

# Master in Biomedical Research

Brief summary of contents of the compulsory subjects and  
list of optional courses

# Molecular and Cellular Pathology-30131

## Master in Biomedical Research

### 1. Subject Description

- Course name: Molecular and Cellular Pathology
- Trimester:1
- Degree: Master Biomedical Research. Subject code: 30131
- Credit number ECTS: 5. Hours of attendance/study: 125, of which 40-50 hours will correspond to classroom attendance.
- Language: English
- Teaching staff: Jose Aramburu (coordinator). Other professors/speakers will participate in specific lessons/seminars.

### 2. Course presentation

**Context:** This course will explore the mechanisms and processes utilized by eukaryotic cells to respond and adapt to stress. Stress is understood in a wide sense, as disturbances in the extracellular environment or intracellular conditions that deviate from normality and trigger a compensatory or adaptive response. These responses activate signaling cascades and transcriptional programs that enable cells to cope with stress and maintain their viability and functions. Since stress can threaten the genetic stability of the cell, stress responses often impinge on the cell cycle, cellular metabolism, viability and death and are relevant in disease.

**Focus:** The course is not intended as an in-depth study of cellular responses to a catalog of stressors, but rather will be mainly based on the analysis and discussion of selected problems, with a proportion of introductory lectures and research seminars that will help to situate the context and current views on the problems being discussed.

**Key aspects:** This is a core subject in a master with a clear orientation towards PhD studies, thus the use of problems and analysis of scientific literature is intended as a tool to allow students to transition from previous courses mainly based on lectures and well consolidated textbooks to the scenario of acquiring and applying information from fast-changing sources.

Problems will be prepared as cases or from published articles and will be given to the students, together with the relevant material, at the beginning of the course. Students are expected to actively engage in discussion and problem solving individually and in groups.

***Requisites:***

Language. The course will be entirely imparted in English, and the articles and class materials will be in English. Students are expected to have an English level sufficient to understand scientific articles, and basic conversational and writing skills to discuss and make oral and written presentations of scientific literature.

Previous formation. Classes will be at an advanced level, with an emphasis on the analysis of biological processes from a molecular, biochemical, and cellular basis. Students are expected to have knowledge on Cell Biology, Molecular Genetics and Biochemistry equivalent to the level achieved in a University degree in Biology, Biochemistry or Biotechnology.

**3. Competencies to be attained in the subject**

General:

1) To develop skills in acquisition, critical processing, and communication of scientific information, and proposal and discussion of hypothesis.

2) To acquire basic abilities to outline and design experimental approaches to solve specific questions.

Specific:

1) To acquire knowledge on fundamental responses of eukaryotic cells to different types of stress.

2) To be able to describe major mechanisms and signaling pathways involved in the detection of and response to different types of stress.

3) To be able to outline questions and plan research proposals on the above topics.

These competencies will unfold in the following aspects:

Instrumental:

Training of analytical and synthesis abilities.

Training in management of information sources.

Training in oral and written communication.

Interpersonal:

Training teamwork abilities (sharing tasks, collaborative work, criticise others, accept criticism from others).

Training abilities for discussion in group.

Systemic:

Training in problem solving, decision making and time management.

Ability to produce, test and project own ideas.

To train in working for quality.

**4. Contents of the course\***

1) Cellular adaptation to stress. Function and dysfunction of cells under stress and consequences for proliferation, survival and genetic stability.

2) DNA damage detection and repair mechanisms. Control of the cell cycle in response to DNA damage. Pathological alterations of DNA damage responses.

3) Energetic and metabolic stress. Mechanisms involved in sensing energy and nutrient availability. Integration of energetic stress and other stressors such as DNA damage.

4) Views on major signaling pathways regulating stress responses. Regulation of gene expression as an adaptive response to stress.

*\* Note: some parts within these topics are pending of confirming availability of speakers and might be substituted by related themes.*

**5. Evaluation**

Continued self-evaluation. There will be short tests at the end of a group of classes (approximately every week) for self-evaluation of concepts and instrumental abilities, in order to facilitate the student a self-assessment of her/his progress and

doubts. This evaluation activity will contribute to the final score, but does not substitute the final exam.

Exams. There will be a final exam in December covering all topics and activities done during the course. The exam will consist on a written test with conceptual and synthesis questions about the lectures and articles presented the course (see 3). It will also include an exercise of application of knowledge and analytical/problem solving skills by commentary and discussion of one representative article or problem. Percentages for the final grade are as follows:

During the period of classes:

1. Continued evaluation (30% of the total grade).
2. Problem presentation (30%, of which one half will come from an oral presentation and the other half from a written report during the period of classes).

Final exam:

3. December exam (written test): 40% of the total grade.

To pass, it is necessary to achieve at least 6/10 in the written test.

