Course unit name: CHROMOSOMIC, INSTABILITY, CANCER, AGING AND COHESYNOPATHIES

1.- General information

Code	303009	Plan		ECTS	3
Type	Elective	Course	2023/2024	Periodicity	1st Semester
Department	Cancer Research Center				
Virtual Platform	Platform:	CICLOUD			
	URL de Acces:	http://cicloud.dep.usal.es/index.php/s/Gp0vghR305Y6glo/authenticate			

Faculty

Professor Coordinator	Dra. Elena Llano Cuadra		
Department	Physiology and Pharmacology		
Research area	Functional analysis of genes involved in chromosome segregation by means of genetically modifed mouse models: participation in human disease		
Center	Cancer Research Center		
Office	Laboratory 9		
Tutorials	Monday to Thursdays from 10 to 13		
URL Web	https://www.cicancer.org/investigador?id=d0cfea83-954e-47ce-a8f7-9d9709d3f8cf		
E-mail	ellano@usal.es	Phone	+34 923294809

Professor Coordinator	Dr. Alberto Martín Pendás		
Research area	Cancer Research Center		
Center	Functional analysis of genes involved in chromosome segregation by means of genetically modifed mouse models: participation in human disease		
Office	Cancer Research Center		
Tutorials	Monday to Thursdays from 10 to 13		
URL Web	https://www.cicancer.org/grupo?id=56		
E-mail	amp@usal.es	Phone	+34 923294809

2.- The course in the context of the Master´s Program

Treaning Module
First block (out of five) of master program organization.

General aim of the subject
Obtaining a real vision of how scientific advances in the field of biomedicine are generated through the use of current experimental models through a deductive process.

Professional specialization
Biomedicine researchers in training.

3.- Previous recommendations

Basic knowledge in molecular biology

4.- Aims of the subject

Our aim is to understand the fundamental principles of genetic analysis and reverse genetics and how this type of methodologies enables to dissect complex biological processes.

Understanding the conceptual basis and technological advances that have allowed the development of reverse genetics in higher animals through the scientific history of the Nobel prizes Capecchi, Smithies and Evans.

Introducing the fundamental concepts and technical progress which were essential from the further development of “gene targeting” such as homologous recombination, development of embryonic stem cells, locus specific recombinases (Cre and Flipase), etc.

Genomic edition through the CRISPR / CAS9 system in experimental animals in Biomedicine. Development of humanized mouse models.

Getting the knowledge of the applications that genetic engineering of mammalians have in Biomedicine and how experimental science is replacing observational science in medicine.

Understanding the molecular processes that ensure the fidelity of chromosomal segregation and nucleus stability.

Underlining the intimate relationship between chromosomal segregation, cancer and aging.

Understanding how can we experimentally determine to what extent chromosomal instability is cause or consequence of tumor progression and aging.

Understanding how the deregulation of the processes studied causes a plethora of diseases from cancer to premature aging and sterility or more broad diseases that affect basic developmental processes such as cohesinopathies.

Understanding how through the knowledge of the molecular processes that underlie the disease the rational drug design of biological targets with therapeutic value can be undertaken.

5.- Contents

Lectures:

1. Techniques for functional genome analysis. Use of model organisms in biomedical research
2. "Genome editing", the new tool for creating genetic engineered animals (CRISPR/Cas9 system) and its main applications in the field of biomedicine
3. Introduction to Functional Genomics
4. Molecular markers. Applications (Positional mapping, QTLs, Association mapping, GWAS)
5. Mechanisms that ensure the fidelity of chromosomal segregation. Cohesins and chromosomal cohesion
6. In vivo induction of chromosome instability and its involvement in cancer and aging.
7. Complex diseases due to mutations in proteins of the cohesion pathway. Cohesins and cohesinopathies. Implications in tumor development.
8. Molecular basis of aging

6.- Skills to be acquired

Basic skills
- Understanding the difference between observational science and experimental science - Obtaining the ability to discriminate between cause and consequence using biological experimentation. - Addressing from an actual perspective the functional analysis of a biological process in a higher organism. - Interpretation of the findings of a scientific article and identification of its possible limitations, as well as how to differentiate between the results and the conclusions derived from their interpretation. - - Having the ability to expose and discuss scientific work with scientific criteria in public.

Specific skills
- Having the ability to understand how pathological situations originate as a result of the deregulation of physiological processes such as wound healing, reproduction, cell migration, embryonic development, organogenesis or immune defense. - Recognize the functional pleiotropy of proteins and the different processes in which they are involved.

7.- Teaching methodology

The course is organized in master classes and seminars run by students. The structural organization of the course (number of master classes, seminars, tutorship etc.), its objectives, the form of evaluation as well as the discussion of questions/doubts and dissemination of the bibliography will be addressed in the first session. In this way, it is intended that the student acquire a global vision of the course that allows him/her to schedule in advance the work that he/she will have to carry out in each moment.

The student must attend all the theoretical sessions of the course (10 hours) which will be evaluated by means of a written exam based on fundamental concepts. The questions will be extracted from the basic concepts addressed in this course both in the theoretical sessions as well as in the seminars / workshops.

The seminars run by the students will be carried out in groups of two / three persons, depending on the total number of students enrolled. The structure of the seminars will be similar to that of any scientific seminar (Introduction, results, discussion and conclusions) but based on several scientific articles related to some of the topics of the course. After the exposure, a critical defence will be established. Both the quality of the seminar and the ability to discuss / defence it with the teacher and with the other students will be evaluated.

All the content of the course is included in the recommended bibliography that each student must have read and understood before the beginning of each block. In order to evaluate the individual effort of each student in this section, the teacher will ask different students during the course of the theoretical sessions on fundamental aspects of the section in question.

Seminars:
Scientific articles (both research and reviews that support them) will be selected according to criteria of novelty and impact on the field, paying special attention to articles that have been published recently (≤ 1 year).
Organization: the seminars will be organized according to the number of students individually or in working groups of a maximum of three persons. Each group / student will present at least three different articles.

8.- Estimated learning time

		Hours tutored by the teacher		Individual work (hours)	TOTAL HOURS
		Attendance required (hours)	Distance learning (hours)		
Lectures		10		12	22
Practices	- In classroom				
	- In laboratory				
	- In computer classroom				
	- Countryside				
	- Visualization classroom				
Seminars					
Work presentations and debates		20		12	32
Tutorials		6			6
Online activities					
Work preparation			13		13
Other activities					
Exams - evaluation		2			2
TOTAL		**38**	**13**	**24**	**75**

9.- Materials

Books

Other bibliographical, electronic references or any other type of resource

Scientific articles on the topics of the course, published in high-impact journals: Nature, Science, Cell, etc.

10.- Assessment

Assessments on the performance of the student

Written final exam (25% of the final grade).

Active participation in all the programmed activities, theoretical sessions, practical sessions and seminars (60% of the final grade).

Self-assesment of the students (15%). Students' presentations will be graded by the rest of the students.

Recommendations