Teaching guide

IDENTIFICATION DETAILS

Degree:	Biomedicine
Scope	Biology and Genetics
Faculty/School:	Experimental Sciences
Course:	MOLECULAR AND DEVELOPMENTAL GENETICS
Type:	Compulsory
ECTS credits:	5
Year:	2
Code:	2142
Teaching period:	Third semester
Subject:	Genetics
Module:	Biochemistry and Molecular Biology
Teaching type:	Classroom-based
Language:	Spanish
Total number of student study hours:	125

SUBJECT DESCRIPTION

The subject of Molecular and Developmental Genetics will study the structure of genetic material and the molecular mechanisms of its replication and expression, both in prokaryotic cells and in eukaryotic organisms, as well as the main routes of gene signaling during development. Scientific articles related to the theoretical and practical contents of the subject will also be analyzed, interpreted and discussed.

The subject of Molecular and Developmental Genetics is a mandatory biannual subject taught in the second year of the Degree in Biomedicine. This course is integrated into the Biochemistry and Molecular Biology module, whose educational objective is: to give a complete overview of the structure and function of biomolecules essential for cellular organization and the metabolic processes necessary for the growth and development of all living organisms.

Just as in Classical Genetics you can talk about a starting point with the principles established by Mendel, in Molecular Genetics it is difficult to talk about a single starting point, since although DNA was discovered by Miescher in 1869 and the transformation by Griffith in 1928, the two were not related until in 1944 Avery demonstrated that the transforming principle is DNA. In 1953 Watson and Crick suggested a structure for DNA in the form of a dextrogyratory double helix, this date can be symbolically considered as the birth of Molecular Genetics. From then until now, the accumulation of information on the structure and function of genes, both in prokaryotic and eukaryotic organisms, has been constant and is to be expected to remain so in the near future.

The subject of Molecular and Developmental Genetics is a basic and completely necessary subject, since it provides students with essential knowledge about the structure and function of genetic material so that they can subsequently approach and understand the rest of the subjects of the Degree in Biomedicine.

GOAL

The subject of Molecular and Developmental Genetics aims to enable students to know and understand the structure of genetic material and the molecular mechanisms of its duplication and expression, both in prokaryotic cells and in eukaryotic organisms.

The specific aims of the subject are:

Understand the molecular characteristics of genetic material and how they relate to its functional properties.

Know and understand the mechanisms of gene expression and the processes that regulate this expression.

Know and understand experimental techniques commonly used in the field of Molecular Genetics.

Encourage the capacity for analysis, interpretation and discussion of scientific articles related to the theoretical and practical contents of the subject.

PRIOR KNOWLEDGE

The student who accesses the subject should have a solid background in cell biology, biochemistry and genetics in order to understand the subject and allow for adequate development.

COURSE SYLLABUS

THEORETICAL SYLLABUS
INTRODUCTION Introduction to the subject. Objectives and learning outcomes of the subject. Teaching Guide. Work plan.
SECTION I. REPLICATION AND REPAIR
TOPIC 1. Replication in prokaryotes.

TOPIC 2. Replication in eukaryotes.
TOPIC 3. DNA repair.
SECTION II. TRANSCRIPTION AND PROCESSING OF mRNA
TOPIC 4. Transcription in prokaryotes
TOPIC 5. Transcription in eukaryotes
TOPIC 6. RNA processing.
SECTION III. TRANSLATION
TOPIC 7. Translation of mRNA
TOPIC 8. Regulatory RNAs.
PRACTICAL SYLLABUS
PRACTICE 1. Tertiary structure of DNA. Analysis of DNA topoisomers. Topoisomerase I and topoisomerase II activity.
PRACTICE 2. Regulation of the E. coli PBAD promoter.