These evaluation activities are individual (except for the research reports presented by a group of students), and all are mandatory.

The dates with the specific evaluation activities will be announced at the beginning of the course.

*Classes and activities in all subjects of the trimester will end by the 3<sup>rd</sup> or 4<sup>th</sup> of December, leaving approximately 2 weeks for exams preparation. Exams usually take place between the 17<sup>th</sup> and 20<sup>th</sup> of December. Exam dates will be announced by the Academic Secretary.*

## **6. Bibliography**

The main sources of bibliography will be reviews on specific topics and selected original research articles. These are updated from year to year, and are available to students at the website of the course in Campus Global at the beginning of the classes.

In addition, a basic textbook on general cellular and molecular biology is highly recommended for basic notions and refreshing forgotten concepts.

An excellent reference book can be found in recent editions of “Molecular Biology of the Cell”, 5<sup>th</sup> Edition (2007) by Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter. Published by Garland Science.

Note that the 2002 edition is freely available at <http://www.ncbi.nlm.nih.gov/sites/entrez?db=Books>

## **7. Format and methodology**

The course will be divided into topics of current active research in different aspects of cellular homeostasis and stress responses.

The format and distribution of the lessons will be: **a)** lectures will be used to present an overview of current topics (20-30%); **b)** session of article discussion and problem solving (60%); and **c)** seminars by invited speakers (10-20%).

The duration of the course is 5 weeks.

Lessons will comprise 40 hours. Attendance is mandatory.

Besides attendance to lessons, students will be assigned specific tasks (directed activities, such as presentation of articles and problems) whose calendar, as that of the lessons, will be posted at the website of the course at the beginning of classes. These activities will be organized as individual or group work and their load will be distributed along the course. Preparation of directed activities outside of the classroom plus autonomous hours of personal study along the 5 weeks of the course requires approximately 80 hours per student.

*Classes and activities in all subjects of the trimester will end by the 3<sup>rd</sup> or 4<sup>th</sup> of December, leaving approximately 2 weeks for exam preparation. Exams usually take place between the 17<sup>th</sup> and 20<sup>th</sup> of December. Exam dates will be announced by the Academic Secretary.*

# Molecular Pathology of Systems-30130

## Master in Biomedical Research

### 1. Subject Description

- Course name: Molecular and Cellular Pathology
- Trimester:1
- Degree: Master Biomedical Research. Subject code: 30130
- Credit number ECTS: 5. Hours of attendance/study: 125, of which 40-50 hours will correspond to classroom attendance.
- Language: English
- Teaching staff: José Aramburu and Cristina López-Rodríguez (coordinators). Other professors/speakers will participate in specific lessons/seminars.

### 2. Course presentation

**Context:** This course will explore the molecular and cellular basis of diseases that have an important social and healthcare impact such as cancer, cardiovascular diseases, neuropsychiatric disorders, chronic inflammatory diseases and immunological disorders. The course will have a greater depth in exploring well known paradigms of cellular and molecular processes whose deregulation affects immune function and cancer, and will also introduce views on current research in vascular disease and neurological disorders.

**Focus:** The course is not intended as an exhaustive listing of processes altered in diseases, but rather will be mainly based on the analysis and discussion of selected problems, with a proportion of introductory lectures and research seminars that will help to situate the context and current views on the problems being discussed.

**Key aspects:** This is a core subject in a master with a clear orientation towards PhD studies, thus the use of problems and analysis of scientific literature is intended as a tool to allow students to transition from previous courses mainly based on lectures and well consolidated textbooks to the scenario of acquiring and applying information from fast-changing sources.

Problems will be prepared as cases or from published articles and will be given to the students, together with the relevant material, at the beginning of the course. Students are expected to actively engage in discussion and problem solving individually and in groups.

***Requisites:***

Language. The course will be entirely imparted in English, and the articles and class materials will be in English. Students are expected to have an English level sufficient to understand scientific articles, and basic conversational and writing skills to discuss and make oral and written presentations of scientific literature.

Previous formation. Classes will be at an advanced level, with an emphasis on the analysis of biological processes from a molecular, biochemical, and cellular basis. Students are expected to have knowledge on Cell Biology, Molecular Genetics and Biochemistry equivalent to the level achieved in a University degree in Biology, Biochemistry or Biotechnology.

**3. Competencies to be attained in the subject**

General:

1) To develop skills in acquisition, critical processing, and communication of scientific information, and proposal and discussion of hypothesis.

2) To acquire basic abilities to outline and design experimental approaches to solve specific questions.

Specific:

1) To correlate dysfunctions in molecules and cellular processes with disease.

2) To identify and describe major hallmarks and processes of oncogenic transformation and tumor progression.

3) To identify and describe major cellular and molecular mechanisms involved in the response of eukaryotic cells to pathogens.

