

Development Biology

Code: 100783
ECTS Credits: 6

Degree	Type	Year	Semester
2500250 Biology	OT	4	2

Contact

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Use of Languages

Principal working language: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Teachers

Joaquim Martí Clúa Martí Clua
Andros Maldonado Linares
Berta Nieves Vazquez Prat
Aurora Ruiz-Herrera Moreno
Ignasi Roig Navarro

Prerequisites

- There are no official prerequisites. However, it is assumed that the student has assimilated the learning skills of "Cell Biology".
- To access to study "Histology" the student must have passed the safety test. This can be found in the virtual campus.

Objectives and Contextualisation

It is a course fourth year, optional, developed the fundamentals of cellular processes that lead to the formation of an animal from the fertilized egg. It has been designed assuming students have basic knowledge of Histology him to achieve an integrated vision of the origin and development of the animal organism until it manifests its structure or adult is able to lead an independent life.

Finally, note that "Developmental Biology" is a theoretical and practical course. This makes it possible to continually interacting theoretical concepts and practical sessions

Objectives:

1. To understand the physiological characteristics of the animal gametes that allow fertilization and the subsequent viability of the zygote.
2. To know, in terms of cell biology, the diversity of mechanisms involved in the embryonic development of the animals.
3. To distinguish the main morphogenetic processes and their chronology embryo.
4. To know the main items of the experimental embryology and to study its experimental models.

5. To acquire the integrated concept of the establishment of the embryonic body plan.
6. Understand the principles of the embryonic organogenesis in a morpho-functional context.
7. To know the genesis and biological significance of the various embryonic annexes.
8. To identify, at the light microscopic level, the successive stages of embryonic development of various animals.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Analyse and interpret the development, growth and biological cycles of living beings.
- Be able to analyse and synthesise
- Be able to organise and plan.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

Learning Outcomes

1. Analyse a situation and identify its points for improvement.
2. Be able to analyse and synthesise.
3. Be able to organise and plan.
4. Critically analyse the principles, values and procedures that govern the exercise of the profession.
5. Describe the cellular bases for embryo development.
6. Explain the processes of cell division, migration, differentiation and death.
7. Identify microscopically development stages of animal embryos.
8. Propose new methods or well-founded alternative solutions.
9. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
10. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
11. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
12. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
13. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
14. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
15. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

Content

Contents are the following:

LECTURES SESSIONS

I. INTRODUCTION TO ANIMAL DEVELOPMENT

Chapter 1. The development of living beings.

II. BEGINNING A NEW ORGANISM

Chapter 2. Spermatozoa.

Chapter 3. Egg.

Chapter 4. Egg membranes.

Chapter 5. Fertilization and zygote.

III CELLULAR DIVERSITY

Chapter 6. Mechanisms of embryonic development.

Chapter 7. Cleavage.

Chapter 8. Gastrulation.

IV MODELS OF EMBRYOGENESIS

Chapter 9. Early development of echinoderms.

Chapter 10. Predetermination of the amphibian body axis.

Chapter 11. Amphibian's cleavage.

Chapter 12. Amphibian gastrulation.

Chapter 13. Regulation in amphibians.

Chapter 14. Early fish development.

Chapter 15. Cleavage in birds.

Chapter 16. Gastrulation in birds.

Chapter 17. Regulation in birds.

Chapter 18. Cleavage in mammals.

Chapter 19. Gastrulation in mammals.

V. ORGANOGENESIS

Chapter 20. Neurulation.

Chapter 21. Body folding in amniotes.

Chapter 22. Development of the neural tube.

Chapter 23. Neural crest derivatives.

Chapter 24. Development of the mesoderm.

Chapter 25. Endoderm derivatives.

VI. ORGANOGENESIS

Chapter 26. Embryonic attached cells in amniotes.

Chapter 27. Chorion and amnion of birds.

Chapter 28. Allantoids of birds.

Chapter 29. Embryonic attached cells in mammalian.

Chapter 30. Allantoids of birds.

Chapter 31. Placenta.

PRACTICAL SESSIONS

Session 1. Microscopic analysis of the fertilization and early embryonic development in invertebrates.

Session 2. Microscopic analysis of the embryonic development in amphibians.

Session 3. Microscopic analysis of the early development and neurulation in birds.

Session 4. Microscopic analysis of the organogenesis and embryonic attachments in amniotes.

Methodology

The contents of "Developmental Biology" include theory, seminars and talks lessons.

Theory lessons

The program theory is taught in 36 classes. They will be done using audiovisual material, which will be at the disposition of the students in the Virtual Campus.

Seminars

There are 3 seminars. They are designed so that the students work in small groups, and acquire skills of teamwork and critical reasoning. The students were divided into groups of 4 to 6 people.

The organization of the groups and the distribution of topics to be discussed will take place during the first class. In the seminars, some groups of students must submit in writing the proposed topic the teacher. The same groups of students orally present the issue to the rest of the class with the resources available in the classroom. The literature will be included in the Virtual Campus. The seminars attendance is mandatory.

Individual coaching sessions

Individual coaching sessions will take place in a personalized way in the professor room. These sessions should be used to clarify concepts and to establish the acquired knowledge. They can also take advantage to resolve questions that students have about the preparation of seminars.