EDUCATION ACTIVITIES

Expository classes: They will consist of master classes given by the teacher in which the contents of the subject are presented. These classes will be supported by computer presentations that will be available to the student through the subject's website. In each academic year, one or two relevant researchers from fields related to the subject may be invited to give a master class related to their research.
Seminars: At the end of the topics, students will be asked, through the subject's website, to solve different tasks related to the contents studied in that topic (solving questions, carrying out tests, solving practical cases, analyzing articles or scientific news, etc...). The teacher will tutor this work through ordinary teaching sessions and individual or group tutoring.
Practical classes: In these classes, students will carry out experimental work in the teaching laboratory applying techniques and knowledge related to the subject. In advance, the student will have the internship script and all the necessary independent study material for the proper use of their stay in the laboratory.
Tutoring: Through tutoring, the teacher, at the request of the student and at the established time for this purpose, will answer questions, or discuss the questions posed to him by the student, in order to guide him in learning the subject.

DISTRIBUTION OF WORK TIME

TEACHER-LED TRAINING ACTIVITIES	INDIVIDUAL WORK
50 Horas	75 Horas

LEARNING RESULTS

Learn about cytogenetic and molecular diagnostic techniques, understanding the interpretation of the results they provide.

Know the basic morphological, metabolic, physiological and genetic characteristics of both prokaryotic and eukaryotic living organisms, taking into account their morphological and functional unit.

Identify the main components of the organization of a gene and of the human genome, including the elements that control gene expression.

SPECIFIC LEARNING RESULTS

RA 1. Identify the key experiments in establishing the dogma of Molecular Biology.

RA2. Describe the mechanisms of DNA replication and repair in prokaryotic and eukaryotic organisms.

RA3. Describe the mechanisms of prokaryotic and eukaryotic DNA transcription and RNA maturation.

RA4. Describe the mechanisms of RNA translation and the rules of the genetic code in prokaryotes and eukaryotes.

RA5. Describe the different levels of regulation of gene expression in prokaryotes and eukaryotes.

RA6. Relate the regulation of gene expression to the gene organization of the genome.

RA7. Describe the epigenetic processes that regulate gene expression.

RA8. Know the basic research techniques used in Molecular Genetics both from a theoretical and practical point of view.

RA9. Appropriately interpret the results obtained in the laboratory and draw conclusions.

RA11. Solve problems and case studies based on the knowledge obtained.

LEARNING APPRAISAL SYSTEM

In the continuous evaluation system, each student's learning will be evaluated using objective data from:
ORDINARY CALL

Evaluation of the theoretical content of the subject (70%): The exams will have as their main objective to verify that the basic concepts presented in the theoretical classes have been assimilated and understood, as well as the students' reasoning ability to solve questions characteristic of the subject. The exams will consist of test-type questions and/or short questions, and problems (learning outcomes RA1 - RA8, RA10 and RA11 will be evaluated).
Realization and resolution of exercises and practical cases (20%): The resolution of questions, tests, resolution of practical cases, analysis of articles or scientific news, etc... presented to students will be evaluated, at the end of each of the topics (learning results RA1 - RA8, R10 and RA11 will be evaluated).
Performing practical work in the laboratory (10%): ATTENDANCE AT INTERNSHIPS WILL BE MANDATORY AND ESSENTIAL TO PASS THE SUBJECT. The way in which the student performs in the laboratory, the ability to solve experimental problems, the interpretation of research results (laboratory notebook and/or questions) and behavior during the development of the practices will be evaluated (the learning results RA8 - RA10 will be

evaluated).

In order to average the different parts, it is essential to obtain a score higher than 5 in the theory exam, in carrying out and solving exercises and practical cases and in the practical work of the laboratory. If any of these parts are suspended in the ordinary call, only these parts will be evaluated in the extraordinary call, since the note of the approved parts will be saved for the extraordinary call (not saved for subsequent enrollment).
EXTRAORDINARY CALL

Theory exam (70%): Like the theory exams in the ordinary call, this test will consist of test-type questions and/or short questions, and problems, to assess the student's acquisition of the competencies included in the teaching guide (learning results RA1 - RA10, RA12 and RA13 will be evaluated).
Carrying out and solving exercises and practical cases (20%): If this part is suspended, an exam will be carried out with questions, analysis of practical cases or analysis of articles or scientific news (learning results RA1 - RA10, RA13 will be evaluated).
Practical laboratory work (10%): Students who have completed the internships and have failed them must pass a specific test to pass the subject in this call, the learning results (RA8 - RA10, RA13) will be evaluated.

