COURSE DATA

DATA SUBJECT

Code: 43461
Name: Experimental models
Cycle: Master's Degree / Doctorate
ECTS Credits: 3
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
2210 - Master's Degree in Research in Molecular, Cellular and Genetics Biology	Facultat de Ciències Biològiques	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2210 - Master's Degree in Research in Molecular, Cellular and Genetics Biology	Experimental models	COMPULSORY

COORDINATION

OLMO MUÑOZ MARCEL LI DEL

SUMMARY

In this course, *students* will gain an *understanding of the basic* biological experimental models and resources available for them. In particular, it is intended that students achieve an advanced level of theoretical knowledge on key aspects of the various experimental models that will allow them to select the most suitable for their future research. It is intended specifically for each model organism that students could answer the following questions:
1) What are the basic features of each model?

2) what is known about it?

3) What are the available resources?

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

The subject "experimental models" is taught in the Masters in Molecular Biology, Cell and Gene as a compulsory subject in the conceptual module. Students should begin taking general knowledge of Molecular Biology and Genetics.

COMPETENCES / LEARNING OUTCOMES

2210 - Master's Degree in Research in Molecular, Cellular and Genetics Biology

Be able to access to information tools in other areas of knowledge and use them properly.

Capacidad para identificar y evaluar la idoneidad de los organismos modelo utilizados en la investigación en biología molecular, celular y genética.

Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.

Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.

Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.

Students should possess and understand foundational knowledge that enables original thinking and research in the field.

To acquire basic skills to develop laboratory work in biomedical research.

To be able to assess the need to complete the scientific, historical, language, informatics, literature, ethics, social and human background in general, attending conferences, courses or doing complementary activities, self-assessing the contribution of these activities towards a comprehensive development.

DESCRIPTION OF CONTENTS

1. General Introduction. Virus and viroids.

Introduction. What is a model system? Experimental models more frequently used.
Virus and viroids. Basic biology of the virus more often used in research. Biological resources collections, mutants, specific databases. Biotechnological possibilities offered: evolution and regulation studies, protein production. Use as gene transfer vectors, such as use as vaccines and vaccine vectors. Transformation tools.

2. Escherichia coli and other prokaryotes used as model organisms.

Introduction. Biological model (structure). Genetic model (genome sequencing, phages, conjugation, transduction). Evolutionary model. Model in the study of proteins and proteomics. Biotechnological potential (heterologous protein production, model development of fermentation systems, ...). Specialized microbial resources. Other prokaryotic models: Bacillus subtilis and others.

3. Simple eukaryotic.

Remarkable biological aspects of S. cerevisiae as a eukaryotic model. Possibilities of genetic manipulation. Biological resources and information sources available. Useful yeast and other fungi. Biotechnological possibilities.

4. Plants

Characteristics of A. thaliana. Bioinformatics tools, databases, information search for genes of interest (Northern virtual, spatial and temporal expression, expression in different environmental conditions), search for mutants (insertional, micro RNAs, tilling). Biological resources available: collections of seeds and other stocks (libraries, clones, BACs, ESTs, vectors). Interest for other model plant species: maize, rice, woody, tomato. Biotechnological possibilities: plants with added- value, resistance to stress, phytoremediation

5. Invertebrates

Biology of the organization: advantages and disadvantages for different experimental applications. Transgenesis methods and types of constructs. The Gal4/UAS directed expression system. Strategies for classical mutagenesis. Reverse genetic techniques: targeted gene disruption and post-transcriptional silencing. Mutation analysis: mosaic generation technique with FLP / FRT. Studies of gene interactions: ordering genes in a route (epistasis) and dose-dependent interactions (enhancers and suppressors). Models of human genetic disease: loss or gain of function and pharmacology. Study routes pathogenesis and drug discovery in Drosophila. Biology and resources available to C. elegans.

6. Vertebrates

Mice, chickens, frogs and fish: Advantages and disadvantages, resources, biotechnology and biomedical applications.

