VNIVERSITAT DE VALÈNCIA

Course Guide
36835 Paleontología

COURSE DATA

Data Subject	
Code	36835
Name	Paleontología
Cycle	Grade
ECTS Credits	7.5
Academic year	2024 - 2025

Study (s)

Degree	Center	Acad. year	Period
1106 - Degree in Biology	Faculty of Biological Sciences	2	Annual

Subject-matter

Degree	Subject-matter	Character
1106 - Degree in Biology	13 - Evolución	Obligatory

Coordination

Name	Department
MARTINEZ PEREZ, CARLOS	356 - Botany and Geology
MONTOYA BELLO, PLINIO	356 - Botany and Geology
VALENZUELA RIOS, JOSE IGNACIO	356 - Botany and Geology

SUMMARY

Paleontology is a compulsory subject in grade Biology at the University of Valencia as part of the matter 'Evolution'. Paleontology studies and interprets the history of living beings on Earth through fossils. This relates it directly to the most essential aspect of life: change, which has two faces that are the evolution, in which arise new, and extinction, eliminating the existing forms. Framed within the natural sciences, a discipline that shares principles and methods with Geology and Biology, so that should be considered an important part of both sciences. The course will be taught during the whole academic year of the second course, which will use the knowledge acquired in other subjects Grade Biology.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

1106 - Degree in Biology

- Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Interpret, analyse, evaluate, process and synthesise biological data and information by applying mathematical and statistical methods.
- Apply principles of physics, chemistry and geology to the field of biology.
- Organise, plan and manage information in a manner that allows the individual to analyse, synthesise and develop critical reasoning that can be applied to solve problems, make decisions and carry out work.
- Use scientific language, both oral and written, and be able to adapt the register to the target audience and/or readers. Use the most common foreign languages in each discipline as a vehicle for communication in a globalised system.
- Understand the historical nature of the evolutionary process in terms of unrepeatability, contingency and/or necessity and apply the principles and methods for the interpretation of the fossil record and its use in dating, palaeoenvironmental reconstruction and evolutionary inferences.
- Analyse the evolutionary mechanisms, processes and models at different levels of biological organisation, and understand their relationship with organic and environmental diversity.
- Explain the major events in evolutionary history from the origin of cellular complexity ? including the role of symbiosis ? to present-day diversity ? including that of the human species ? by applying the main models, theories and experimental observations with palaeontological, morphological, archaeological and genetic data.

- To distinguish between scientific and pseudo-scientific explanations in evolution.

- To apply statistical methods in evaluating scientific hypotheses.

- To understand the formation process of a fossil.

- To analyze the biological information contained in the fossil record.

- To understand the historical nature of evolutionary process in its aspects of uniqueness, contingency and/ or need.

- To determine the patterns and processes involved in past biodiversity crises and the implications of their study for the analysis of the current one.

- To understand the concept of species in paleontology and analyze the mechanisms and patterns of speciation from the fossil record.

- To know the major groups of fossil organisms and their stratigraphic ranges, and their use in paleoenvironmental inference and in the construction of the chronostratigraphic standard Framework.

- To identify the evolutionary relationships among major groups of organisms.

- To collect and integrate data from field and laboratory to solve problems in Evolutionary Biology, Biostratigraphy, Palaeoecology and Palaeogeography..

- To understand the importance of preserving the Paleontological Heritage as part of the Natural Heritage.

DESCRIPTION OF CONTENTS

1. Introduction

Concept and types of fossils. Fossils and sedimentary rocks. The fossil record: bias and representativeness. Paleontology and its subdivisions: taphonomy, paleobiology and applied paleontology.

2. History of Paleontology

Classical Antiquity, Middle, Modern and Contemporary Ages Seventeenth and eighteenth centuries: the nterpretation of fossils as remains of past living beings. Nineteenth and twentieth centuries: the great paleontological controversies: fixists vs. evolutionists and gradualists vs. punctuationists. Paleontology and the scientific method.Palaeontology in Spain.

3. Taphonomy.1. Biostratinomy

Taphonomy: definition, objectives and parts. Main biostratinomic processes. Formation and types of fossil assemblages. Criteria for recognition in the fossil record.

