VNIVERSITAT DE VALÈNCIA

Course Guide
33152 Development genetics

COURSE DATA

Data Subject	
Code	33152
Name	Development genetics
Cycle	Grade
ECTS Credits	4.5
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1109 - Degree in Biochemistry and Biomedical Sciences	Faculty of Biological Sciences	3	Second term

Subject-matter

Degree	Subject-matter	Character
1109 - Degree in Biochemistry and Biomedical Sciences	12 - Biomedicina molecular	Obligatory

Coordination

Name	Department
ARTERO ALLEPUZ, RUBEN DARIO	194 - Genetics
PEREZ ALONSO, MANUEL	194 - Genetics

SUMMARY

The subject "Genetics of Development" is taught in second semester of the third year of the Degree in Biochemistry and Biomedical Sciences. This is a compulsory subject, with subjects Genomics, Developmental Genetics, Human Genetics, Genetics and Cytogenetics, Genetic Analysis Techniques and Genetic Engineering aims in order to provide students with the basic knowledge about biological inheritance and the conceptual and methodological tools which enable it to carry out, in their professional work, tasks related to genetic analysis and clinical genetics.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

OUTCOMES

1101 - Degree in Biochemistry and Biomedical Sciences

- Comprensión de los mecanismos moleculares básicos que controlan los procesos de división, proliferación celular, diferenciación celular, apoptosis y senescencia.
- Comprensión de los mecanismos moleculares y celulares que controlan el desarrollo de los organismos.
- Comprensión de las bases celulares y moleculares del establecimiento de patrones de destino celular y la morfogénesis.
- Conocimiento de las bases moleculares del cáncer.
- Comprensión de los procesos de renovación y reparación tisular a nivel celular y molecular.
- Conocimiento de los organismos modelo fundamentales en el estudio del ciclo celular, diferenciación y desarrollo.
- Conocimiento de la conservación de procesos esenciales en el control de la división celular, diferenciación celular y desarrollo.
- Conocimiento del método científico. Desarrollo de la capacidad de entender y razonar la base experimental del conocimiento.
- Comprensión y manejo de los sistemas experimentales y métodos utilizados en la investigación de las materias de estudio.
- Capacidad para la organización de la información (esquemas, diagramas, mapas conceptuales) y la preparación de exposiciones públicas.
- Capacidad de aprendizaje autónomo.
- Conocimiento y manejo de diversas fuentes de información.

LEARNING OUTCOMES

Understanding the molecular and cellular mechanisms that control the development of organisms.
Understanding the cellular and molecular basis of establishing patterns of cell fate and morphogenesis.
Knowledge of the molecular basis of cancer.
Knowledge of key model organisms to study the development
Knowledge of conservation of essential processes in development control
Knowledge of the scientific method. Developing the ability to understand and reason the experimental basis of knowledge.

Understanding and management of test systems and methods used in the investigation of the subject matter.
Ability to organize information (schematics, diagrams, concept maps) and the preparation of public exhibitions.
Autonomous learning ability.
Knowledge and use of various sources of information.
Ability to argue from rational criteria, clearly differentiating what is debatable to what they are made or accepted scientific evidence.
Ability to interact with both the teacher and with peers.
Ability to build a comprehensive text written and organized.
Training. In this aspect, since the subject is to develop in students the ability to propose experiments to the modeling of human genetic diseases and the use of these models for identifying potential new drugs.

DESCRIPTION OF CONTENTS

1. The development of the organisms as a genetic program

Inheritance and development. Stability of genetic information. Differentiation and determination. Concept of positional information. Establishment of body patterns.

2. Model organisms in Developmental Genetics

Drosophila melanogaster, Xenopus, Caenorhabditis elegans and mouse. Other models in the study of the animal and plant development

3. Gene regulation in cell differentiation

Proteins determine the phenotypic characteristics of cells. Genes as responsable for the control of differentiation. Totipotency: studies in plants and amphibians. Differential gene expression.

