VNIVERSITAT DE VALÈNCIA

Course Guide
33071 Development biology

COURSE DATA

Data Subject	
Code	33071
Name	Development biology
Cycle	Grade
ECTS Credits	4.5
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
1100 - Degree in Biology	Faculty of Biological Sciences	2	Second term

Subject-matter

Degree	Subject-matter	Character
1100 - Degree in Biology	8 - Development biology	Obligatory

Coordination

Name	Department
TARIN FOLGADO, JUAN JOSE	23 - Functional Biology and Physical Anthropology

SUMMARY

The compulsory course entitled “Developmental Biology” is taught in the second semester of the second year of the Degree in Biology. This course aims that undergraduate students reach a comparative vision of gametogenesis, fertilization and embryonic and postnatal development of different groups of metazoans. Various animal models of morphogenesis, specification of embryonic axes, organogenesis, migration of primordial germ cells, primary and secondary sex determination, limb development, and tissue regeneration are analyzed. Likewise, special mention is made of the role that programmed cell death plays in animal development.

Thus, this course collects, rethinks, expands and questions previous knowledge acquired by students about the genesis of new organisms.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1100 - Degree in Biology

- Capacidad de obtención, análisis y síntesis de la información.
- Utilización del vocabulario de Biología del Desarrollo.
- Capacidad de resolución de problemas y toma de decisiones.
- Habilidad para el trabajo en equipo.
- Análisis crítico de textos científicos.
- Aprendizaje autónomo y creatividad.
- Valoración de las implicaciones éticas de los conocimientos sobre Biología del Desarrollo.
- Conocer las estrategias metodológicas más relevantes, para el estudio de la Biología del desarrollo.
- Conocer y comprender los procesos, interacciones y cambios temporales/espaciales que rigen el desarrollo de los organismos, en los distintos niveles de organización.
- Conocer y comprender los procesos celulares y moleculares de renovación y reparación tisular.
- Conocer los procesos del desarrollo embrionario de los principales organismos modelo en Biología del Desarrollo.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

• Ability for independent learning and problem solving.

• Understanding of the scientific method applied in Biology. To integrate knowledge previously acquired.

• Ability to critically argue using rational criteria on topics related with human development.

• Ability for analysis, synthesis and discussion of scientific literature.

• Ability for collaborating with teachers and peers.

• Ability for efficient oral and writing communication.

DESCRIPTION OF CONTENTS

1. Theoretical issues I

1.- Definition, objectives, origins and evolution of the basic concepts of Developmental Biology.

2.- Comparative overview of animal gametogenesis. Differences and similarities between male and female gametogenesis. Spermatogenesis and oogenesis in amniotes, anamniotes and insects.

3.- Comparative overview of animal fertilization. Differences and similarities across the animal kingdom in the events taking place before and after sperm entry.

4.- Development of a multicellular organism. The cell cycle during cleavage stages. Patterns and mechanisms of segmentation in echinoderms, amphibians, mammals, birds and insects.

5.- Gastrulation patterns. Main types of movements of gastrulation and formation of germ layers. Gastrulation in echinoderms, amphibians, mammals, birds and insects.

6.- Mechanisms of cell differentiation and morphogenesis. Control of differentiation at transcriptional-posttranscriptional and translational-posttranslational level. Mechanisms of cell specification: autonomous, conditional and syncytial. Morphogenesis and cell adhesion: differential cell affinity; cadherins and cell adhesion. Epithelial-mesemchymal transition. Cell migration.

7.- Proximal cellular interactions. Cascades of induction: sequential and reciprocal inductions. Instructive and permissive interactions. Epithelial-mesenchymal interactions: regional and genetic specificity. Mechanisms of inductive interactions: juxtacrine and paracrine interactions.

2. Theoretical issues II

8.- Specification of the embryonic axes. Specification of the antero-posterior, dorso-ventral, and left-right axis in amphibians. Speciation of the antero-posterior axis in Drosophila and mammals..