4. Taphonomy.2. Fossildiagenesis

Definition and objectives. Fossilization processes: Fossildiagenetic processes: Results and consequences of Fossildiagenesis. Mineralization processes of organic remains. Introduction to exceptional sites or "lagerstätte."

5. Palaeobiology 1. Biology of fossil populations

Basic concepts: interpopulation and intrapopulation differences and their identification in the fossil record. Reconstruction of population dynamics and identification criteria of ancient R-strategy and K-strategy populations. Microevolutionary processes and their study in the fossil record: The case of the Cretaceous ostreid Agerostrea mesenterica and its important evolutionary consequences.

6. Palaeobiology 2. The shape of organisms I

Size and shape: general concepts. Ontogeny in fossils: modes of skeletal growth, description of ontogenetic changes, isometry and allometry. Ontogeny and Phylogeny: heterochrony, causes, consequences, morphological and evolutionary
significance. Growth speeds. Results and directionality of the adaptations, the adaptative landscapes and its evolutionary consequences

7. Palaeobiology 3. The shape of organisms II

Theoretical Morphology: model analysis of coiled shells of invertebrates and their relationship to adaptive landscapes.
Functional morphology. Reconstruction of the functions of the past organisms: the principle of similarity,biomechanical analysis and paradigmatic method. Examples of functional morphology.

8. Palaeobiology 4. Palaeoecology notions

Methods of reconstruction of the lifestyles of past organisms. Environmental parameters and limiting factors in paleoecology and their study in the geological record. Study of fossil communities. Evolutionary paleoecology.

9. Palaeobiology 5. Palaeoclimatology and fósil record

Influence of plate tectonics and climate on the distribution of fossil organisms: climatic gradients.
Reconstruction of past climates: paleobotanical, sedimentological and paleozoological data.
Problems of geographical distribution of organisms in the past: concepts and examples from the fósil record.
Brief description of biogeographic and climatic changes in Earth's history.

10. Palaeobiology 6. Evolutionary Palaeontology

Introduction to macroevolutionary processes: an overview.
The biological species concept and its problems in Palaeontology: time dimension of the species.
Fossil record and speciation: punctuated equilibria and phyletic gradualism, examples of both processes in the geological record.
Background extinctions (Van Valen Law) and mass extinctions.
The rate of organic change: evolutionary rates, types, calculation methods and examples from the fósil record.
Evolutionary trends: phyletic and phylogenetic. Its causes and evolutionary consequences. Natural selection of species. Examples.
Patterns of evolution: evolutionary radiations, ecological displacement, evolutionary convergences, parallelism, ecological replacement and iterative evolution. Its causes, consequences and examples from the fossil record.
General conclusions about evolutionary processes in light of the paleontological record.

11. Applied Palaeontology 1. Stratigraphic Palaeontology

Introduction to the basic concepts for understanding the History of Life on Earth. Basic principles and methods for the chronostratigraphic interpretation of the fossil record. The principle of faunal succession. The collection of data in the field as the basis of all temporal interpretation of the paleontological record. The biostratigraphic event and the biological event. The process of classifying fossils. Definition, identification, characterization and classification of paleontological species. Characterization and organization of stratigraphic units by their paleontological content. Concept of biozone and types of biozones. The process of construction of the world reference time scale: The International chronostratigraphic chart. Reference sections: GSSPs and stratotypes. Stratotypical sections in Spain.

12. Practical sessions: Fossil record knowledge

1. Types of fossils: body fossil, internal and external molds, impressions, casts, tracks.
2. Diploblastic animals: Porifera: Sponges, Archeocyaths and Stromatoporoids.
3. Diploblastic animals: Cnidaria: Rugosa, Tabulata and Scleractinia.
4. Fossils of triploblastic animals. 1. Mollusca. Importance of the fossil record. Gastropoda: Main fossil groups.
5. Fossils of triploblastic animals. 1. Mollusca. Bivalvia: Fossil groups and their diverse ways of life.
6. Fossils of triploblastic animals. 1. Mollusca. Cephalopoda: Main groups: Orthoceratoidea, Nautiloidea and Ammonoidea. Its importance in the fossil record.