4. Genetic analysis of the development

Fundamentals of the analysis of mutants. Mutant isolation protocols. Maternal and zygotic effect mutations. Transposon tagging. Mutational analysis of segmentation in Drosophila. Somatic genetics.

5. Genetic tools for studying cell lineage relationships

The paradigm of C. elegans. Experimental embryology. Genetic methods of labeling. Mosaic gynandromorphs and mitotic recombination. Autonomy versus cell interactions. The development of the Drosophila compound eye.

6. Molecular genetic analysis

Mutations and molecular mapping of transcripts. Methods for ectopic gene expression: production of dominant phenotypes. Molecular analysis of gene interactions: molecular epistasis studies. Functional significance of protein-DNA interactions and protein-protein

7. Molecular and cellular analysis of differential gene expression

In situ hybridization and immunohistochemistry. Northern blot and Western blot. Reporter gene and the enhancer trap. Utility of transgenic organisms in the analysis of regulatory elements: gene fusions.

8. Maternal genome contribution to embryonic development

Oogenesis. Determining the axial coordinate. The anteroposterior axis and dorsoventral axis. Protein gradients and positional information. Specification of the anteroposterior axis: the paradigm of gene bicoid.

9. Zygotic genome activation

Embryogenesis and larval development: the blastoderm fate maps of Drosophila. Segmentation genes: expression patterns and gene functions. Preparation of the anteroposterior axis: compartments and parasegmentos. Molecular analysis of the segmentation: molecular epistasis. Hierarchies of gene regulation. Interaction between the maternal genome and zygotic genome. Specification of tissues: elaboration of dorsoventral axis.

10. Diversification of gene expression patterns

Homeotic genes and the homeobox. Gene complexes that control the body plan of insects: the bithorax complex and Antennapedia Complex. Selector genes and effector genes. Evolutionary conservation of homeotic genes: Hox complexes in vertebrates. Homeotic genes in plants. Homeosis and evolution.

11. Developmental Genetics in the context of biomedical research

The use of animal models in the understanding of disease pathways. Biomedical research and biopharmaceutical reseach. The translation of knowledge in Biomedicine and collaboration with biotech industry. From the understanding of the biological basis of disease to the discovery of therapeutic targets, drug disvovery and biopharmaceutical development.

12. A practical case of the aplication of Developmental Genetics in translational biomedical

The discovery of genes relevant for the development of disease. From the implication of one gene in a pathophysiological pathway to the creation of a disease model. From mutant phenotypes to the understanding of disease. Developmental Genetics tools in drug discovery. Preclinical development of drugs.

13. LABORATORY PRACTICAL CLASSES

Practice 1: Study of mutations affecting the pattern of larval cuticle of Drosophila.

Practice 2: Detection of genes regulated during Drosophila development by the enhancer trap technique: description of embryonic expression patterns.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	32,00	100
Laboratory practices	10,00	100
Tutorials	3,00	100
Study and independent work	67,50	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

The development of the subject, as to-face work, is divided into:

Theory classes: Three weekly sessions of theory classes one hour for 9 weeks. In these sessions is to present and analyze the basic concepts of the subject with a special interest in highlighting the practical aspects of the same. It is highly recommended prior reading of the issues. A total of 27 sessions required 1 hour of presentation of topics by the teacher.

Hands-on labs: 5 sessions of two hours each. Attendance at these sessions is mandatory.

Group mentoring: The student will be encouraged to utilize this resource for advice and discuss any topic with the teacher about the program, the subject, or career. A total of 3 hours have been allocated for these tutorials.

Seminars, conferences and other activities: 3 hours for participation in activities, which will serve to allow students to expand their knowledge on the subject and relate with other disciplines, and promote the acquisition of competences other than those acquired in the theoretical and practical classes.

One of these activities (1.5 hours) will consist in critical analysis of scientific papers selected by the teachers of the subject. This activity aims at training the student in the reading of scientific papers (which necessarily involves reading technical English), bringing him/her closer to the original literature and to

new insights that enable the development and advancement of biomedical sciences. This activity is mandatory, will be organized jointly with the other subjects in their third year, corresponding to the Genetics of Development a total of 3 articles. The preparation, presentation and discussion (30 minutes) of the topics are held in groups of 2 students and supervised by the teacher through the tutorials.

