subject. Special emphasis is placed on the idea of equipping students with general and specific principles that will enable them to apply their knowledge of functional morphology to organisms whose biology they are unfamiliar with. In other words, students are expected to be able to apply the knowledge of functional morphology they acquire.

2. Principles of functional morphology

This unit introduces the determinants of morphology (constructional morphology) and its link to its ecological consequences (ecomorphology). The key concept is that of performance, which links the structural and morphological characteristics of any structure to its potential functionality.

3. Functional morphology of teleosts

This unit gives a brief review of the external morphology of teleosts, and the following basic principles are outlined:

1) Functional morphology of feeding in teleosts: biomechanical basis (prey capture and processing, pharyngeal tooth plates), ecological consequences of functional morphology.

2) Functional morphology of locomotion in teleosts: body shape, fins, movement in water (thrust, drag, viscosity, inertia), buoyancy, propulsive forces.

4. Functional morphology of birds

The following aspects are covered in this thematic unit:

1) Evolution of feathers and flight as determinants of bird morphoanatomy.

2) Basic principles of functional interpretation of beak morphology. Key aspects: Accuracy and risk of breakage. Tomia.

3) Basic principles of interpretation of leg morphology: Key aspects: changes in number and orientation of toes, size and shape of nails, addition of elements (membranes, feathers).

4) Basic principles of interpretation of feather morphology. Types of feathers. Main performances: insulation, waterproofing, defence, information transmission, flight. General adaptations to flight.

5. Functional morphology of mammals

The following aspects are covered in this unit:

1) Thermoregulation in mammals: Body heat loss (body size, hairs, fat). Excess body heat (sweat and sebaceous glands, thermal windows, vascular system). Behavioural (hibernation/lethargy, migration).

2) Functional morphology of locomotion: external morphology, foot structure and posture, types of locomotion.

3) Functional morphology of feeding: endothermy, skull morphology (bones, muscles and teeth), food processing, sensory organs.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	20,00	100
Laboratory practices	10,00	100
Preparing lectures	10,00	0
Preparation of practical classes and problem	35,00	0
TOTAL	**75,00**	

TEACHING METHODOLOGY

A theoretical-practical programme consisting of 5 themes will be developed during the first four-month period. During the classes, the active participation of the student will be encouraged through the presentation and resolution of problems and through non-classroom activities. The bulk of the latter consists of problem solving by the student in an autonomous manner.

The programme also includes two practicals in which, using in toto specimens and skulls, students will analyse various aspects of the functional morphology of vertebrates, with special emphasis on trophic ecology and locomotion.

EVALUATION

The module will be evaluated based on three procedures:

- Carrying out a written exam that the students will work in a non on-site way after finishing the course. The exam will address problems of functional morphology. (1) the degree of elaboration, (2) the argumentation and (3) the originality in the answers will be valued.

- Attendance and proficiency of the practical sessions, which will be assessed in accordance with a report that will be carried out during them. The report will include the resolution of some problems.

- Problem solving in class.

The weight of each part on the overall mark of the subject will be as follows:

1. Exam: 75%

2. Laboratory report: 25%

REFERENCES

Basic

- Alexander R McNeill (1992) Exploring biomechanics: animals in motion. New York, Scientific American Library, 247 pp.
- Alexander, R. McNeill (2003) Principles of animal locomotion. Princeton (NJ), Princeton University Press, 371 pp.
- Biewener AA (2003) Animal locomotion. Gran Bretaña, Oxford University Press, 281 pp.
- Domenici P & Blake RW (2000) Biomechanics in Animal Behaviour. (Domenici P and Blake RW eds.) Bios Scientific Publishers. 344 pp.
- Shadwick RE & Lauder GV (2006) Fish biomechanics. Amsterdam, Elsevier, 542.
- Videler JJ (1993) Fish swimming. Gran Bretaña, Chapman & Hall, 260 pp.
- Videler, JJ (2005) Avian flight. Gran Bretaña, Oxford University Press, 258 pp.
- Wainwright SA, Biggs WD & Currey JD (1982) Mechanical Design in Organisms.
- Vogel S (1994) Life in moving fluids. USA, Princeton University Press, 467 pp. USA, Princeton University Press, 423 pp.
- Wainwright PC & Reilly SM (1994) Ecological morphology: integrative organismal biology. Chicago, University of Chicago Press, 367 pp.