7. Fossils of triploblastic animals. 2. Brachiopoda. Convergences with bivalve mollusks and distinction of the shells of both groups. External morphologies and importance of internal characters.
8. Fossils of triploblastic animals: 3. Arthropoda. Study focused on trilobitomorphs and other fossil groups.
9. Fossils of triploblastic animals. 4. Echinodermata. Paleozoic diversity and current diversity. The different fossil groups with special attention to the echinoids.
10, Micropaleontology. Preparation techniques and main groups of microfossils: Protists (Foraminifera, radiolarians, etc.), porifera, arthropods (Ostracods), Conodonts and vertebrates (remains of fish and micromammals).
11 Fossils of triploblastic animals. 5. Vertebrata. Recognition of the different types of vertebrates. Observation of bones and teeth of mammals.
12. Paleoichnology: Ichnites and their geological and paleontological importance. Classification and ichnofacies. Ethological and paleoenvironmental inferences.
13 plant fossils. Recognition of the main groups of plant remains from the Paleozoic and Mesozoic. Recognition of the main ways of preserving plant remains.

13. Fieldwork

Field practice: Methodical observation of the fossil record in different outcrops and elaboration of the geological history of the visited area.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	39,00	100
Laboratory practices	34,00	100
Tutorials	2,00	100
Attendance at events and external activities	5,00	0
Development of group work	8,00	0
Study and independent work	52,00	0
Preparation of evaluation activities	32,50	0
Preparing lectures	10,00	0
Resolution of case studies	5,00	0
TOTAL	**187,50**	

TEACHING METHODOLOGY

-Theoretical classes

-Lab sessions

-Field trip

-Seminar and/or conference

-Oral presentations and/or posters

Interdisciplinary work: conducting and presenting a seminar. The activities of the subject are completed and complemented with the transversal activity "Interdisciplinary Seminars" directly focused on the work on competences. This is a cross-disciplinary activity common to all subjects in the second year of the degree in Biology (Histology, Evolutionary Processes and Mechanisms, Zoology II, Botany II, Biochemistry, Genetics, Paleontology, Developmental Biology, and Biostatistics). It consists of the preparation and presentation, by a working group (3 students), of a seminar, which will consist of a written text and an oral presentation. The activity is compulsory for all students enrolled in the second year, except for those who have done it before. Each working group prepares a seminar on a topic proposed by the teachers of the participating subjects. The assignment of each group to the subjects will be randomly done. Each interdisciplinary work will thus be linked to the corresponding subject resulting from the draw. A tutor will be assigned to each of the projects, who will supervise the completion of the project and supervise its presentation. To this end, a series of regular meetings will be held with the tutor throughout the course. A co-tutor will also be assigned, who will review the final version of the work submitted. Each paper will be presented orally by all members of the group for 30 minutes. The presentation will be attended by all students on the course, as attendance is compulsory, and by two lecturers: the tutor and a second lecturer. Both students and teachers will take part in the presentation.

EVALUATION

The follow-up of the theory will be carried out by taking two eliminatory partial exams (with a grade equal to or greater than 5 out of 10 in both) and a final exam, on the date proposed by the faculty. The grade obtained in the theory will represent the 60% of the final grade.

The practical classes will be evaluated by a final exam that will consist of a visu recognition test of the fossil groups studied and a series of questions about the different groups. The evaluation of the field practice will be carried out on place at the end of the activity through a questionnaire on the main aspects observed during the practice and count for a 20% of the final grade in this practical part. Thus, the whole mark for the labs and fieldwork will count for a 30% of the final grade.

The grade obtained in the interdisciplinary work will account for 10% of the grade for the subject. The tutor and an assistant lecturer (cotutor) will participate in the grading and will take into account both the oral presentation of the work and the written text. In these assessments, the relative weight of the tutor's and co-tutor's marks will be 60% and 40%, respectively. The evaluation of this activity will take into account both the scientific content and the way in which it has been presented, especially the ability to communicate and transmit ideas and concepts. The works selected for presentation at the Biology Congress will receive an extra mark, corresponding to 10% of the mark for the activity.

In the event of failing the course, the grade for the interdisciplinary work will be saved for the following year.

In the event that the interdisciplinary work (of a compulsory nature) is not carried out, this subject will be failed if it is the subject linked to this interdisciplinary work, regardless of the grade obtained in the rest of the subject.

REFERENCES

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