Molecular Bases of Signal Transduction and Cancer 2015/2016

Code: 42893
ECTS Credits: 9

Degree	Type	Year	Semester
4313794 Biochemistry, Molecular Biology and Biomedicine	OT	0	2

Contact

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Use of languages

Principal working language: english (eng)

Other comments on languages

80%

Teachers

Néstor Gómez Trias

Jose Ramon Bayascas Ramirez

Victor J. Yuste Mateos Grup mort cel.lular, senescència i super

Anna Bassols Serra

External teachers

Guillermo Velasco Diez

Susana Puig

Violeta Serra

Prerequisites

This is an advanced course for graduate students in in Biology, Biotechnology, Biochemistry, Biomedicine, G enetics, Microbiology, as well as graduates in Medicine and Veterinary.

A comprehensive understanding of Molecular Cell Biology is highly recommended

Specific interest in the subject. Commitment active and dynamic students

High level of English is mandatory (Understanding, spoken writing).

Objectives and Contextualisation

Providing advanced training on the molecular mechanisms involved in signal transduction pathways and in the control of cell proliferation, and how these mechanisms are altered in the cancer cell.

Reviewing and updating key concepts of the field

Defining our current knowledge on the field, as well as identifying critical issues to be investigated.

Skills

- Analyse and correctly interpret the molecular mechanisms operating in living beings and identify their applications.
- Analyse and explain normal morphology and physiological processes and their alterations at the molecular level using the scientific method.
- Develop critical reasoning within the subject area and in relation to the scientific or business context.
- Identify and propose scientific solutions to problems in molecular-level biological research and show understanding of the biochemical complexity of living beings.
- Integrate contents in biochemistry, molecular biology, biotechnology and biomedicine from a molecular perspective.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use and manage bibliography and IT resources related to biochemistry, molecular biology or biomedicine.
- Use scientific terminology to account for research results and present these orally and in writing.

Learning outcomes

1. Describe, in molecular terms, the mechanisms involved in signal transduction and its alteration in cancer.
2. Develop critical reasoning within the subject area and in relation to the scientific or business context.
3. Discuss cases of molecular interactions that can trigger physiological reactions.
4. Distinguish the mechanisms of action of antitumour drugs.
5. Explain how the deregulation of normal processes in a tissue (angiogenesis, metabolism) affects tumour progression and degree of malignancy.
6. Explain, in molecular terms, the mechanisms that control the cell cycle and genomic integrity.
7. Explain the importance of tumoral stem cells in the process of tumoral progression and the relation to to the processes of cell differentiation and cell death.
8. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
9. Understand responses triggered by receptors of growth factors and antiproliferative factors.
10. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
11. Use and manage bibliography and IT resources related to biochemistry, molecular biology or biomedicine.
12. Use scientific terminology to account for research results and present these orally and in writing.

Content

Introduction (Anna Bassols). *How can we define cancer? Definition and tumor types. Origin, causes and carcinogen agets. Epidemiology and risk factors.*

Protein kinases (Nestor Gomez). *Structure, classification, regulation and its role in cancer.*

MAP kinases (Nestor Gomez). *MAP kinases in mammals and other organisms. MAP kinases function. Regulation of MAP kinases activity and subcellular localization. Inhibitors.*

Protein phosphatases (Nestor Gómez). *Classification, structure and regulation. Phosphatases and cancer*

The PI3-kinase pathway (Jose Miguel Lizcano). *The discovery of the PI3-kinase pathway. Role of the PI3-K signalling pathway on the activation of the AGC protein kinases Akt (PKB), and p70S6K.*

mTOR and PDK1 signaling to the AGC kinases (Jose Ramon Bayascas). *The PDK1 signalling network. Regulation of mTORC1 by nutrients. Insights into the regulation of mTORC2.*

The LBK1-AMPK- mTOR pathway (Jose Miguel Lizcano). *The signaling pathway regulated by the tumour supressor protein kinase LKB1.*

Protein kinase inhibitors in cancer (Jose Miguel Lizcano). *Protein kinase inhibitors for the therapeutic intervention in cancer*

Tumor supresor genes (Jose Ramon Bayascas). *Generalities. Tumor supresor genes in cell cycle, signalling, DNA repair, DNA methyilation and as microRNAs.*

Apoptosis and its role in cancer tumorogenesis and resistance (Victor Yuste). *Signal transduction in apoptosis. Necroapoptosis or programmed necrotic cell death. Senescence and its alteration in cell death. Apoptosis and cancer: importance of genome degradation in chemotherapy.*

Autophagy: principies and role in cancer (Guillermo Velasco; Universidad Complutense de Madrid). *Molecular and genetic mechanisms of autophagy. Role of autophagy in cancer.*

Cancer epigenetics (Nestor Gomez) *DNA Methylation. Chromatin/Histone modifications. Epigenetics in cancer and cell signalling.*

Cancer stem cells (To be announced)

The stromal component of tumors (Anna Bassols). *Molecular mechanisms mediating cell-cell and cell-substrate interactions. Components of the tumor stroma. How the stroma influences* tumor biology and behavior.

Cancer immunotherapy (Susana Puig; IDIBAPS, Barcelona)

Therapeutic strategies (Anna Bassols) *Radiotherapy. Chemotherapy. Hormone therapy. Immunotherapy. Some examples of targeted therapy.*

Mechanisms of resistance of cancer therapies (Violeta Serra; VHIO, Barcelona). *Predicting pathways for breast cancer resistance to Pi3-K/Akt/mTOR inhibitors*

Methodology

Oral lectures and student homework and preparation of different topics that will be discusses ath the classroom

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Lectures	45	1.8	9, 1, 4, 6, 7, 8
Type: Supervised			
Supervised work	52.5	2.1	9, 1, 2, 3, 4, 5, 6, 7, 8, 11, 12
Type: Autonomous			
Homework	125.5	5.02	9, 1, 3, 4, 5, 6, 7, 8, 10, 11, 12

Evaluation

Evaluation will be the result of:

1.Class attendance

2.Active participation/intearction during classes and seminars, by adressing questions and comments.

3.Oral defense of a journal paper.

4.Writing a scientific report

The student will not be evaluated ("Non-evaluable" mark) if misses more than 20% of the lectures, or in case she/he does not write a scientific project or she/he does not defend a journal paper.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Oral defense of a journal paper.	60	2	0.08	9, 1, 2, 3, 4, 5, 6, 7, 8, 11, 12
Writing a scientific report	40%	0	0	9, 1, 2, 3, 5, 6, 7, 8, 10, 11, 12

Bibliography

Molecular Biology of the Cell. Alberts et al. Garland Science. (2007). 5ed.

The Biology of Cancer. Weinberg. Garland Science. (2013). 2ed.

Targeting protein kinases for cancer therapy. Matthews and Gerritsen. Wiley. (2010). 1ed.

*Cell Signalling.*Wendell, Mayer and Pawson. Garland Science (2014). 1ed

Cancer Biology. King and Robins. Pearson Education. (2006) 3ed.

Signal Transduction in Cancer. Edited by David Frank. Kluwer Academic.(2003). (Access from the browser www.bib.uab.cat).

Molecular Biology of Human Cancers. Edited by Wolfgang Schultz. Kluwer Academic. (2006). (Access from the browser www.bib.uab.cat).