These competencies will unfold in the following aspects:

Instrumental:

Training of analytical and synthesis abilities.

Training in management of information sources.

Training in oral and written communication.

Interpersonal:

Training teamwork abilities (sharing tasks, collaborative work, criticise others, accept criticism from others).

Training abilities for discussion in group.

Systemic:

Training in problem solving, decision making and time management.

Ability to produce, test and project own ideas.

To train in working for quality.

#### **4. Contents of the course\***

1) The tumor cell. The process of cellular transformation and tumor formation.

2) Mechanisms utilized by tumor cells to survive and propagate. Subversion of cell growth and proliferation control in tumor cells.

3) The connection between inflammation and cancer.

4) Alterations in pathogen recognition mechanisms and disease.

*\* Note: some parts within these topics are pending of confirming availability of speakers and might be substituted by related themes.*

#### **5. Evaluation**

Continued self-evaluation. There will be short tests at the end of a group of classes (approximately every week) for self-evaluation of concepts and instrumental abilities, in order to facilitate the student a self-assessment of her/his progress and doubts. This evaluation activity will contribute to the final score, but does not substitute the final exam.

Exams. There will be a final exam in December covering all topics and activities done during the course. The exam will consist on a written test with conceptual and synthesis questions about the lectures and articles presented the course (see 3). It will also include an exercise of application of knowledge and analytical/problem solving

skills by commentary and discussion of one representative article or problem. Percentages for the final grade are as follows:

During the period of classes:

1. Continued evaluation (30% of the total grade).
2. Problem presentation (30%, of which one half will come from an oral presentation and the other half from a written report during the period of classes).

Final exam:

3. December exam (written test): 40% of the total grade.

To pass, it is necessary to achieve at least 6/10 in the written test.

These evaluation activities are individual (except for the research reports presented by a group of students), and all are mandatory.

The dates with the specific evaluation activities will be announced at the beginning of the course.

*Classes and activities in all subjects of the trimester will end by the 3<sup>rd</sup> or 4<sup>th</sup> of December, leaving approximately 2 weeks for exam preparation. Exams usually take place between the 17<sup>th</sup> and 20<sup>th</sup> of December. Exam dates will be announced by the Academic Secretary.*

## **6. Bibliography**

The main sources of bibliography will be reviews on specific topics and selected original research articles. These are updated from year to year, and are available to students at the website of the course in Campus Global at the beginning of the classes.

In addition, basic textbooks on general cellular and molecular biology and immunology are recommended for basic notions and refreshing forgotten concepts.

An excellent reference book can be found in recent editions of "Molecular Biology of the Cell", 5<sup>th</sup> Edition (2007) by Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter. Published by Garland Science.

For an excellent background in immunology, see "Cellular and Molecular Immunology", 6<sup>th</sup> Edition (2007), by Abul K. Abbas, Andrew H. Lichtman, and Shiv Pillai. Published by Elsevier Science.

Note that NCBI website contains a number of previous editions of freely available books on numerous disease-related disciplines at <http://www.ncbi.nlm.nih.gov/sites/entrez?db=Books>

## **7. Format and methodology**

The course will be divided into topics of current active research in different aspects of cellular homeostasis and stress responses.

The format and distribution of the lessons will be: **a)** lectures will be used to present an overview of current topics (40%); **b)** session of article discussion and problem solving (40%); and **c)** seminars by invited speakers (10-20%).

The duration of the course is 5 weeks.

Lessons will comprise 40 hours. Attendance is mandatory.

Besides attendance to lessons, students will be assigned specific tasks (directed activities, such as presentation of articles and problems) whose calendar, as that of the lessons, will be posted at the website of the course at the beginning of classes. These activities will be organized as individual or group work and their load will be distributed along the course. Preparation of directed activities outside of the classroom plus autonomous hours of personal study along the 5 weeks of the course requires approximately 80 hours per student.

*Classes and activities in all subjects of the trimester will end by the 3<sup>rd</sup> or 4<sup>th</sup> of December, leaving approximately 2 weeks for exams preparation. Exams usually take place between the 17<sup>th</sup> and 20<sup>th</sup> of December. Exam dates will be announced by the Academic Secretary.*

## **Optional subjects:**

For description and contexts, go to:

<http://www.upf.edu/postgraubiomed/biomed/syllabus/>

- Cell Communication.
- Genes and Cell Function.
- Model Organisms in Biomedical Research.
- Genomes and Systems.
- Elements of Biocomputing.
- Introduction to Biomedicine.
- Advanced Seminars in Biomédicas Research.
- Science in Action
- Progressos en Neurociències (classes are in Spanish).
- Comunicació Científica (classes are in Catalan).
- Epidemiologia (classes are in Catalan).