

Cellular Signalling

Code: 100864
ECTS Credits: 6

Degree	Type	Year	Semester
2500252 Biochemistry	OB	3	1

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Other comments on languages

el material subministrat pel seguiment de les classes està en anglès

Prerequisites

Basic knowledge and competences of Biochemistry, Cell Biology, Physiology and Histology, Chemistry, Mathematics, Physics.

Objectives and Contextualisation

The subject of Cell Signaling is included in the matter Biochemistry Functional . A subject of this matter has been studied during the second year, the others will be studied during this third year.

The behavior of a cell depends on the physiological situation in which it is found. This process requires the cell to have sensors of the external stimuli and respond appropriately to these stimuli. This process of recognition of the stimulus and response of the cell is known as cell signaling or signal transduction.

In this subject, the nature of the signal molecules and the mechanisms by which the cells recognize these molecules and respond appropriately to them will be studied.

Targets

Describe the molecules involved in intracellular and intracellular communication systems.

Have an integrated vision of the function of hormones, neurotransmitters and growth factors in the control of gene expression.

Explain the signal transduction pathways involved in the regulation of the cell cycle, apoptosis and cancer.

To know the experimental approaches to the study of signal transduction mechanisms.

Search bibliography and interpret information of biological signal transmission databases.

Interpreting experimental results and identifying the consistent and inconsistent elements.

Read specialized texts in the English language.

Know how to make an oral and visual presentation of a topic related to the subject to classmates.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Be able to self-evaluate.
- Collaborate with other work colleagues.
- Demonstrate an integrated vision of the function of hormones, neurotransmitters and growth factors in the control of gene expression and metabolism.
- Describe intercellular and intracellular communication systems that regulate the proliferation, differentiation, development and function of animal and plant tissues and organs.
- Describe the structural, physiological and biochemical characteristics of the different types of cells and explain how their properties fit in with their biological function.
- Explain the structure of cell membranes and their role in signal transduction processes, the transport of solubles and the transduction of energy.
- Interpret experimental results and identify consistent and inconsistent elements.
- Introduce changes in the methods and processes of the field of knowledge to provide innovative responses to the needs and demands of society.
- Manage bibliographies and interpret the information in the main biological databases, and also know how to use basic ICT tools.
- Manage information and the organisation and planning of work.
- Read specialised texts both in English and one's own language.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take responsibility for one's own learning after receiving general instructions.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Think in an integrated manner and approach problems from different perspectives.
- Use ICT for communication, information searching, data processing and calculations.

Learning Outcomes

1. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
2. Be able to self-evaluate.
3. Collaborate with other work colleagues.
4. Describe the molecules, structures and processes involved in hormone, neuron and growth factor control.
5. Describe the structural and metabolic factors that govern cellular metabolic specialisation, their response to different extracellular signals and their functional appropriateness.
6. Discern the molecules, structures and processes involved in the communication of the cell with the external environment and with other cells, in intracellular homeostasis and in the response to extracellular signals.
7. Discern the role of cell membranes in the processes of biological signal transduction.
8. Explain the functioning and regulation of the cell cycle and the signal transduction pathways involved in apoptosis and cancer.
9. Interpret experimental results and identify consistent and inconsistent elements.
10. Introduce changes in the methods and processes of the field of knowledge to provide innovative responses to the needs and demands of society.
11. Manage information and the organisation and planning of work.
12. Read specialised texts both in English and one's own language.
13. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.

14. Take responsibility for one's own learning after receiving general instructions.
15. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
16. Think in an integrated manner and approach problems from different perspectives.
17. Use ICT for communication, information searching, data processing and calculations.
18. Use databases on metabolic pathways, biological signal transmission and their disorders in pathological situations.

Content

Topic 1. Cell signaling characteristics

Topic 2. Basic Biochemistry of Signal Transduction.

