COURSE DATA

DATA SUBJECT

Code: 46753
Name: Palaeodiversity and Plant Evolution
Cycle: Master's Degree
ECTS Credits: 3
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
2266 - Master's Degree in Applied Palaeontology	Facultat de Ciències Biològiques	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2266 - Master's Degree in Applied Palaeontology	Palaeodiversity	ELECTIVES

COORDINATION

ABELLA PEREZ JUAN

SUMMARY

The course **Paleodiversity and Plant Evolution** explores the historical evolution of plants, with special emphasis on the origin and subsequent diversification of the main groups and their interrelationships. As an interdisciplinary subject, taught within the Faculty of Biology and offered by the Department of Geology, it places particular emphasis on the biological and geological aspects of the palaeobotanical approach. This combination makes it possible to establish when the main plant groups originated, when each reached its maximum diversity, and, in some cases, when they became extinct.

Taphonomic aspects and the reconstruction of whole plants from disarticulated remains are also relevant. The course will focus on the following topics: 1) The evolution of the main plant groups; 2) Contributions to biostratigraphy and correlation; 3) Palaeoecology and the evolution of palaeoenvironments through the study of palaeovegetation; and 4) The reconstruction of palaeoclimates from plant fossils.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

no other requirements are needed

COMPETENCES / LEARNING OUTCOMES

2266 - Master's Degree in Applied Palaeontology

Access information tools from other areas of knowledge and use them appropriately.

Access the necessary information in the specific field of the subject (databases, scientific articles, etc.) and have sufficient judgement to interpret and use it.

Apply critical reasoning and argumentation based on rational criteria.

Apply science from a social and economic point of view, promoting the transfer of knowledge to society.

Apply the knowledge acquired and problem-solving abilities in new or unfamiliar situations within broader (or multidisciplinary) contexts related to the field of study.

Apply the research experience acquired to initiate the research phase of a PhD programme on biodiversity-related topics.

Assess the need to complement their scientific, historical, language, IT, literature, social and human ethics education by attending lectures or courses and/or carrying out complementary activities, self-evaluating the contribution that these activities make to their overall education.

Assume an ethical commitment and sensitivity towards environmental problems and natural and cultural heritage.

Communicate and popularise scientific ideas.

Communicate conclusions and the knowledge and rationale supporting them to specialised and non-specialised audiences clearly and unambiguously.

Continue the learning process in a manner that is largely self-directed or independent.

Demonstrate in-depth understanding of the historical nature of the evolutionary process, both in its aspects of unrepeatability and contingency and in those linked to the fulfilment of laws of nature of all kinds and, therefore, of necessity.

Demonstrate intellectual curiosity and encourage responsibility for one's own learning.

Develop experimental skills in the handling of laboratory material and equipment in palaeontology.

Have an in-depth knowledge and understanding of the nature of biodiversity and its ecosystemic relationships both now and in the past.

Have an in-depth knowledge and understanding of the regional geology of Spain and surrounding areas, particularly the Valencian Community, with detailed knowledge of the main palaeontological sites found in

the Iberian Peninsula and North Africa.

Integrate knowledge and confront the complexity of making judgements based on information that, although incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of knowledge and judgements.

Interpret environmental and ecological variables of the past from the study of organism traces in the fossil record.

Know, understand and draw conclusions, applicable to the present time, about the crises of biological diversity, and their causes and consequences within the framework of actualism.

Know and understand past biological events, as well as the zonations, in time and space, of biota in order to establish the relative stratigraphic position of sedimentary rocks from different geographical areas.

Know and understand the palaeodiversity of living beings, their ecosystemic relationships and the palaeogeographical distribution achieved by the main groups of living beings throughout the Earth's history.

Make quick and effective decisions in complex situations in their professional or research work, by developing new and innovative work methodologies adapted to the scientific/research, technological or professional field in which they carry out their activity.

Prepare, write and present reports and projects in public in a clear and coherent manner, defend them with rigour and tolerance and respond satisfactorily to any criticism that may arise from the presentation.

Produce all types of reports related to palaeontological matters clearly and concisely at an official or professional level (reports, grants, heritage impact reports, research projects, etc.)

Skillfully handle the field, laboratory and office techniques for the extraction, preparation, cataloguing, digital reconstruction, study and dissemination of microfossils and macrofossils.

Understand the causes of climate change and the proxies used (diatom studies, foraminifera, tree growth rings, ice cores, current climate data, etc.) to characterise past climates.

Understand the nature of the fossil record in relation to the sedimentary process, the biostratinomic and phosildiagenetic phases of the process and the mechanisms of fossilisation.

Use acquired knowledge as a basis for originality in the development or application of ideas, often in a research context.

Work efficiently in a professional or research team, acquiring the ability to participate in research projects and scientific or technological collaborations.

DESCRIPTION OF CONTENTS

1. General Aspects of Paleobotany
Introduction to Paleobotany. Objectives of Paleobotany. Nature of the fossil plant record. Evolution of terrestrial plant communities through time. Paleoclimatic studies. Brief history of paleobotanical research.

2. Biostratigraphy and Correlation
Types and methods of correlation. Types of stratigraphic units. Types of correlation. Correlation methods. Use of fossils in Geology. Palynology.

3. Taphonomic Concepts in Paleobotany
Plant taphonomy. Necrobiosis: contributions to autoecology. Bioestratinomy: contributions to synecology. Fossildiagenesis: contributions to the anatomy and biochemistry of fossil plants.

4. Primitive Organisms and Environmental Context of the Precambrian
The earliest record of life on Earth. Oxygenation of the Earth. Origin of eukaryotes. The earliest multicellular life. Stromatolites.