To be able to average the different parts, it is essential to obtain a score higher than 5 in the theory exam, in solving tasks and in the practical work of the laboratory. The note of the approved parties will not be saved for subsequent enrollment.
Students who enroll in the subject for the second or successive time, and students with academic exemption, SHOULD CONTACT THE TEACHER IN THE FIRST WEEK OF THE SEMESTER to find out about the evaluation criteria specific to their case.
Plagiarism, as well as the use of illegitimate means in evaluation tests, will be sanctioned in accordance with those established in the Evaluation Regulations and the University's Coexistence Regulations.

ETHICAL AND RESPONSIBLE USE OF ARTIFICIAL INTELLIGENCE

1.- The use of any Artificial Intelligence (AI) system or service shall be determined by the lecturer, and may only be used in the manner and under the conditions indicated by them. In all cases, its use must comply with the following principles:
a) The use of AI systems or services must be accompanied by critical reflection on the part of the student regarding their impact and/or limitations in the development of the assigned task or project.
b) The selection of AI systems or services must be justified, explaining their advantages over other tools or methods of obtaining information. The chosen model and the version of AI used must be described in as much detail as possible.
c) The student must appropriately cite the use of AI systems or services, specifying the parts of the work where they were used and describing the creative process followed. The use of citation formats and usage examples may be consulted on the Library website(https://www.ufv.es/gestion-de-la-informacion_biblioteca/).
d) The results obtained through AI systems or services must always be verified. As the author, the student is responsible for their work and for the legitimacy of the sources used.
2.- In all cases, the use of AI systems or services must always respect the principles of responsible and ethical use upheld by the university, as outlined in the Guide for the Responsible Use of Artificial Intelligence in Studies at UFV. Additionally, the lecturer may request other types of individual commitments from the student when deemed necessary.
3.- Without prejudice to the above, in cases of doubt regarding the ethical and responsible use of any AI system or service, the lecturer may require an oral presentation of any assignment or partial submission. This oral evaluation shall take precedence over any other form of assessment outlined in the Teaching Guide. In this oral defense, the student must demonstrate knowledge of the subject, justify their decisions, and explain the development of their work.

BIBLIOGRAPHY AND OTHER RESOURCES

Basic

Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick. Lewin's Genes XII/12th ed. Burlington (Massachusetts): Jones and Bartlett Learning, 2018.

Brown, Terry A. Genomes 4/4th ed. New York; London: Garland Science, 2018.

James D. Watson... [et al.]. Molecular biology of the gene/7th ed. San Francisco: Pearson, 2013.

Additional

John Wilson, Tim Hunt. Molecular Biology of the CellThe Problems Book./6th ed. Garland Science, 2014.
(John Wilson, Tim Hunt. Molecular Biology of the CellThe Problems Book./6th ed. Garland Science, 2014. , ||Jeremy W. Dale, Malcolm von Schantz and Nick Plant. From Genes to Genomes: Concepts and Applications of DNA Technology/3rd. ed. Oxford: Wiley and Sons, 2011.)

Bruce Alberts... [et al.]; with problems by John Wilson, Tim Hunt. Molecular biology of the cell/6th ed. New York: W.W. Norton & Company, 2015.
(Bruce Alberts... [et al.]; with problems by John Wilson, Tim Hunt. Molecular biology of the cell/6th ed. New York: W.W. Norton & Company, 2015. , ||Benjamin A. Pierce. Genetics: a conceptual approach/7th ed. New York: Macmillan Learning, 2020.)