INTRACELLULAR SIGNALING IN CANCER

1.- General information

Code	303028	Plan		ECTS	3
Type	Elective	Course	2026/2027	Periodicity	1st Semester
Language		English			
Department	Cancer Research Center				
Virtual Platform	https://cicloud.dep.usal.es/				

1.1.- Faculty

Professor Coordinator	Dr. Alberto Fernández Medarde		
Departments	Bioquemistry and Molecular Biology		
Research area	Analysis of SOS proteins as therapeutic targets in cancer		
Center	Cancer Research Center		
Office	Laboratory 1		
Tutorials	To be arranged by email		
URL Web	https://www.cicancer.org/investigador?id=c6ac8867-1ceb-4c8b-b641-e3dd57d9e01b		
E-mail	afm@usal.es	Phone	+34 923294801

Professor	Dra. María Elena Díaz Rodríguez		
Departments	Biochemistry and Molecular Biology		
Research area	New therapies in breast cancer therapy. Mechanisms of action and resistance.		
Center	Cancer Research Center		
Office	Laboratory 15		
Tutorials	To be arranged by email		
URL Web	https://produccioncientifica.usal.es/investigadores/148141/detalle		
E-mail	ediaz@usal.es	Phone	+34 923294815

2.- Previous recommendations

It is recommended to take this course together with the subjects teaching on cell cycle regulation and control of cell proliferation and migration. Proficiency in English is recommended, since the subject will be taught in that language.

3.- Aims of the subject

To know the main signaling pathways that are altered in tumor processes, their components, activation mechanisms as well as their function in normal and pathological situations. Study the interactions between signaling pathways and understand that they are not linear processes, but

are part of extensive signaling networks. Understand the mechanisms that regulate the different pathways and how they are coordinated. To understand how alterations in these pathways modify cells during tumorigenesis, as well as the assignment of specific molecular alterations to specific types of cancer. Analyze therapeutic approaches that target specific signaling molecules and their success.

4.- Skills to be acquired / Learning outcomes

Skills

4.1: Basic skills:

- Basic knowledge of the different signaling pathways (CG001), the alterations they present in cancer (CG002) and their usefulness as a therapeutic target (CG003).

4.2: Specific skills:

- To know the different families of Ras GTPases, the signaling pathways controlled by these GTPases, as well as the cellular functions they regulate and their role in tumor development (CE001).
- to have an understanding of the role of PI3K signaling in the control of protein synthesis, cell metabolism and survival, as well as the alterations that make this pathway a therapeutic target in many types of cancer (CE002).
- To know the signaling pathway of Wnt -> β-Catenin and its role in tumor processes (CE003).
- To understand the physiological function of TGFβ in a normal cell and the interaction with other signaling pathways, as well as its implication in tumor development (CE004).
- To understand the role of inflammation in cancer and the role of the TNF family in the regulation of inflammatory processes (CE005).
- To understand the signaling that leads to apoptosis and its regulation (CE006).
- To study and understand the role of calcium signaling in cell physiology (CE007).
- To know the role of NFκB in survival and its interaction with other signaling pathways (CE008).
- To know and understand the role of signaling routes activated by Sonic Hedgehog, Jak / Stat, Notch or Hippo (CE009).
- To associate the different signaling routes in cancer, understand that they are not isolated entities and understand the concept of signaling networks (CE010).
- To know the latest developments in targeted therapy, learn about the tendency to seek specific therapeutic targets in cancer treatment and future prospects (CE011).

4.3: Transferable skills:

5.- Contents (Syllabus)

The subject is divided into two blocks. The first focuses on lectures in which the teacher will give the necessary notions to know the main cellular signaling pathways and will cover all the points mentioned in the objectives of the subject.

Topics discussed:

1- Introduction to signaling in cancer.
2- The small intracellular GTPases of the Ras family.
    2.1- The GTPases of the Rho family and the control of the cytoskeleton.
    2.2- Canonical Ras GTPases and their central role in tumor processes.
3- Signaling by other GTPases of the Ras family.
4- Signaling by PI3K. Lipids as Second Messengers.

5- The signaling path of Wnt-β–Catenin.
6- The TGFβ superfamily in cancer.
7- TNF and inflammatory processes in cancer.
8- Other signaling pathways implicated in cancer (Notch, Jak/Stat, SHH, Hippo, etc.)
8- Alterations in signaling in cancer.
9- Targeted therapies as a future in cancer treatment.

Seminars:
In the second block, students will choose a series of articles for debate (change / update year by year):

A series of topics and an appropriate number of articles relevant to this field will be selected annually, either because of their seminal nature or because of their novelty, reflecting recent advances in the topic. Each student must prepare at least one of these seminars, based on the presentation and criticism of one or more selected articles. The other students must attend all these seminars and actively participate in their presentation and discussion.

6.- Teaching methodology

The student must attend the assessable theoretical sessions of the course (14 hours) having previously read and understood the recommended bibliography; During the first session there will be a brief introduction to the program of the subject, but also the how the sessions will be organized. In addition, doubts and comments from the students will be discussed.

The student must attend the seminars (18 hours) in which each group (or student) will present a published research work or a line of research (Journal Club type), a critical dialogue will be established in which all students must ask questions and discuss on the work previously presented.

6.1.- Estimated learning time

		Hours tutored by the teacher		Individual work (hours)	TOTAL HOURS
		Attendance required (hours)	Distance learning (hours)		
Lectures		14		10	24
Practices	- In classroom				
	- In laboratory				
	- In computer classroom				
	- Countryside				
	- Others (specify)				
Seminars					
Work presentations and debates				10	10
Tutorials		18			18
Online activities		10			10
Work preparation					
Other activities				10	10
Exams - evaluation		3			3
TOTAL		**45**		**30**	**75**

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

The bibliography will be provided for each individual topic during the theoretical sessions.

PubMed bibliographic search.

8.- Assessment

8.1: Assessment Criteria:

8.2: Assessment Systems:
Final exam: Test and short answers (80% of the final grade).
Seminars presented by students on the subject (20% of the final grade).

8.3: General Considerations and Recommendations for Assessment and Resit:
To stimulate the critical discussion and understanding of the subject, the questions asked by the students during the seminars and during the theoretical sessions will also be valued. The absence to the theoretical sessions without justification will be considered at the time of the final evaluation

Recommendations after failing to reach the evaluation criteria A second exam will be prepared. Grades from the seminars will also be considered.

9.- Weekly Teaching Schedule