COURSE DATA

Data Subject	
Code	33071
Name	Development biology
Cycle	Grade
ECTS Credits	4.5
Academic year	2017 - 2018

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 given on the second four-month period of the second year of the Biology Degree. This course aims that undergraduate students understand the morphogenesis processes taking place during animal development. In order to reach this aim, paradigms of interaction, dynamic and regulatory processes involved in differentiation will be analyzed. In addition, the mechanisms that keep the differentiate state during adulthood, such as renovation, aging and cellular death will be stressed. Thus, this course will join together and will redefine knowledge previously learned by students under a genesis and developmental point of view.

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. 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.- Genetic, environmental and epigenetic causes of aging. Role of programmed cell death in development.

3. List of laboratory exercices

1.- Fertilization and embryo development in sea urchins.
2.- Male and female gametogenesis in insects, fish and mammals.
3.- Gastrulation and larval histogenesis in amphibians.
4.- Histogenesis in avian embryos during organogenesis.
5.- Cerebellar histogenesis 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	5,00	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	**112,00**	

TEACHING METHODOLOGY

The activities used for students to acquire knowledge and abilities are as follow:

Theory sessions: The teacher will introduce the essential contents of each subject matter using proper audiovisual resources. Previously, the teacher will provide students with guidelines and references of the theory sessions through the virtual classroom and bibliography section.

Laboratory exercises sessions: During the 2-hour laboratory sessions, the teacher will introduce the aim and the guidelines of each laboratory exercise. Thereafter, the student will apply the recommended methodology in order for them to collect data and perform their analysis and interpretation.

Group and individual tutorial sessions: Devoted to the discussion and expansion of different parts of the program to deepen into the content of the course or debate topics directly related with the theory and/or laboratory sessions or current issues of social or scientific interest. In addition, 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.

Inter-course literature reviews: 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 mark obtained will represent the 10% of the final mark in each of the second-year courses. The best reviews will be presented in a meeting organized by the Faculty of Biology. Alternatively to this activity, it can make other interdisciplinary activity of a project of educational innovation supported by the CAT.

EVALUATION

It will collect the assessment of the activities of students, such as attendance at all classroom activities, completion and submission of all the works performed, and the degree of participation and involvement in all processes. In proportion to the ETCS for each activity, the theory will represent 80% of the total mark, requiring indispensably achieve a rating of 5 out of 10 to pass the course. The laboratory exercises account for 10% of the final mark, with the same constraint of the theoretical evaluation. The two parts (theory and practice) will be assessed separately in each one of the two official calls. However, students may choose freely to be examined of the entire syllabus of theory in the first call (May-June), or perform an eliminatory partial exam of about the first half of the syllabus of theory at midway of the second quarter; and another exam of the second half of the syllabus that will always coincide with the official date of the first call (May-June). In the case of performing partial exams, the final note of theory will be calculated as the average of the two partial exams, regardless of the mark obtained in each of them. Students who do not pass the theory in the first official call (May-June) will be examined of the entire syllabus of theory in the second official call (June to July). If the student does not pass the whole subject syllabus in the first and second call, the mark of the interdisciplinary work will be kept in the next academic year. As indicated in the previous section, the mark of the interdisciplinary work will represent the 10% of the final mark.

REFERENCES

Basic

- Gilbert, S.F. and Barresi, M.J.F. (2016). Developmental Biology. 11th 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.