COURSE DATA

DATA SUBJECT

Code: 42598
Name: Evolution
Cycle: Master's Degree
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2116 - Master's Degree in Bioinformatics	Escola Tècnica Superior d'Enginyeria	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2116 - Master's Degree in Bioinformatics	Evolution	ELECTIVES

COORDINATION

MOYA SIMARRO ANDRES

SUMMARY

This course aims to familiarize students with the basic principles of evolutionary theory today. This exposes them to the complexity of biological processes and the diversity of shapes, patterns and mechanisms that use different agencies for solving common problems (survival, reproduction, etc..) In different circumstances. It is shown that, despite this huge diversity, evolutionary theory provides a unifying framework without which it is impossible to approach the study of different biological disciplines to reconstruct the history of life.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

None

COMPETENCES / LEARNING OUTCOMES

2116 - Master's Degree in Bioinformatics

Be able to access the information required (databases, scientific articles, etc.) and to interpret and use it sensibly.

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.

Students should possess and understand foundational knowledge that enables original thinking and research in the field.

DESCRIPTION OF CONTENTS

1. Evolutionary theory as an explanation of biological diversity, adaptation and hierarchies of biological organization

Why is it important to the theory of evolution?
Fixation against evolution
Before Darwin
The theory of natural selection
Controversies over Darwinism

2. Analysis of the processes of evolutionary change: the dynamics of genes in populations.

Origin, description and quantification of genetic variability.
Processes of evolutionary change: mutation, migration, selection and drift.
Maintaining the variability and its cost.
Heritability and evolution of multigenic traits.

The evolution at the molecular level.
Neutral theory.

3. Molecular evolution: genes and genomes as records of evolutionary change.

The evolution at the molecular level.
Adaptation at the molecular level.
The genome as the unit of evolution.
Compared evolution of genomes.

4. Study of the emergence of new species: genetic basis of speciation.

Species concepts.
Isolation mechanisms.
Biogeographic patterns in speciation.
Genetic differentiation along speciation.
Rates of speciation.

5. Phylogenetic reconstruction of the evolutionary process

Introduction to the evolutionary hypothesis: the questions
The tree of life
The evolutionary hypothesis: the answers
Schools classification: evolutionary, phenetic and cladistic
The design of the Blind Watchmaker: evidence, convergences and historical errors

6. Development and evolution

Punctuated equilibrium and phyletic gradualism.
Microevolution and macroevolution.
The necessity and the limits of the adaptationist program.
Units and levels of selection.
Evolutionary conflict.
The origin of the body patterns.
Homeotic mutations and Hox genes.
The origin of evolutionary novelties.

Evolution of major taxa.
Origin and evolution of Precambrian life.
The phylogenetic tree of metazoan radiation.
Paleozoic life.
The origin of tetrapods.
Terrestrial life animal: the origin and diversification of the amniotes.
Cenozoic Life: The Age of Mammals.
The road from primates to the human origins

7. Human Evolution

Evolution of major taxa.
Origin and evolution of Precambrian life.
The phylogenetic tree of metazoan radiation.
Paleozoic life.
Hominid evolution

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Total hours	**30,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	8,00
Individual or group project	4,00
Independent study and work	78,00
Preparation of lessons	0,00
Preparation for assessment activities	12,00
Resolution of case studies	20,00
Total hours	**122,00**

TEACHING METHODOLOGY

Tasks training of the teaching-learning environment interaction in the classroom through expository sessions. Previous assignments include preparation (information search, reading texts supplied by teachers), teaching sessions themselves and the later work of deepening.

• Learning by case study analysis, through which it is acquiring skills on different aspects of materials and subjects

• Cross-disciplinary skills. Include attendance at courses, conferences or round tables organized by the CEC of the Master and / or conduct of a bibliographic work on issues that contribute to the integral. It produces a report of activities.

EVALUATION

In the two calls:

SE1 Continuous assessment: 20.
SE2 Activities: 50
SE4 Exams: 30.

REFERENCES

- Freeman, S., and Herron, J.C. 2007. Evolutionary analysis. 4th edition. Prentice Hall. Versión en castellano: 2002. Análisis evolutivo. Prentice Hall, Madrid.
- Referencia c1: Barton N.H., Briggs, D.E.G., Eisen, J.A., Goldstein, D. B., and Patel, N.H. 2007. Evolution. CSHL Press.
- Referencia c2: Fontdevila, A., y Moya, A. 2004. Evolución. Editorial Síntesis, Madrid.
- Referencia c3: Futuyma, D.J. 2009. Evolution. 2nd edition. Sinauer.
- Referencia c4: Stearns, S.C., y Hoekstra, R.F. 2005. Evolution: An introduction. 2nd edition. Oxford UniversityPress, Oxford.
- Referencia c5 Majerus, M., Amos, W. y Hurst, G. 1996. Evolution. The four billion year war. Longman.
- Regerencia c6 Ridley, M. 2004. Evolution. 3rd edition. Blackwell.
- Referencia c7 Smith, J.M. 1997. Evolutionary Genetics. 2ª edición. Oxford Univ. Press.
- Referencia c8 Moya, S. 2009. Pensar desde la ciencia. Trotta. Madrid
- Referencia c9 Moya, A. 2010. Evolución. Puente entre dos culturas. Laetoli. Pamplona.
- Referencia c10 Moya, A. 2011. Naturaleza y futuro del hombre. Síntesis. Madrid.
- Referencia c11 Moya, A y Peretó, J. 2012. Simbiosis. Seres que evolucionan juntos. Síntesis. Madrid