9.- Organogenesis I. Anatomical, histological and cellular differentiation of ectoderm: mechanisms of neurulation and differentiation of neural tube.

10.- Organogenesis II. Anatomical, histological and cellular differentiation of endoderm and paraxial, intermediate and lateral-plate mesoderm: digestive tube and its descendants, somites and their descendants, urogenital apparatus, circulatory system and hematopoiesis.

11.- Migration of primordial germ cells in mammals. Determination of primordial germ cells: specification by germ plasm or cell interactions. Primary and secondary sex determination.

12.- Development of a limb pattern in tetrapods: generation of buds and the anterior-posterior proximal-distal and dorsal-ventral axes of limbs. Development of limbs in Drosophila.

13.- Mechanisms of tissue regeneration in animals: stem cell mediated regeneration, epimorphosis, morphallaxis and compensatory regeneration.

14.- Role of programmed cell death in development: sculpting / shaping of structures; removal of structures; regulation of cell number; elimination of abnormal and / or potentially dangerous cells. Role of caspases in cell differentiation and stimulation of proliferation, wound healing and tissue regeneration.

3. List of laboratory exercices

1- Male and female gametogenesis in insects, fish and mammals.
2- Gastrulation and larval histogenesis in amphibians.
3- Fertilization and embryo development in sea urchins.
4.- Histogenesis in avian embryos during organogenesis.
5.- Histogenesis of cerebellum and spinal cord in mammals.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	8,00	100
Tutorials	7,00	100
Attendance at events and external activities	3,00	0
Development of group work	15,00	0
Readings supplementary material	3,00	0
Preparation of evaluation activities	24,00	0
Preparing lectures	24,00	0
Preparation of practical classes and problem	8,00	0
TOTAL	**122,00**	

TEACHING METHODOLOGY

The acquisition of knowledge and skills by the students is based on five types of activities:

Theoretical classes: The teacher will present the essential contents of each topic, using the appropriate audiovisual resources, guiding students in the use of bibliographic material, as well as the discussion of problems raised in the classroom.

Practical classes: During the laboratory sessions, the teacher will present the objective and the guidelines of each laboratory exercise. Thereafter, the student will observe, analyze and interpret the respective histological slides.

Regulated tutorials: Dedicated to expanding different parts of the theory program to delve into the contents that, due to time constraints, cannot be covered in theory classes.

Personal tutorials:

Students' individual doubts will be clarified using the time assigned by the University regulations. Optionally, at the discretion of each teacher, tutorials may be interactive and/or on-line.

Interdisciplinary works: These will be performed by 2-3 students on topics related with any of the courses taught in the second year of undergraduate studies. The number of topics will be proportional to the number of hours taught in each course. Each literature review will be orally exposed in classroom sessions. The best reviews will be presented in a meeting organized by the Faculty of Biology. Alternatively to this activity, other interdisciplinary activities, framed within a project of educational innovation supported by the CAT may be performed.

EVALUATION

In proportion to the ETCS allocated to each activity, the theory will represent 80% of the total mark, requiring a score of 5.00 out of 10.00 to pass the course. The laboratory exercises account for 10% of the final mark, with the same constraint of the theoretical evaluation. That is, the two parts (theory and laboratory exercises) will be evaluated independently and it will be necessary to have passed each of the two parts to pass the course. The interdisciplinary work will represent the remaining 10% of the final mark.

There will be two partial theory exams, (test type) using the computer resources of the Virtual Classroom. Each of these exams will evaluate approximately half of the theory syllabus. The final mark for the two exams will be obtained by calculating the arithmetic mean of the mark obtained in the two partial exams, regardless of the mark obtained in each of them. Students who do not take one or both partial theory exams may take the entire syllabus at the first official call of the Faculty. Both the students who take the two partial theory exams, as well as those students who take the entire theory syllabus in the first official call of the Faculty, who do not achieve a minimum mark of 5.00, will have to take the exam of the entire theory syllabus in the second official call of the Faculty.

