

Degree	Type	Year
2500252 Biochemistry	OB	3

Contact

Name: Maria Plana Coll

Email: maria.plana@uab.cat

Teaching groups languages

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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

Activities and Methodology

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

Seminar preparation/team work	20	0.8	3, 4, 5, 6, 7, 8, 9, 11, 12, 14, 16, 17, 18
Study	62	2.48	2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 14, 16, 17, 18

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 3-4 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 in no case exceed 25 minutes. These presentations of the seminars will be made on the days scheduled by the coordination

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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 3-4 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.

Assessment

Continuous Assessment Activities

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

The assessment of the subject will be individual and continuous and will be subdivided into the following modules: partial tests where theory and practical cases will be integrated, deliveries of exercises 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 website of the Faculty. These tests will consist of multiple-choice questions, and short questions/problems. In this way, it is intended to make an integrated evaluation of all the concepts seen in the face-to-face classes.

The partial exams are eliminatory, so that those students who have obtained a grade equal to or greater than 3.5, will obtain a grade for this section that will be the average of the notes of the two partials. Those students who have not exceeded the value of 3.5 in one of the partials must examine the pending partial on the day scheduling for the recovery exam, being the last notes those that will be taken into account for the calculation of the final grade.

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

Deliveries of exercises through the Virtual Campus

Periodically, exercises or practical cases will be proposed that students must solve in a group of 3-4 people and deliver through the corresponding tool of the virtual campus before a specific date. Sufficient time will be given between the announcement and the end date of the delivery, but this last date will have to be strictly respected since the virtual campus automatically rejects any delivery after the deadline. The qualification of these deliveries will be by group and weighted for each individual as follows:

The grade obtained by the group in the delivery will be weighted to calculate the individual grade of each member of the group. The weighting factor will be given by the average of the marks given by the other members of the group on the participation of each student.

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

Seminars

The evaluation of the seminars prepared in groups of 3-4 people will count 15% of the final grade.

The capacity for 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 made taking into account the content of the seminar, the summary, the presentation and oral defense and the answers to the questions. In this evaluation participates the teacher who awards 80% of the grade. The remaining 20% is given by the evaluation made by the classmates. Attendance at seminar presentations is mandatory, so that unjustified absence will penalize the grade of this section by 50%.

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

Overall assessment

Students must participate and be evaluated in all sections of the subject in order to pass it. Apart from the minimum grade of 3.5 that must be obtained in the partials, to eliminate the corresponding subject, no other minimum grade is necessary. To participate in the "recovery", students must have been previously evaluated in a set of activities whose weight is equivalent to a minimum of two thirds of the total grade of the subject or module. Therefore, students will obtain the qualification of "Not Evaluable" when the evaluation 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 grade is subdivided reaches a value of 5.0.

Single evaluation

Students who take advantage of the single evaluation must attend the seminar sessions that touch them according to the group to which they belong (A or B), in the sessions programmed in the calendar of the degree. You must also participate in the elaboration in the group of the presentation of the seminar that corresponds to you and in the scheduled activities of exercises via virtual campus.

The single evaluation consists of a single synthesis test with questions related to the entire syllabus of the subject on the day scheduled in the academic calendar to make the second partial of the subject. This test will consist of 20 multiple-choice questions with 5 possible options and only 1 correct answer, which will be evaluated on 6, and 4 short-answer questions, each weighing 1 out of 10. The grade obtained in this test corresponds to 80% of the final grade of the subject. The remaining 20%, non-recoverable, corresponds to the activities through the virtual campus and to the attendance and realization of the seminars.

The same recovery system used for continuous assessment shall be applied.

Bibliography

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[Bruce Alberts](#) , [Rebecca Heald](#) , [Alexander Johnson](#) , [David Morgan](#) , [Martin Raff](#) , [Keith Roberts](#) , [Peter Walter](#)

Norton 2022.

ISBN: 97808153443229780393884852

Lehninger Principles of Biochemistry, 8th edition

David L. Nelson, Michael M. Cox

New York: [Macmillan Higher Education](#); 2021.

ISBN: 9781319228002

Molecular Cell Biology, 9th edition

Harvey Lodish; Arnold Berk; Chris A. Kaiser; Monty Krieger; Anthony Bretscher; Hidde Ploegh; Kelsey C. Martin; Michael Yaffe; Angelika Amon

New York: [Macmillan Higher Education](#); 2021.

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

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	331	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	332	Catalan	first semester	morning-mixed
(TE) Theory	33	Catalan	first semester	morning-mixed