VNIVERSITAT DE VALÈNCIA

Course Guide
43249 Paleodiversity and invertebrate evolution

COURSE DATA

Data Subject	
Code	43249
Name	Paleodiversity and invertebrate evolution
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2022 - 2023

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	5 - Cross-disciplinary optional subject areas 1	Optional

Coordination

Name	Department
ROS FRANCH, SONIA	356 - Botany and Geology

SUMMARY

This subject will provide an overview of the great events in the history of invertebrates through time. We will study the main invertebrate phyla from a morphological, systematical and paleoecological point of view. We will focus on the origin of the groups, the great evolutionary radiations and the extinctions. The fossil record provides us information on both extinction and diversification processes, showing how the balance between both processes is one of the driving force of evolutionary change.

That is why the subject will focus on the great extinction and recovery events throughout the history of life. The course aims to show the student how the fossil record provides information on evolutionary processes and the paleoecological conditions in which invertebrates developed during the Phanerozoic. Metazoans currently occupy the majority of the terrestrial and marine habitats; the verification of this fact in the past is contrasted with the fossil record, which provides us with relevant information about their past geographical distribution (paleobiogeography). Finally, the fossil record in the sedimentary rocks offers details about the spatial-temporal distribution of the different groups, allowing us to know the relative age of the various geological materials and their biostratigraphic correlation over geological time.

The subject has a theoretical-practical nature. The practical part of the lectures will be dedicated to the recognition and description of specimens of the different invertebrate groups that appear in the fossil record, as well as their systematic and paleoecological implications, among other aspects.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

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 be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- 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 make quick and effective decisions in professional or research practice.
- 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.
- To be able to assess the need to complete the scientific, historical, language, informatics, literature, ethics, social and human background in general, attending conferences, courses or doing complementary activities, self-assessing the contribution of these activities towards a comprehensive development.
- Stimulate the capacity for critical reasoning and for argumentation based on rational criteria.
- Favour intellectual curiosity and encourage responsibility for one's own learning.
- Encourage ethical commitment and environmental awareness.
- Be able to communicate and disseminate scientific ideas.

LEARNING OUTCOMES

To:

- To know the main groups of invertebrates in the fossil record, their morphology and systematics, their mode of life, evolutionary and biogeographic aspects, temporal distribution and main environments in which they lived and evolved during the Phanerozoic.

- Acquire knowledge on the main trends that have occurred in the diversity of invertebrates (extinctions and radiation) and on the changes produced in marine and continental ecosystems over time and their use to understand the current organic world.

- Evaluate the temporal and/or ecological significance of each group and its use for dating and paleoenvironmental interpretation of sedimentary rocks. Emphasis is placed on some characteristic fossils from successive geological ages and from different paleoecological contexts, which will make it possible to characterize some of the main milestones in the history of life on Earth.

- Learn the use of the fossil invertebrate record as an indicator of climate change at different scales.

DESCRIPTION OF CONTENTS

1. Introduction

Paleontological record of the main groups of invertebrates in the Proterozoic and Phanerozoic. Radiations, extinctions and recoveries. Exceptional fossil deposits. Fossilization processes and basic concepts on biostratigraphy.

2. Porifera and Bryozoa

Morphology, systematics, paleoecology, stratigraphic and geographic distribution, diversity and evolutionary history (main radiation and extinction events; ecological dominance).

3. Cnidaria and reefs

Morphology, systematics, paleoecology, stratigraphic and geographic distribution, diversity and evolutionary history (main radiation and extinction events; ecological dominance). Reefs and reef organisms through time.

4. Brachiopoda

Morphology, systematics, paleoecology, stratigraphic and geographic distribution, diversity and evolutionary history (main radiation and extinction events; ecological dominance).

5. Mollusca Bivalvia

Morphology, systematics, paleoecology, stratigraphic and geographic distribution, diversity and evolutionary history (main radiation and extinction events; ecological dominance).

6. Mollusca Cephalopoda

Morphology, systematics, paleoecology, stratigraphic and geographic distribution, diversity and evolutionary history (main radiation and extinction events; ecological dominance), biostratigraphy.