Topic 3. Evolution of Cellular Data Processing

Topic 4. Basic Equipment: G-Proteins, Second Messengers, and Protein Kinases

Topic 5. Signal Transduction by Receptors with Seven Transmembrane Domains

Topic 6. Signal Transduction by Serine/Threonine Kinase-Coupled Receptors

Topic 7. Signal Transduction by Tyrosine Kinase- and Protein Phosphatase Coupled Receptors

Topic 8. Eukaryotic Gene Transcription: The Ultimate Target of Signal Transduction

Topic 9. Signals Controlling mRNA Translation

Topic 10. Mitogen-activated Protein Kinase and Nuclear Factor κ B Modules

Topic 11. Regulation of Cell Division

Topic 12. Signal Transduction by Proteolysis, and Programmed Cell Death

Topic 13. Signal Transduction by Ions

Topic 14. Sensory Signal Processing

Topic 15. Signaling at Synapses: Neurotransmitters and their Receptors

Methodology

Methodology

The training activities of the subject are divided into theory classes, practical cases / seminars, delivery of work through the Virtual Campus.

Theory classes

In these classes the content of the syllabus will be developed, with the support of audiovisual material that will be available to the student through the Virtual Campus of the subject.

The material published on the Intranet of the Virtual Campus is exclusively for teaching and support for face-to-face exhibitions. Students accessing it have the right to make them exclusively for personal use. These images can not be reproduced by any other means or publicly disseminated on websites, social networks or digital networks for the exchange of teaching materials.

It is recommended that the student consult the material published on the Virtual Campus and the books and websites that are recommended in the Bibliography section.

Seminars

Six sessions dedicated to seminars related to the content of the theory program are planned.

During the first weeks of the course, the teacher will propose a set of topics that will be developed for groups of 4-5 people. The result of this work will be reflected in a file in pdf format that will be published on the Virtual Campus and an oral presentation during a seminar session, previously programmed. The oral presentation can not exceed in any case the 20 min. These presentations of the seminars will be held in the last weeks of the semester and will be included in the calendar published on the Faculty website.

Delivery of work

Through the Virtual Campus, practical exercises or cases will be proposed that students will have to work and solve in groups of 4-5 people, before a specific date. A total of two deliveries are expected throughout the semester to be sent - in PDF format - through the Virtual Campus archiving tool within the established term.

This teaching activity is designed to complement the teaching of both theory and seminars.

Students are responsible for learning everything that is contained in this teaching guide. In order to achieve this, we recommend that you use your right to consult in person with the teacher anything related to the subject, its contents and the work commissioned, within the schedule that is determined.

To facilitate communication between students and teachers outside class hours, it is essential that students activate and use the institutional email that UAB provides them. The tools that are considered appropriate from the Virtual Campus of the UAB will also be used.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Seminars/ case study	6	0.24	1, 15, 13, 17, 3, 5, 4, 6, 8, 11, 9, 10, 12, 16, 14, 18
Theory classes	39	1.56	1, 15, 13, 5, 4, 7, 6, 8, 10, 12
Type: Supervised			
Virtual work through moodle	6	0.24	17, 3, 5, 4, 7, 6, 8, 11, 9, 12, 16, 14, 2, 18
Type: Autonomous			
Seminar preparation	3	0.12	17, 3, 5, 4, 7, 6, 8, 11, 9, 12, 16, 14, 18
Seminar preparation/team work	20	0.8	17, 3, 5, 4, 7, 6, 8, 11, 9, 12, 16, 14, 18
Study	62	2.48	17, 3, 5, 4, 7, 6, 8, 11, 9, 12, 16, 14, 2, 18

Assessment

The assesment of the subject will be individual and continuous and will be subdivided into the following modules: partial tests where the theory and practical cases will be integrated, exercises deliveries through the virtual Campus and seminars.

Partial tests

There will be two partial tests throughout the semester on the days that appear in the calendar published on the Faculty website. These tests will consist of questions like test, short questions and problems. In this way, an integrated assessment of all the concepts seen in face-to-face classes is intended.

The partial examinations are eliminatory, so that those students who have obtained a grade equal to or greater than 3.5, will obtain a note for this section that will be the average of the notes of the two partial ones. Those students who have not passed the value of 3.5 in one of the partial ones will have to examine the partial one pending the day scheduling for the recovery exam, the last notes being those that will be taken into account for the calculation of the note final. However, it is possible to access to improve the note of the partial previously surpassed, with the sole condition of renouncing the first note obtained.

