

**Developmental Biology and Teratology**

Code: 101890  
ECTS Credits: 6

Degree	Type	Year	Semester
2501230 Biomedical Sciences	OB	2	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

### Contact

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### Use of Languages

Principal working language: catalan (cat)  
Some groups entirely in English: No  
Some groups entirely in Catalan: Yes  
Some groups entirely in Spanish: No

### Other comments on languages

Una part de l'assignatura és realitzarà en anglès

### Teachers

Michael John Edel  
Keyvan Torabi Asensio

### Prerequisites

It is highly advisable that students know the embryology content of Human Anatomy subjects, as well as the bases of cell biology and genetics of the subjects: Genetics, Cell Biology, Molecular Biology of the Cell and Human Genetics. The teaching of the subject Biology of development and Teratology is organized on the basis that the students must have learned a series of previous concepts of these subjects.

It is recommended that students have sufficient knowledge of English as many of the sources of information in developmental biology and teratogenesis are in this language

### Objectives and Contextualisation

Biology of Development and Teratology is a compulsory subject of 6 ECTS where teaching activities are developed with the aim that students know, understand and learn:

- the genetic, cellular and embryological bases of normal and abnormal development,
- the processes and mechanisms of the normal development of the organs and systems of the human body, at a deeper and more specific level than that achieved in other subjects of the first two courses (see Prerequisites), in which the level is more basic.
- the processes and mechanisms involved in the genesis of congenital defects (teratogenesis)

- the bases of experimental embryology and the main experimental models

On the other hand, the subject Biology of development and Teratogeny is complemented with a practical training in the laboratory in the subject Laboratory 2 and is related to the subjects Medical Genetics (third course) and Genetics and Reproduction (optional).

## Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Display knowledge of the bases and elements applicable to the development and validation of diagnostic and therapeutic techniques.
- Display knowledge of the concepts and language of biomedical sciences in order to follow biomedical literature correctly.
- Display theoretical and practical knowledge of the major molecular and cellular bases of human and animal pathologies.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Read and critically analyse original and review papers on biomedical issues and assess and choose the appropriate methodological descriptions for biomedical laboratory research work.
- 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.
- Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

## Learning Outcomes

1. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
2. Contrast the techniques and methods that allow genetic diagnosis.
3. Correctly use the terminology of genetics and its text and reference books
4. Design methodologies for the experimental study of genetic diseases.
5. Discern the principal morphogenetic processes and their chronology, and understand the significance of possible alterations to these.
6. Identify chromosome variants and anomalies, understand the mechanisms that originate them and determine the risk of their transmission to descendants.
7. Identify the genetic bases of human development.
8. Identify the genetic bases of the principal diseases with a genetic base or component.
9. Interpret genetically the diagnosis, prognosis, prevention and therapy for the most frequent genetic pathologies in the human population.
10. Interpret scientific publications and solve problems and typical cases in the area of cytogenetics.
11. Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
12. Recognise the anomalies of human chromosomes and assess their consequences.

13. Relate genetic dysfunction to the pathological phenotype.
14. 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.
15. 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.
16. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
17. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
18. 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.
19. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
20. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
21. Understand scientific texts on genetics and development, and write review papers on them.
22. Understand the principal experimental techniques in embryology and teratology and their use in basic and applied research.
23. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

## Content

### BLOCK 1.- GENERAL ASPECTS OF THE DEVELOPMENT BIOLOGY AND TERATOGENY:

- 1) Concepts, history and scientific-professional fields of application
- 2) Normal development in the human
  - a) Preparation for pregnancy:
    - i) Gametogenesis
    - ii) Preparation of the female genital tract for pregnancy
    - iii) Gamete transport and fertilization
  - b) Prenatal development: Human embryonic and fetal periods:
    - i) Segmentation of the zygote: properties of development during segmentation
    - ii) Transport and Implantation of the blastocyst. ectopic pregnancy
    - iii) Formation of the bilaminar embryonic disc, the amniotic, vitelline and chorionic sacs, of the extraembryonic mesoderm and the chorion
    - iv) Gastrulation: formation of the trilaminar embryonic disc. Derivatives of the germinal layers.
    - v) Embryonic organogenesis
    - vi) Fetal period.
    - vii) Estimation of the degree of development and gestational age.
  - c) Postnatal development: breastfeeding, childhood, adolescence, initial adulthood.
  - d) Development of the placenta and fetal adnexal membranes
  - e) Cell biology and development genetics:

- i) Cell differentiation and control of gene expression
- ii) Proliferation and cell death
- iii) Cell adhesion and Morphogenesis
- iv) Genes of control of embryonic development. Gene families
- v) HOX genes and genes with Homeobox. Normal functions and associated pathologies
- vi) Growth factors and associated pathologies
- vii) WNT family and BMP. associated pathologies
- viii) Hedgehog Genes. associated pathologies
- ix) Genetic control of the formation pattern. Gastrulation
- x) Biology and molecular genetics of the early stages of development
- xi) Establishment of the embryo body plan
- xii) Neurulation
- xiii) Somitogenesis. Segmentation clock
- xiv) Differentiation of muscle cells
- f) Embryology of multiple gestations and associated congenital pathologies.
- 3) Abnormal development in humans:
  - a) Concept of physical congenital defects (FCD) and congenital anomaly. Incidence and health repercussions.
  - b) FCDs: Classification:
    - i) According to severity: FCD higher and lower
    - ii) According to the pathogenesis: Primary and secondary FCDs: deformation; disruption; malformation and dysplasia
    - iii) According to clinical presentation. Simple and multiple FCDs: syndrome; association and sequence.
  - c) Teratogenicity:
    - d) Factors and teratogenic agents.
      - (1) Genetic factors: Microduplications and chromosomal microdeletions. epigenetics and developmental alterations.
      - (2) Environmental factors: Basic principles in teratogenesis. Pathogenesis of congenital malformations.
      - (3) Multifactorial inheritance
    - ii) Epidemiology of congenital defects
- 4) Experimental embryology.
  - a) Principles of experimental embryology
  - b) Study techniques.

5) Comparative embryology: Biological bases and experimental animal models. EVO-DEVO

BLOCK 2.- MOLECULAR, CELLULAR, TISSUE, GENETIC AND EMBRYOLOGICAL BASES OF THE NORMAL DEVELOPMENT AND THE PHYSICAL CONGENITAL DEFECTS OF THE APPARATUS AND SYSTEMS IN THE HUMAN.

- 1) Normal and anomalous development of integuments
- 2) Normal and abnormal development of the trunk: parietal elements and cavities
- 3) Normal and abnormal development of the limbs
- 4) Normal and abnormal development of the pharyngeal apparatus and the craniofacial massif
- 5) Normal and abnormal development of the nervous system, the neural crest and the sense organs
- 6) Normal and abnormal development of the circulatory system and blood cells
- 7) Normal and abnormal development of the digestive and respiratory systems
- 8) Normal and abnormal development of the urinary and genital apparatus
- 9) Chromosomal syndromes
- 10) Development mechanisms involved in cancer and regeneration

## Methodology

Theoretical classes: They are programmed so that the students acquire the scientific knowledge related to the general aspects of the normal development in the human and, more specifically, with the molecular, tissular, genetic and embryological bases of the normal development and malformations

Classroom practices: The topics 1.3.ci.1, 1.5 and 2.10 are dealt with in classroom practices. In addition there will be classroom practices dedicated to the preparation, presentation and discussion of scientific articles related to the subject.

Virtual learning: Some aspects of the sections treated in the theoretical classes and classroom practices, must be obtained from teaching material provided through the virtual campus of the UAB.

Work in groups: Work teams consisting of three or four students, must do the critical analysis of scientific articles related to development biology and / or teratogenesis, submit a written report (abstract in Catalan, Spanish and English) and do them an oral presentation in public.