7. Mollusca Gastropoda and minor groups

Morphology, systematics, paleoecology, stratigraphic and geographic distribution, diversity and evolutionary history (main radiation and extinction events; ecological dominance).

8. Echinodermata

Morphology, systematics, paleoecology, stratigraphic and geographic distribution, diversity and evolutionary history (main radiation and extinction events; ecological dominance).

9. Hemichordata Graptolithina

Morphology, systematics, paleoecology, stratigraphic and geographic distribution, diversity and evolutionary history (main radiation and extinction events; ecological dominance), biostratigraphy.

10. Arthropoda Trilobita

Morphology, systematics, paleoecology, stratigraphic and geographic distribution, diversity and evolutionary history (main radiation and extinction events; ecological dominance), biostratigraphy.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	20,00	100
Laboratory practices	10,00	100
Development of individual work	8,00	0
Preparation of evaluation activities	16,00	0
Preparing lectures	16,00	0
Preparation of practical classes and problem	5,00	0
TOTAL	**75,00**	

TEACHING METHODOLOGY

It is proposed to teach the course in theoretical-practical classes that will include a theoretical part with exposition of the subject and related problems through a master class followed by a practical part where fossil invertebrate materials will be examined and practical problems solved. The exposition of the concepts will be framed in a particular way for reaching a basic knowledge of the main invertebrate fossil groups, with special emphasis on the well-represented groups in the fossil record, as well as their biostratigraphic and paleoecological applications, all framed within the evolution of invertebrate paleodiversity through time, guided by the main extinctions and radiations of the Phanerozoic.

It is proposed that the course follow a basic taxonomic organization in order to provide students with a good systematic and morphological base that in turn will be the foundation on which any study of a phylogenetic, ecological, biostratigraphic, or paleobiogeographic nature can be developed, among other. This type of approach allows the student to acquire basic skills related to the management and interpretation of the data necessary to address different issues involved in the evolutionary history of different groups.

To complete the training of students, it is proposed to introduce, in parallel to the taxonomic development, some standard study cases to demonstrate the applications of fossil invertebrates to broad concepts such as functional morphology, palaeoecology, evolutionary trends, etc.

During the development of the course, we will encourage the active participation of students in the classes, with the aim of developing a critical spirit and logical thinking, positively valuing reflective knowledge about the routine accumulation of information.

The course will be completed with the attendance to specialized conferences and seminars held in conjunction with other subjects and with both group and individual student work. In learning, personal characteristics are what define the basic strategies that each student must explore and enhance to increase their performance; on the other hand, they must be able to work as a team.

Teamwork will be carried out in the practical part of the classes, where students must complete several guides, and attend to the material to be examined where they can interact with their classmates, as well as with the teacher. Regarding individual work, the writing of a short monograph will be proposed from the beginning of the course, which will be delivered at the end of the course. The topics of these monographs can be chosen from a list or propose a topic of their own choice, after consultation with the teacher. For

the proposal, development and monitoring of these monographic works, a scheme based on the research process will be followed that will culminate in the delivery of the written monographs and their oral presentation in a special class at the end of the course.

EVALUATION

The evaluation of the theoretical and practical aspects of the subject will be carried out as follows: half of the grade will come from the evaluation of the theoretical-practical classes. To pass this part it will be necessary to attend the classes, deliver all the complete work guides on the agreed dates (10 in total, one per class) and actively participate in their development of the class. The other half of the qualification will consist of the personal elaboration of a short written work on a topic of your choice, and its subsequent oral presentation in a public class. This work will be developed progressively under supervision and discussion with the teacher throughout the course, following as a model the general steps of a publication of research results. The discussion, correction and presentations will be made in part in the Virtual Classroom of the subject, and in part in face-to-face class.

In case of not attending at least 80% of the classes, in addition to the above, a written exam of all the matter will be carried out in which it will be necessary to recognize fossil material, in addition to answering various theoretical and practical questions related to the contents seen in class.

In addition, seminars will be held in coordination with other subjects, which will be assessed according to the attendance and participation of the student in the discussion. From the seminars carried out, the student will prepare a report in which they show their ability to synthesize and interrelate the concepts discussed and may add up to 1 point to the final grade. Attendance at these seminars will be optional.