Do model organisms really inform the human? Examples of successes
and failures in translating results obtained from model organisms to humans.
Humanized animal models. The human as a subject of experimentation. Research possibilities in human beings: non-invasive screening methods, cell cultures,
identification of genes by linkage and association analysis,

7. Human

Do model organisms really inform the human? Examples of successes
and failures in translating results obtained from model organisms to humans.
polygenic risk estimation, stem cells, clinical trials and meta-analysis.
meta-analysis. Mendelian randomization. Ethical and legal aspects:
Biomedical Research Law, Scientific Research Ethics Committees and Biobanks.

8. Cell cultures

Basic knowledge of cell cultures. Problems and limitations. Resources available

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	2,00
Theory	24,00
Other activities	4,00
Total hours	**30,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	0,00
Preparation of lessons	0,00
Preparation for assessment activities	45,00
Resolution of case studies	0,00
Total hours	**45,00**

TEACHING METHODOLOGY

The following methodological approaches will be used in this subject: attending lectures and tutorials. An overview of the topic will be presented in the lectures, with special emphasis on the key concepts. The most appropriate resources for a deepening of the subject will also be presented in these lectures, so that students complete their education.
The subject is devised to be developed in the form of presential and non-presential work.

EVALUATION

Assessment of student learning will be made by:
1) A single call theoretical and practical examination in to be held in the classroom. This test will be worth 100% of the mark and will be made after the end of classes. Exam questions may include multiple choice questions, and questions with short and long answers.
2) In addition the student will accumulate points associated with the assessment that the professor makes about his interest in the subject expressed as participation in organized discussions, the answers to the questions ask by the teacher during the sessions , tutoring assistance and / or any other type of activity carried out by the student in relation to the subject. It can get up to 5% of the final grade for the course.

The final grade for the course will be the sum of that obtained in the evaluation of the theoretical credits and additional activities as previously described.

REFERENCES

- Systems Biology and Biotechnology of Escherichia coli. Lee, Sang Yup (Ed.) Springer. 2009. Microbiología de Prescott, Harley y Klein. Willey, J.M.; Sherwood, L.M. y Woolverton, C.J. 7ª ed. McGraw-Hill-Interamericana de España, S.A.U. 2009. Brock-Biología de los Microorganismos. Madigan, M.T., J.M Martinko, P.V. Dunlap y D.P. Clark. 12ª ed. Pearson. Addison Wesley. 2009. Microorganismes. Schaechter, M., J. L. Ingraham y F. C. Neidhard. 1ª ed. Reverté. Barcelona. 2008. White, D. The Physiology and Biochemistry of Prokaryotes, 3ª ed. Oxford Univ. Press, Oxford. 2006. Freshney, R.I. (2010) Culture of animals cells. 6th Ed. John Wiley and Sons, Hoboken, New Jersey (USA). ISBN: 978-0-470-52812-9. Walbot,V. (1992). Strategies for mutagenesis and gene cloning using transposon tagging and T-DNA insertional mutagenesis. Annu. Rev. Plant Physiol. Plant Mol. Biol. 43, 49-82. Greenspan, R. J. Fly pushing the theory and practice of drosophila genetics.

- Ashburner, Golic y Hawley. Drosophila a laboratory handbook. The GMO handbook. genetically modified animals, microbes and plants in Biotechnology. Edited by Sara R. pareck. Humana Press. 2004 Principles of gene manipulation and genomics. Primrose and Twyman. 7th edition. Blackwell Publishing 2006. Aitman TJ, Boone C, Churchill GA, Hengartner MO, Mackay TF, Stemple DL. The future of model organisms in human disease research. Nat Rev Genet. 2011 Jul 18;12(8):575-82. doi: 10.1038/nrg3047. Bruce H. Littman & Stephen A. Williams. The ultimate model organism: progress in experimental medicine. Nature Reviews Drug Discovery 4, 631-638, 2005. Hobin JA, Galbraith RA. Engaging basic scientists in translational research. FASEB J. 2012 Jun;26(6):2227-30. van der Worp HB, Howells DW, Sena ES, Porritt MJ, Rewell S, et al. (2010) Can Animal Models of Disease Reliably Inform Human Studies? PLoS Med 7(3): e1000245. Ley 14/2007, de 3 de julio, de Investigación biomédica. BOE 4 julio 2007, núm. 159: pág. 28826.

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