Teaching guide

IDENTIFICATION DETAILS

Degree:	Biotechnology
Scope	Biology and Genetics
Faculty/School:	Experimental Sciences
Course:	GENETICALLY MODIFIED ORGANISMS
Type:	Compulsory
ECTS credits:	6
Year:	4
Code:	2042
Teaching period:	Seventh semester
Subject:	Applied Biotechnology
Module:	Biotechnological Processes and Products
Teaching type:	Classroom-based
Language:	Spanish
Total number of student study hours:	150

SUBJECT DESCRIPTION

The course of Genetically Modified Organisms, taught in the seventh semester of the Degree in Biotechnology, focuses on the study of the various strategies for generating genetically modified plant and animal organisms, both in vitro and in vivo and their possible applications to various biological problems.

The generation of genetically modified organisms (both plant and animal in nature) is today one of the tools with the greatest impact in the area of Biotechnology both for its applications at the level of generation of products of interest and for its use as a tool for the study of a multitude of biological processes and pathologies. The generation of plant organisms capable of generating products with some quality of interest over natural variants for man, the generation of animal organisms carrying genetic mutations that are key to the onset and development of diseases... are examples of the scope of this discipline within the area of Biotechnology.

In line with what was written in the previous paragraph, the subject of Genetically Modified Organisms aims to provide students with the knowledge necessary for the generation, through various genetic modification strategies, of complete organisms (both plant and animal) to obtain natural products of human interest and the study of biological processes and various pathologies.

GOAL

The objective of the course Genetically Modified Organisms is to provide students with knowledge related to techniques for manipulating the genome of plant and animal organisms applied to the resolution of various problems such as the generation of products of interest, organisms with desired properties, studies of the role of genes in the body's vital processes, etc.

The specific aims of the subject are:

Learn about the various possible techniques for manipulating the genome of plant organisms.

Understand the different possible applications of genome manipulation techniques depending on the different needs of each case.

Learn about the biology of the mouse as a genetically modified animal model and what makes it ideal for transgenesis and similar studies.

Assimilate the different techniques for manipulating the mouse genome and know how to apply them according to the needs of each study.

PRIOR KNOWLEDGE

Students who study the subject of Genetically Modified Organisms and wish to obtain optimal use of it must have solid knowledge of the bases and tools of Recombinant DNA Technology, as well as Molecular Genetics, Plant and Animal Physiology and Cell Biology.

COURSE SYLLABUS

First Part: Plant organisms.
Topic 1: Introduction to plant transgenesis.
Theme 2: Plant transformation systems.
Topic 3: Transgene expression.
Topic 4: Transient transgene expression.
Topic 5: Introduction to the applications of plant transgenesis.
Second Part: Animal organisms.
Theme 6. Genetic modification models in mice.
Topic 7: General characteristics of Mus musculus as an animal model.
Topic 8. Transgenic mouse models.
Topic 9. Mouse knock-out models using classical homologous recombination.

Topic 10. Mouse knock-in models using classical homologous recombination.
Topic 11. Mouse models generated using CRISPR/Cas9.

EDUCATION ACTIVITIES

The classes in the subject of Genetically Modified Organisms will make use of various methodologies in order to achieve the proposed objectives. The various teaching activities will consist of:
AF1. Participatory exhibition class.
AF2: Practical classes: exercises, case studies
AF3: Carrying out individual/group bibliography/laboratory work
AF4: Seminars, round tables, workshops, tutorials, debates, etc.
THE TEACHERS OF THE SUBJECT DO NOT AUTHORIZE THE PUBLICATION BY THE STUDENT OF THE MATERIAL PROVIDED BY THE TEACHERS OF THE SUBJECT IN THE VIRTUAL CLASSROOM, OR BY ANY OTHER MEANS

DISTRIBUTION OF WORK TIME

TEACHER-LED TRAINING ACTIVITIES	INDIVIDUAL WORK
60 Horas	90 Horas

SKILLS

Basic Skills

Students must have demonstrated knowledge and understanding in an area of study that is founded on general secondary education. Moreover, the area of study is typically at a level that includes certain aspects implying knowledge at the forefront of its field of study, albeit supported by advanced textbooks

Students must be able to apply their knowledge to their work or vocation in a professional manner and possess skills that can typically be demonstrated by coming up with and sustaining arguments and solving problems within their field of study.

Students must have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgments that include reflections on pertinent social, scientific or ethical issues

Students must be able to convey information, ideas, problems and solutions to both an expert and non-expert audience

Students must have developed the learning skills needed to undertake further study with a high degree of independence

To acquire firm theoretical, practical, technological and humanistic training needed to develop professional activity.