Each one of these tests will have a weight of 40% to the total grade of the course; Therefore, the total weight of this section in the final note is 80%.

Exercise delivered through the Virtual Campus

Periodically exercises or practical cases will be proposed that students will have to solve in a group of 4-5 people and deliver them by means of the corresponding tool of the CV before a specific date. There will be enough time between the ad and the delivery date, but this last date must be strictly adhered to, since campusvirtual automatically rejects any delivery outside the deadline. The rating of these deliveries will be per group and weighted for each individual in the following way: Each member of the group must rate their participation and that of their peers in the group's work on a scale of 1 to 10. The individual note will be calculated from the average of the notes obtained by the group multiplied by the weighting factor calculated from the average of the notes given by the other members of the group.

It is planned to propose two deliveries throughout the semester and the weight of this section in the final note is 5%.

Seminars

The evaluation of the seminars prepared in groups of 4-5 people will count 15% of the final grade.

The capacity of analysis and synthesis of the students of each group will be evaluated, as well as the skills of group work and oral presentation. This evaluation will be carried out considering the content of the seminar, the summary, the presentation and oral defense and the answers to the questions. This evaluation involves the teacher who awards 80% of the grade. The remaining 20% is given by the evaluation carried out by classmates. Attendance at the seminar presentations is mandatory, so the unjustified absence will penalize the grade of this section by 50%.

The individual grade will be calculated from the group note multiplied by the weighting factor that will be calculated from the average of the notes awarded by all the members of the group.

Global assesment

Students must participate and be assessed in all the sections of the subject to be able to pass it. Apart from the minimum grade of 3.5 that must be obtained in the partial, in order to eliminate the corresponding matter, no other minimum grade is required. To participate in the second-chance examination, the students must have previously been evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject or module. Therefore, students will obtain the "Non-Valuable" qualification when the assessment activities carried out have a weighting of less than 67% in the final grade.

The subject will be considered approved when the final sum of the sections in which the note is subdivided reach a value of 5.0.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Delivery of work using moodle	5	6	0.24	17, 5, 4, 7, 6, 8, 11, 9, 12, 16, 14, 2, 18
First partial exam	40	2	0.08	1, 15, 13, 5, 4, 7, 6, 8, 11, 9, 10, 12, 16, 14
Second partial exam	40	2	0.08	5, 4, 7, 6, 8, 11, 9, 12, 16
Seminars	15	4	0.16	1, 15, 13, 17, 3, 5, 4, 7, 6, 8, 11, 9, 10, 12, 16, 14, 18

Bibliography

Molecular Biology of the Cell, 6th edition

Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter.

New York: [Garland Science](#); 2014.

ISBN: 9780815344322

Lehninger Principles of Biochemistry, 7th edition

David L. Nelson, Michael M. Cox

New York: [Macmillan Higher Education](#); 2017.

ISBN: 9781319108243

Molecular Cell Biology, 7th edition

Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, Matthew P. Scott

New York: [W. H. Freeman](#); 2013.

ISBN-10: 1-4292-3413-X

Cellular signal processing (second edition)

Friedrich Marks, Ursula Klingmüller, Karin Müller-Decker

Garland Science;2017

ISBN: 978-0-8153-4534-3

Signal Transduction (Third edition)

Ijsbrand M. Kramer

Elsevier Inc. ; 2015

ISBN: 978-0-12-394803-8

Cell signalling, 3rd edition

John Hancock

Oxford University Press; 2010

ISBN-10: 0-1992-3210-5

Biochemistry of Signal Transduction and Regulation, 5th Edition

Gerhard Krauss

Ed. John Wiley and Sons, 2013,

ISBN-10: 3-5273-3366-5

Handbook of Cell Signaling. 2th edition

Ralph A. Bradshaw and Edward A. Dennis

Elsevier. Academic Press, 2009,

ISBN-10: 0123741459

Software

No specific software is required