Practical sessions

The practical sessions will be done in small groups of students (about 20 per session) in the laboratory. They are designed to complement theoretical training.

The main goal of these sessions is to microscopic diagnosis and individual delivery of questionnaires. The practical sessions also include to do a dossier with the microscopic observations carried out. The practical sessions attendance is mandatory.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical sessions	12	0.48	7, 2, 3
Seminars	3	0.12	5, 2, 3
Theory lessons	36	1.44	5, 6
Type: Supervised			
Custom tutorials	5	0.2	5, 6
Type: Autonomous			
Preparation of seminars	25	1	5, 6, 2, 3
Resolution of practical seminars	2.5	0.1	7, 2, 3
Study	60	2.4	5, 6, 2, 3

Assessment

Evaluation

The evaluation of the course will be continued through individual test that assess individual learning by students from theory lessons, seminars and practical sessions.

Evaluations activities planned in the course of "Developmental Biology" are the following:

Exams: two partial exams. Each test will be worth 70% of the final grade. Exams will be multiple choice questions 25 with two options and only one correct (part A), and 25 with three options and only one correct (part B). A correction value will be subtracted 1/2 and 1/3 per wrong answer for each question in part A and B, respectively. To pass this part of the course, students must achieve a minimum of 4 points (from 0 to 10) in each partial exam. Whether this minimum is not achieved, students must do a final full or partial exam.

Seminars: They will be worth 10% of the final grade as follows:

- i) 50% for the written work (this work will be assessed by the professor).
- ii) 20% for the oral presentation of the collective work (this work will be assessed by the professor).
- iii) 15% for the intra-group evaluation
- iv) 15% for the inter-group evaluation

The attendance at seminars is mandatory. If a student do not attend any of the seminar sessions, because not justified, there will be a penalty in the final grade of the seminars.

- i) Absence to 1 session = discount of 20% of the grade.
- ii) Absence to 1 session = discount of 40% of the grade.
- iii) Absence to 1 session = discount of 80% of the grade.

Practical sessions: They will be worth 20% of the final grade as follows:

- i) Evaluation of the contents at the end of each practical session (50% of the grade). This test consist of a set of questions as well as recognition of microscopic structures. The final grade of this section is obtained from the average of the grades obtained in each practical session. The attendance at the practical sessions is mandatory. If a student do not attend any of the practical session, because not justified, the grade will be zero.
- ii) Test of microscopic diagnostic (50% of the grade). This test will consist in the diagnosis of microscopic structures proposed along the course. To be able to weigh the notes obtained in each section, it will be essential that students get a rating equal to or greater than 4 points (out of 10) in each one of them. Students who have received a final grade lower than 5 (of 10) required to write an examination of recovery, which will consist of a microscopic diagnosis test and a questionnaire.

Attendance to practical sessions (or field trips) is mandatory. Students missing more than 20% of programmed sessions will be graded as "No Avaluable".

Successful completion of the course

To pass the course, the following two requirements must be met:

1. To obtain at least 5 out of 10 in the overall calculation of the written tests of theory and seminars.
2. To obtain at least 5 points out of 10 in the practices.

The presentation of the student to any recovery exam (theory and / or practice) entails the waiver previously obtained qualification.

To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course or module. Thus, the student will be graded as "No Avaluable" if the weighthin of all conducted evaluation activities is less than 67% of the final score.

Repeaters

Repeaters do not need to repeat the written tests, seminars or practices if the student had previously obtained a minimum of five in any of these tests. This exemption will be maintained fora period of three additional registrations.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exams	Weight 70%	5	0.2	14, 4, 1, 5, 6, 8, 13, 12, 9, 10, 2, 3
Practical sessions	Weight 20%	1	0.04	5, 6, 7, 13, 12, 9, 10, 2, 3
Seminars	Weight 10%	0.5	0.02	15, 5, 6, 11, 2, 3

Bibliography

BOOKS

Balinsky, B.I.: Introducción a la Embriología (ed. Omega).

Carlson, B.M.: Embriología Básica de Patten (ed. Interamericana- McGraw Hill).

Carlson, B.M.: Embriología Humana y Biología del Desarrollo (ed. Harcourt).

Eynard, A.R. y col.: Histología y Embriología del ser humano (ed. Panamericana).

Gilbert, S.F.: Biología del Desarrollo (ed. Panamericana).

Müller, W.A.: Developmental Biology (ed. Springer).

Sadler, T.W.: Langman Embriología médica. Con orientación clínica (ed. Panamericana).

Slack, J.M.W.: Essential Developmental Biology. (ed. Blackwell).

Wolpert, L. y col.: Principios del Desarrollo (ed. Panamericana).

ATLASES

Freeman, W.H. & Bracegirdle, B.: Atlas de embriología (ed. Paraninfo).

Schoenwolf, G.C.: Laboratory studies of vertebrate and invertebrate embryos (ed. Prentice Hall).

Schoenwolf, G.C. and Mathews, W.W.: Atlas of descriptive embryology (ed. Pearson Education, Inc.).

On line material:

<https://www.vcbio.science.ru.nl/en/virtuallessons/embryology/>

Software

No specific programme is needed.