There will be a test-type practice exam, which will coincide with the day and time of the second partial exam of theory. Those students, who, for unjustified reasons, do not take this practical exam, may do so at the first official call of the Faculty. However, if in any of the two previous circumstances, students do not reach a minimum mark of 5.00, they will have to take the practical exam in the second official call of the Faculty. The qualification obtained in the practical exam, in the event of a student passes this exam, but fails in theory, will remain valid during the current academic year. The mark will not be kept in successive academic courses.

In the event of not passing the complete course (theory and practices, each one separately), the mark of the interdisciplinary work will be saved for the following year.

REFERENCES

Basic

- Barresi, M.J.F and Gilbert, S.F. (2021). Developmental Biology. 12th ed. Sinauer Associated, Inc.
- Tarín, J.J., Cano, A. (2000). Fertilization in Protozoa and Metazoan Animals. Cellular and Molecular Aspects. Springer.

Additional

- Aeckerle N, Drummer C, Debowski K, Viebahn C, Behr R. Primordial germ cell development in the marmoset monkey as revealed by pluripotency factor expression: suggestion of a novel model of embryonic germ cell translocation. Mol Hum Reprod. 2015 Jan;21(1):66-80. doi: 10.1093/molehr/gau088. Epub 2014 Sep 18. Erratum in: Mol Hum Reprod. 2015 Jun;21(6):552.
- Callebaut M. Origin, fate, and function of the components of the avian germ disc region and early blastoderm: role of ooplasmic determinants. Dev Dyn. 2005 Aug;233(4):1194-216.
- Kaneda T, Motoki JY. Gastrulation and pre-gastrulation morphogenesis, inductions, and gene expression: similarities and dissimilarities between urodelean and anuran embryos. Dev Biol. 2012 Sep 1;369(1):1-18. doi: 10.1016/j.ydbio.2012.05.019.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

1. Content

In the assumption that the health situation, which we are suffering since the beginning of 2020, modifies classroom attendance during the course and, therefore, the theoretical and/or practical teaching must be adapted to the blended modality or, even, on-line modality, all the contents of the Teaching Guide will be maintained, independently of whether the teaching modality is blended, or fully on-line.

2. Volume of work and teaching schedule

Independently of whether the teaching modality were blended or fully on-line, the weight of the different activities that add the hours of dedication in ECTS credits marked in the original Docent Guide will be kept.

If the modality of teaching were blended, the timetables (days and hours) of the regular tutoring, laboratory practices and theory sessions will be kept. The groups of students enrolled will be subdivided into two semigroups to cut classroom attendance in half. The attendance of the students to classrooms will be carried out in alternate weeks.

Independently of whether the teaching modality were either fully on-line or blended, in the sessions of regular tutorials and laboratory practice, students will have fully freedom to carry out the activities assigned according to their own programming.

3. Teaching methodology

Independently of whether the teaching modality were blended or fully on-line:

(1) Theoretical classes will be developed with the support of digital cameras in the classrooms or teachers' offices to telematically broadcast the classes using the computer resources offered by the Virtual Classroom.

(2) Laboratory practice and regulated tutoring sessions will be based on the study and analysis of images and videos that will be provided to students, as well as links to WEB pages from universities or institutions of recognized academic prestige.

(3) The personal tutoring sessions will be on-line using the computer resources offered by the Virtual Classroom.

4. Evaluation

All the partial theory and laboratory practice exams will be carried out by means of objective tests (multiple choice) using the resources of the Virtual Classroom, as specified in the Teaching Guide.

5. Bibliography

The bibliography recommended in the Teaching Guide is not modified.

Due to the changing evolution of the pandemic, the specific details of the adaptation of teaching to the different health situations that may occur will be communicated through the Aula Virtual.