In any of the above-mentioned training activities, students are encouraged to learn autonomous learning, with which they must essentially complete their training.

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			
Classroom practices	9	0.36	22, 21, 2, 4, 9, 10, 12, 23
Lectures	36	1.44	2, 5, 8, 7, 6, 9, 12, 13, 3

Type: Supervised

Face-to-face and virtual tutors	5	0.2	22, 21, 2, 4, 5, 8, 7, 6, 9, 10, 12, 13, 23, 3
virtual Lectures	10	0.4	22, 21, 2, 4, 5, 8, 7, 6, 9, 10, 12, 13, 3
Type: Autonomous			
Documentation search	5	0.2	22, 21, 10, 23, 3
Reading of texts	10	0.4	21, 10, 23, 3
Study	58	2.32	22, 21, 2, 4, 5, 8, 7, 6, 9, 10, 12, 13, 3
work production	12	0.48	22, 21, 2, 4, 5, 8, 7, 6, 9, 10, 12, 13, 23, 3

## Assessment

Continued evaluation:

1. Monitoring assessments: Along the course, the students will do evaluation exams or short works, related to the subject. The value of the average grade obtained in the follow-up assessments will represent 25% of the final mark.

2. Assessment of teamwork: It will represent 15% of the final mark. The qualification obtained can be modified individually if it is considered that the participation in the work of the group is much lower than expected. If a student does not attend the public presentation of the work, they will be qualified with half of the score obtained by the team. Those students who register for the second or more times on the subject and have carried out the activity in previous courses, having obtained a qualification equal or superior to 5 (in scale of 0-10 points), will be exempt to realize the activity in the current course where it will be applied the previously obtained mark. However, this exemption can be waived by participating in the activity of the current course, knowing that by calculating the final grade, the work mark corresponding to the last participation in the activity will be applied. This exemption will remain as long as the regulations have not changed.

3. Partial evaluations: Two objective tests are scheduled, each of which will include all the contents of each Block. They will consist of individual test exams with five options and one valid (penalization of 0.25 points for each incorrect answer). The mark of each test will represent 30% of the global mark of the subject.

4. Recovery exam: In order to participate in the recovery, the students must have been previously evaluated in a series of activities whose weight equals to a minimum of two thirds of the global grade of the subject or module. Recovery of each one of the partial evaluations will be carried out, with the same weighting as in the previous ones. In this exam can also participate the students who wish to improve their qualification, either to obtain the grade of sufficiency or to improve the previously obtained mark. In any case, the marks obtained in the recovery exam will only be applied when they represent an improvement of the qualification obtained previously.

Sufficiency mark: The sufficiency in the subject will be obtained with a weighted grade equal to or greater than 5 (scale 0-10). In order to make the weighted sum of all the marks included in the continuous assessment of the subject, it will be necessary to obtain a note greater than or equal to 4 in each partial evaluation. In the event that this requirement is not met, the final mark may not be greater than 4 points (scale 0-10)

Synthesis Test: From the second registration, students will be able to opt for an examination of the totality of the subject of the subject instead of the exam of recovery of the continuous evaluation. The mark achieved the synthesis test will represent up to 85% of the final mark and the remaining 15% will correspond to the qualification achieved in team work. The mark that results from the weighted sum of these two grades will be the final mark of the subject.

Not evaluable: Students will obtain the "Non-Valuable" qualification when the evaluation activities carried out have a weighting of less than 67% in the final grade.

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assessment of teamwork	15%	1	0.04	1, 20, 19, 21, 2, 4, 5, 8, 7, 6, 9, 10, 11, 16, 14, 15, 12, 13, 23, 3
Partial evaluations	60%	3	0.12	22, 21, 2, 4, 5, 8, 7, 6, 9, 10, 18, 17, 12, 13, 3
continued evaluation	25%	1	0.04	22, 21, 2, 4, 5, 8, 7, 6, 9, 10, 12, 13, 3

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## Software

For the development of the subject is enough with the Microsoft Office pack.