EVALUATION

The subject will be assessed using the following breakdown:

A written test of theory, consisting of a single test, consisting of theoretical issues (80% of final grade). Assessment of practical activities developed, considering the care and use of laboratory sessions. Similarly, there will be a Practical Examination will match on the same date the theory exam. Overall, the Practice Note represents 15% of the final grade.

Evaluation based on participation and involvement in seminars. To evaluate the activity of critical analysis of scientific papers will consider the following evaluation criteria: knowledge and understanding of the information contained in the articles, correct use of terminology and speaking skills. You can also valued integration with other theoretical and practical content of this or other subjects of the grade. We could get a maximum score of 10 points, 5 points still needed to overcome this activity. The mark obtained will represent 5% of the final grade for the course. If the student does not reach the minimum score required, suspend the subject in which the fishery. Likewise, the participation of other students in the presentation and discussion sessions may be taken into account by the teacher to modulate the final of the subject.

Other considerations:

Attendance at the labs and seminars is mandatory.

The final score is the sum of the grades achieved in each of the sections.

To pass the course will be necessary to obtain an overall rating higher than 5 out of 10.

Exceptionally, for those students who obtain a note of Practice less than 5, and have suspended the theory, or vice versa, will keep the note passed to the second round of the same academic year and a maximum during the next academic year

REFERENCES

Basic

- Para la Teoría:

ALBERTS, B., A. JOHNSON, J. LEWIS, M. RAFF, K. ROBERTS, P. WALTER (2007). Molecular Biology of the Cell, 5ª edición. Garland Science (New York), pp. 1728.

GILBERT, S.F (2003). Developmental Biology, 8ª edición. Sinauer Associates (Sunderland), pp. 751. Referencia online:
Developmental Biology Online (8ª edición) http://8e.devbio.com/

GRIFFITHS, A.J.F., J.H. MILLER, D.T. SUZUKI, R.C. LEWONTIN y W.M. GELBART (2002). Genética, 7ª edición. McGraw-Hill - Interamericana, pp. 860.

Para las Prácticas de Laboratorio

ASHBURNER, M. (1989). Drosophila: a laboratory handbook. Cold Spring Harbor Laboratory Press (New York), pp. 1331.

ASHBURNER, M. (1989). Drosophila: a laboratory manual. Cold Spring Harbor Laboratory Press (New York), pp. 434.

CAMPOS-ORTEGA, J.A. y V. HARTENSTEIN (1985). The embryonic development of Drosophila melanogaster. Springer-Verlag (Berlin), pp. 227.

STERN, C.D. y P.W.H. HOLLAND (1993). Essential Developmental Biology: A Practical Approach. IRL Press (Oxford), pp. 333.

Additional

- BATE, M. y MARTINEZ-ARIAS (1993). The Development of Drosophila melanogaster, vols. I y II. Cold Spring Harbor Laboratory Press (New York), pp. 1564.

LAWRENCE, P.A. (1992). The Making of a Fly: the genetics of animal design. Blackwell Scientific Publications (Oxford), pp. 228.

MARTÍNEZ-ARIAS, A. Y A. STEWART (2002). Molecular Principles of Animal Development. Oxford University Press, pp. 410.

MOODY, S.A. (2007). Principles of Developmental Genetics. Academic Press (San Diego), pp. 1104.

WILKINS, A.S. (1992). Genetic Analysis of Animal Development, 2ª edición. John Wiley and Sons

(New York), pp. 566.

Recursos informáticos:

Aula Virtual: Genética del Desarrollo

Páginas web:

Developmental Biology Online (8ª edición):
http://8e.devbio.com/

Martinez Arias & Stewart: Molecular Principles of Animal Development Online:
http://www.oup.com/uk/orc/bin/9780198792840/resources/images/

Molecular Biology of The Cell Online:
http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=mboc4

Scitable (Nature)
http://www.nature.com/scitable/topics