To be familiar with the applications of biotechnology in the healthcare, food, agrobiotechnological, environmental

and chemical fields.

To understand the social, economic and environmental implications of professional activity.

To understand the ethical implications of professional and personal activity.

Capacity for teamwork and group management.

To have acquired the ability for analytical, synthetic, reflective, critical, theoretical and practical thought.

Capacity for problem-solving and decision-making.

To foster a concern for knowledge as a key tool in the personal and professional growth process of a student.

To recognize the mutual influence existing between science, society and technological development in order to strive for a sustainable future.

To develop capacity for and a commitment to learning and personal development.

To develop an ability to search for, take in, analyze, sum up and relate information.

To be familiar with the basic principles and theories of human and experimental sciences.

To develop oral and written communication skills.

To acquire the skills needed for experimental work: design, preparation, the compilation of results and the obtainment of conclusions, understanding the limitations of an experimental approach.

To acquire the molecular biology and biochemistry knowledge needed to develop biotechnological processes and products.

General Skills

To acquire firm theoretical, practical, technological and humanistic training needed to develop professional activity.

To be familiar with the applications of biotechnology in the healthcare, food, agrobiotechnological, environmental and chemical fields.

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Specific skills

To know the methods for obtaining genetically modified organisms as the basis of animal experimentation and their relevance for the diagnosis and treatment of pathologies.

To know the methodology of gene transfer in plants and its biotechnological application.

Understand and know how to apply genetic and omic technologies to the plant world.

Develop habits of rigorous thinking.

Ability to communicate the knowledge acquired orally and in writing.

Know how to work as a team in an effective and coordinated way.

Analyze and synthesize the main ideas and contents of all types of texts; discover the theses contained in them and the issues they raise, and critically judge their form and content.

Cultivate an attitude of intellectual concern and the search for truth in all areas of life.

LEARNING RESULTS

Adequately conceptualize the possible strategies for the transformation of plant organisms applied to particular cases and taking into account their practical needs.

Recognize the elements involved in the transient or stable expression of transgenes in plant organisms.

Design transgenesis strategies to obtain products of interest in plant organisms.

Adequately conceptualize the various strategies for transforming the Mus musculus genome with their corresponding advantages and disadvantages.

Design murine models (Mus musculus) for the purpose of studying biological/pathological processes.

Describe in a rigorous manner the technical procedures leading to the generation of genetically modified organisms, whether plant or animal.

Develop the ability to understand and discuss scientific work.

LEARNING APPRAISAL SYSTEM

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.
LEARNING ASSESSMENT SYSTEM
The criteria set out here will apply to both the Ordinary and Extraordinary calls.
ORDINARY SYSTEM (SE):
• IS1. Evaluation of the theoretical content of the subject: 70% of the final grade
• IF 2. Evaluation of works: 15% of the final grade
• IF 3. Seminar evaluation: carrying out and presenting exercises, case studies, debates, tutoring, etc.: 15% of the final grade
To apply the indicated SE1, SE2 and SE3 percentages, it is essential to obtain a rating equal to or greater than 5 in each of them.
EXTRAORDINARY SYSTEM (SEE): Only in the case of students in the second call and later, and students with academic exemption, they can choose to take advantage of the previously specified primary system (in which case they must meet all the requirements, including class attendance) or to take advantage of the extraordinary system, in which the following percentages will apply:

SEE1: Evaluation of the theoretical content of the subject (70%).
SEE2: Evaluation of works for the Plant Part (15%)
SEE3: Evaluation of seminars for the Animal part (15%)

To be able to average the different parts in the alternative system, it is essential to obtain a rating equal to or greater than 5 both in SEA1, and in SEA2 and SEA3.

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

H. S. Chawla. Introduction to plant biotechnology/3rd. ed. Enfield (New Hampshire) :Science Publishers, 2009.

edited by Marten H. Hofker and Jan M. van Deursen. Transgenic mouse methods and protocols/2nd ed. New York:Humana,2011.

Benavides FJ and Guénet JL Manual of Laboratory Rodent Genetics: Basic Principles and Applications, 2003 (Benavides FJ and Guénet JL Manual of Laboratory Rodent Genetics: Basic Principles and Applications, 2003 , Ed. University of Alcalá and Spanish Society for Laboratory Animal Sciences)

Additional

Strachan, T. and Read, A.P. Human Molecular Genetics. 5th edition.
(Strachan, T. and Read, A.P. Human Molecular Genetics. 5th edition. , Routledge, Taylor & Francis Group)