Mouse models in cancer research

1.- General information

Code	303021	Plan		ECTS	3
Type	Elective	Course	2025/2026	Periodicity	1st Semester
Language		Spanish			
Department		Cancer Research Center			
Virtual Platform		https://cicloud.dep.usal.es/			

1.1.- Faculty

Professor Coordinator	Dr. Manuel A. Sánchez Martín
Departments	Medicine
Research area	Medicine
Center	Faculty of Medicine, Medicine Department.
Office	Lab. Transgenic, Basement -3, CIC.
Tutorials	16.00-18.00
URL Web	https://nucleus.usal.es/es/transgenesis
E-mail	adolsan@usal.es	Phone	+34 923294500-3015

Professor Coordinator	Dra. Sandra Muntión Olave
Research area	Unidad de Terapia Celular, Servicio de Hematología
Center	Hospital Universitario de Salamanca. IBSAL
URL Web	https://ibsal.es/es/tgyc-01-medicina-regenerativa-c
Tutorials	16.00-18.00
E-mail	smuntion@usal.es	Phone	+ 34 923291100-56751

2.- Previous recommendations

3.- Aims of the subject

• Acquire knowledge about the use of mouse models genetically modified for the cancer in vivo study.

• Acquire detailed knowledge about current genetic manipulation techniques used to generate transgenic, "knock-out" and "knock-in" mice.

• Acquire practical skills in mouse genome manipulation techniques and reproductive management.

4.- Skills to be acquired / Learning outcomes

Skills

4.1: Basic skills:

Development of laboratory skills based on genetic concepts and recombinant DNA technology to generate mouse models as a tools for human cancer research.

4.2: Specific skills:

Manipulating the cell and the mouse embryo by genome editing nuleases: CRISPR approaches.

4.3: Transferable skills:

Promotion of scientific discussions regarding cancer.

Development of skills to disseminate information of scientific topics.

5.- Contents (Syllabus)

LESSONS:

Topic 1: The human genome complexity. Mouse models as a tool for studying the human disease.

Lesson 1. Human variability. The Human Genome Project, 1000 Genomes Project, 1K and 100K Genome Projects. The Cancer Genome Atlas, The Cancer Genome Project and The International Cancer Genome Consortium.

Lesson 2. Animal models in cancer. The Fancy mouse: history of the laboratory mouse. Outbreed strains and inbreed strains. Genetic standardization of the mouse. Quantitative trait locus.

Lesson 3. Immunodeficient mice strains. Xenografts assays in cancer research. Carcinogenesis in the mouse.

Topic 2: Making human cancers in mice: classical models

Lesson 4. Manipulating the mouse embryo. Classical transgenic mice and human cancer. Conditional transgenic mice and human cancer.

Lesson 5. Transgenesis by transposition. Generation of transgenic mice with lentiviral vectors.

Lesson 6. Gene targeting in embryonic stem cells. Generation of chimeras. Knock-out mice and embryo lethality. Knock-in mice. Knock-out/in mice mouse models and human cancer.

Topic 3: Making human cancers in mice: new approaches

Lesson 7. Cre and Flp recombinases. Cre/Flp conditional mouse models to turn-off tumor suppressor genes. Cre/Flp conditional mouse models to turn-on oncogenes.

Lesson 8. Gene Trap approaches. Gene Trap consortiums and mouse models in cancer.

Lesson 9. Zin-finger nucleases and TALEN nucleases: mouse models. CRISPR history.

Lesson 10. CRISPR-Cas9 System. Genome editing with CRISPR technology.

Lesson 11. CRISPR-Cas reagents and protocols. Mouse models created by CRISPR technology in cancer research.

LABORATORY WORK

One group per week (3-4 students)

1. Colony management.

2. Generation of mouse models by pronuclear injection.

3. Cryopreservation of lines

4. Delivering CRISPR reagents: in vitro approaches

5. Analysis of CRISPR edited cells

6.- Teaching methodology

A. 10 master classes (2h each one) divided in 3 topics:

Human genome complexity and mouse models as a research tool. Inbreed and outbreed mouse strains.

Modeling Human Cancer in the Lab Mouse I: classical techniques for generating genetically modified and mutant mice.

Modeling Human Cancer in the Lab Mouse I: genome editing nucleases and conditional mouse models.

B. Lab work: from Monday to Friday (6 h at day) at the Transgenic Facility of the University of Salamanca. Small groups (3-4 people).

C. Scientific seminars.

6.1.- Estimated learning time

		Hours tutored by the teacher		Individual work (hours)	TOTAL HOURS
		Attendance required (hours)	Distance learning (hours)		
Lectures		22			22
Practices	- In classroom				
	- In laboratory	30			30
	- In computer classroom				
	- Countryside				
	- Others (specify)				
Seminars		4		8	12
Work presentations and debates					
Tutorials		2			2
Online activities					
Work preparation					
Other activities					
Exams - evaluation		1		8	9
TOTAL		**59**		**16**	**75**

7.- Materials, other bibliographical, electronic references or any other type of resource

1. Manipulating the mouse embryo. A laboratory manual. Third edition. CSHL Press.

8.- Assessment

8.1: Assessment Criteria:

8.2: Assessment Systems:

Written final exam: test type, 50 multi-answer questions. 50% of the final grade.

A continous follow up of the capacities during the sessions and theorical classes attendance and participation. 25% of the final grade.

Continuous evaluation of the lab practices will be evaluated. 25% of the final grade

8.3: General Considerations and Recommendations for Assessment and Resit:
Kahoot
PPT for semminars
Participation in other semiars sessions and practises.

9.- Weekly Teaching Schedule