	Number of exercises or reports	Percentage of the final grade	Maximum value in the final grade	Minimum value to pass
Work guides	10	50	5	5
Monograph	1	25	2,5	5
Monograph exposition	1	25	2,5	5
Seminaries	2	-	1	-

Evaluation considerations in 1st call

1. All exercises, reports and assignments will be scored on a grade of 10, being considered approved when the minimum value to pass is reached.

2. The subject is considered to have been approved when the sum of the points corresponding to the evaluated aspects is equal to or greater than 5.

Evaluation considerations in 2nd call

In the event that the final score of the evaluated aspects is lower than the minimum points required to eliminate the subject, the student will return to carry out that exercise and/or corresponding reports that have not reached the minimum score to be approved. In any circumstance, the same considerations contemplated in the first call will apply.

REFERENCES

Basic

- Benton, M.J. & Harper, D.A.T. 2009. Introduction to Paleobiology and the fossil record. Wiley-Blackwell, 592 pp.
- Briggs, D.E.G. & Crowther, P.R. (Eds.) 2001. Paleobiology II. Blackwell Sci. Publ. Ltd., Oxford.
- Boardman, R. S., Cheetham, A. H. & Rowell, A. J. (eds.) 1987. Fossil Invertebrates. Blackwell scientific Publications, 713 pp.
- Camacho, H.H. & Longobucco, M.I. 2008. Los invertebrados fósiles. Fundación de Historia Natural Félix de Azara Vázquez Mazzini Editores, Buenos Aires, 2 volúmenes, VI+785 pp.
- Clarkson, E.N.K. 1986. Paleontología de Invertebrados y su evolución. Ed. Paraninfo, Madrid, 357 pp.
- Clarkson, E.N.K. 1998. Invertebrate Palaeontology and Evolution. Fourth Edition. Blackwell Science Ltd., 452 pp.
- Doyle, P. 1996. Understanding Fossils. An Introduction to Invertebrate Palaeontology. John Wiley & Sons, 409 pp.
- Martínez Chacón, M.L. & Rivas, P. (Eds.) 2009. Paleontología de Invertebrados. Sociedad Española de Paleontología-Instituto Geológico y Minero de España-Universidad de Oviedo, 524 pp.
- Raup, D.M. & Stanley, S.M. 1978. Principios de Paleontología. Ed. Ariel, Barcelona.
- Savazzi, E. (Ed.) 1999. Functional morphology of the Invertebrate Skeleton. J. Wiley & Sons Ltd.
- Stearn, C.W. & Carroll, R.L. 1989. Paleontology: the record of life. John Wiley & Sons, 453 pp.
- Stanley, S.M. 1989. Earth and life through time, 2ª ed. W.H. Freeman and company, 689 pp.
- Stanley, S.M. 2009. Earth System History. Third Edition. W.H. Freeman & Company, 551 pp.
- Treatise on Invertebrate Paleontology. Geological Society of America and University of Kansas Press.

Additional

- Brenchley, P.J. & Harper, D.A.T. 1998. Palaeoecology: Ecosystems, environments and evolution. Chapman & Hall, 402 pp.
- Doménech, R. & Martinell, J. (1996). Introducción a los fósiles. Masson, Barcelona 252 pp.
- Fedonkin, M.A., Gehling, J.G., Grey, K., Narbonne, G. M. & Vickers-Rich, P. 2007. The Rise of Animals. Evolution and diversification of the Kingdom Animalia. The Johns Hopkins University Press, Baltimore, 327 pp.
- Lipps, J. H. & Signor, P. W. (eds) 1992. Origin and Early Evolution of the Metazoa. Plenum Press, New York, 570 pp.
- Tasch, P. 1980. Paleobiology of the invertebrates. 2nd edition. John Wiley and Sons, 975 pp.
- Valentine, J.W. 2004. On the Origin of Phyla. University of Chicago Press, Chicago, 614 pp.
- Vargas, P. & Zardoya, R. 2012. El Árbol de la Vida: Sistemática y evolución de los seres vivos. Madrid, 597 pp.