5. Paleozoic Flora
General aspects of paleogeographic and floral evolution in the Cambrian. Paleogeography, climate, and sea level in the Ordovician. Life and flora in the Ordovician. Paleogeography and plant life in the Silurian. Terrestrial colonization. Paleogeographic context and Devonian flora. The first forests. Paleogeography and general flora of the Carboniferous. Climate and Permian flora. Evolution of paleoclimatic belts.

6. Mesozoic Flora
Paleogeography, climate, and Triassic flora. Paleogeography, climate, and Jurassic flora. Paleogeography, climate, and Cretaceous flora. The angiosperm explosion.

7. Cenozoic Flora
Paleogeography, climate, and Paleogene flora. Paleogeography, climate, and Neogene flora. Paleogeography, climate, and Quaternary flora.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	12,00
Seminar	2,00
Laboratory	16,00
Total hours	**30,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	0,00
Preparation of lessons	0,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**0,00**

TEACHING METHODOLOGY

The course will be taught through a combination of lectures, theoretical–practical sessions, and complementary activities, designed to integrate the acquisition of conceptual knowledge with the development of applied skills. **Lectures** will mainly follow an expository format and are intended to provide students with the fundamental concepts regarding plant diversity through geological time, its evolution, and the major floristic transitions. **Theoretical–practical** classes will focus on the analysis and discussion of case studies, problem-solving, and direct work with palaeobotanical materials, making use of real specimens whenever possible. This approach will allow students to work with concrete examples of fossil plant remains and reinforce the concepts presented in the lectures.

The delivery of content will follow a **chronological and phylogenetic organization**, providing a solid basis in plant systematics and morphology, which will serve as a starting point for further phylogenetic, palaeoecological, palaeobiogeographical, and evolutionary studies. Course contents will be framed within the evolution of plant palaeodiversity from the Precambrian to the present, with special attention to major radiation and extinction events, as well as to the most significant changes in the composition of terrestrial vegetation. This approach will provide students with the necessary tools to interpret palaeobotanical information in its geological and biological context.

In addition, **case studies** will be presented to illustrate the utility of fossil plant remains for interpreting aspects such as functional morphology, the structure of past ecosystems, plant–animal coevolution, and the response of vegetation to climatic changes over time.

The course will also include a **one-day field trip**, during which students will observe fossil plant remains in situ and discuss their stratigraphic and palaeoenvironmental context. The outcomes of the field and laboratory activities will be recorded in a practical report that will form part of the course assessment.

From the beginning of the semester, each student will carry out an **individual project** on a specific topic related to palaeodiversity and plant evolution. This project will be structured following a methodology based on the scientific research process and will be presented at the end of the semester in a special session through an oral presentation to the group.

EVALUATION

The evaluation of theoretical and practical course contents will be carried out as follows:

• **Individual seminar (70% of the final grade):** Students will prepare a presentation and deliver an oral exposition on a topic related to palaeodiversity and plant evolution, selected in agreement with the teaching staff. The work must include a critical analysis of a problem taxon, with emphasis placed on the use of specialised bibliographic sources and its presentation following a structure similar to that of a scientific publication. The oral presentation will take place at the end of the course in a public session.

• **Laboratory report (20%):** To be submitted at the end of the practical sessions and include answers to the activities carried out during the theoretical–practical classes. Regular attendance and active participation in these sessions will also be considered.

• **Fieldwork report (10%):** To be submitted together with the laboratory report and include a synthesis of observations made during the field trip (fossil material and geological context). Active participation during the activity, as well as comprehension of the contents explained in situ, will be taken into account. Attendance at the field trip is compulsory. This report may be submitted individually or in pairs.

To pass the course, students must obtain a minimum grade of **5 out of 10** in each of the assessment components.

If students fail to attend at least **80% of scheduled classes**, in addition to meeting the above requirements they will be required to take a final written exam. This exam will include theoretical and practical questions on the course contents, as well as the identification and interpretation of palaeobotanical material.

REFERENCES

Basic

- Taylor, T.N., Taylor, E.L., Krings, M. 2009. Paleobotany. The Biology and Evolution of Fossil Plants. Academic Press, 1230 p.
- Halbritter, H., · Ulrich, S., Grímsson, F., · Weber, M.,· Zetter, R., Hesse, M., Buchner, R., · Svojtka, M., Frosch-Radivo, A. 2018. Illustrated Pollen Terminology. Springer Cham, 483 p.
- Martín-Closas C., Gómez, B. 2004. La tafonomía vegetal: una herramienta para la reconstrucción de la vegetación del pasado. Aportaciones recientes en el conocimiento de la historia de la vida: Trabajos del "VI Curso de Paleontología en Cuenca", 45–70.
- One Thousand Plant Transcriptomes Initiative. 2019. One thousand plant transcriptomes and the phylogenomics of green plants. Nature, 574: 679–685.

Complementary

- Boyce, C.K., Lee, J.-E. 2017. Plant Evolution and Climate Over Geological Timescales. Annual Review of Earth and Planetary Sciences, 45: 61–87.
- Gurung, K., Field, K.J., Batterman, S.A., Goddéris, Y., Donnadieu, Y., Porada, P., Taylor, L.L., Mills, B.J. W. 2022. Climate windows of opportunity for plant expansion during the Phanerozoic. Nature

Communications, 13: 4530.
- Moreno Sanz, M. 2003. La colonización de la Tierra por los vegetales. Monografías del Real Jardín Botánico de Córdoba, 11: 11–27.
- Salles, T. Husson, L., Lorcery, M., Boggiani, B.H. 2023. Landscape dynamics and the Phanerozoic diversification of the biosphere. Nature, 624: 115–121.
- Bowles, A.M.C., Williamson, C.J., Williams, T.A., Lenton, T.M., Donoghue, P.C.J. 2023. The origin and early evolution of plants . Trends in Plant Science, 28: 312–329.