



Universitat de Lleida

DEGREE CURRICULUM  
**CELLULAR AND MOLECULAR  
PATHOLOGY**

Coordination: DOLCET ROCA, FRANCESC XAVIER

Academic year 2021-22

## Subject's general information

<b>Subject name</b>	CELLULAR AND MOLECULAR PATHOLOGY			
<b>Code</b>	101510			
<b>Semester</b>	PRIMER QUADRIMESTRE			
<b>Typology</b>	<b>Degree</b>	<b>Course</b>	<b>Character</b>	<b>Modality</b>
	Bachelor's Degree in Biomedical Sciences	2	COMPULSORY	Attendance-based
	Master's Degree in Biomedical Research		COMPLEMENTARY TRAINING	Attendance-based
<b>Course number of credits (ECTS)</b>	6			
<b>Type of activity, credits, and groups</b>	<b>Activity type</b>	PRALAB	PRAULA	TEORIA
	<b>Number of credits</b>	1	1.5	3.5
	<b>Number of groups</b>	3	2	1
<b>Coordination</b>	DOLCET ROCA, FRANCESC XAVIER			
<b>Department</b>	BASIC MEDICAL SCIENCES			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Distribution of credits</b>	Attendance class credit 6 ECTS Non-attendance credits 15 ECTS Theory classes 3,5 ECTS Practical classes 1,5 ECTS Seminars 1 ECTS			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
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## Learning objectives

### Competence 27

#### Aims

To understand and know how to apply the concepts specified in the theoretical program established in the topics of the program Understand the terminology and basic scientific language related to injury, repair and cell death. Understand the most common cellular and subcellular disorders Know how to use the concepts related to these thematic contents to interpret physiological aspects and human pathology.

### Competence 28

#### Aims

To understand and know how to apply the concepts specified in the theoretical program established in the program topics and in scheduled seminars. Understand the terminology and basic scientific language related to research and research in a molecular diagnostic laboratory. Know how to use the concepts related to these thematic contents to interpret physiological aspects and human pathology.

### Competence 40

#### Aims

To understand and know how to apply the concepts specified in the theoretical program established in the program topics and in scheduled seminars. To know the models and systems of study in molecular and cellular pathology. Learn the basic techniques in molecular pathology through scheduled laboratory practices To know the terminology and basic scientific language related to diagnostic research in a molecular pathology laboratory.

### Competence 41

#### Aims

To understand the main molecular diagnostic tests in a laboratory of pathological anatomy and molecular genetics Acquire practical skills in sample handling and processing. Become familiar with the basic scientific language related to research and diagnosis in a pathological anatomy laboratory.

### Competence 42.

#### Aims

To know and apply the basic techniques of sample processing in a molecular pathology laboratory. Acquire practical skills in sample handling and processing. To know the terminology and basic scientific language related to research and research in a molecular diagnostic laboratory.

## Competences

- 27. To understand and know how to recognize tissue characteristics at the cellular and molecular levels in the different situations of injury, adaptation and cell death.
- 28. To understand and know how to use biochemical, cytogenetic and molecular biology markers applied to clinical diagnosis.
- 40. To understand the methods of diagnosis and study of genetic variation
- 41. To know how to obtain and process a biological sample for its study by means of the different diagnostic procedures
- 42. To understand and understand the most common parameters used in the description of the main diagnostic tests in the laboratory

## Subject contents

### THEORY PROGRAM

#### **CAUSES AND MECHANISMS OF PATHOGENESIS: CELL INJURY, ADAPTATION AND CELL DEATH.**

##### **1. Introduction to molecular and cellular pathology.**

- 1.1. The branches of pathology and their relationship with other disciplines.
- 1.2. Contributions of molecular pathology to the knowledge of the disease.
- 1.3. Brief historical analysis and evolution of the Pathology.

##### **2. Genetic and epigenetic alterations in the development of pathologies.**

- 2.1. Genetic alterations: mutations.
- 2.2. Epigenetic alterations: methylation, acetylation, microRNAs and lncRNAs. 2.3. Techniques for detecting genetic and epigenetic alterations: PCR and FISH, sequencing techniques, other molecular alteration detection techniques.
- 2.5 Techniques for detecting protein alterations: immunohistochemistry and cytometry.
- 2.6. Models of study of genetic diseases.

##### **3. Alterations in cellular communication in the development of pathologies. .**

- 3.1. Basic mechanisms of intracellular signaling.
- 3.2. Alterations in reception and signal transduction as the basis of pathologies

3.3. Classification and alterations in the main signaling pathways. Examples

#### **4. Cellular injury: causes and mechanisms.**

4.1. Loss of cell homeostasis: from stress to cell injury.

4.2. Type of agents causing injury. Molecular mechanisms of cell injury.

4.3. Examples of types of injury.

#### **5. Responses to cellular stress: cell adaptation.**

5.1. Maintenance mechanisms of cell homeostasis.

5.2. Cellular adaptations of growth and differentiation: Atrophy, hypertrophy, hyperplasia, metaplasia.

5.3. Autophagy

#### **6. Responses to cell injury: Subcellular disorders.**

6.1. Water accumulation.

6.2. Intracellular deposits of triglycerides and cholesterol.

6.3. Protein deposits. Response to the accumulation of misfolded proteins (UPR).

6.4. Pigment accumulations.

6.5. Metabolic disorders of iron and copper: hemochromatosis and Wilson's disease.

6.6. Intercellular deposits of carbohydrates.

6.7. Dystrophic and metabolic calcifications.

#### **7. Responses to irreversible cell injury: cell death.**

7.1. Types and classification of cell death.

7.2 Types of necrosis.

**7.3. Types, causes, morphological and molecular changes of apoptosis.** Alterations of apoptosis in the development of pathologies.

7.4 Necroptosis

7.5 Other types of cell death

#### **REACTION, RESOLUTION AND CONSEQUENCES OF THE INJURY.**

#### **8. Reaction to injury: Inflammation.**

8.1. Concept and type of inflammation.

8.2 Acute inflammation

8.3.Chronic inflammation.

8.4. Chemical mediators of inflammation. Etiological agents of chronic inflammation.

8.5 Inflammation and repair mechanisms.

8.6. Inflammation in the development of diseases

**9. Recovery of cell injury: repair and cell regeneration.**

9.1. Cell repair and regeneration concepts.

9.2 Stem cells in cell regeneration.

9.3. Tissue repair due to scarring and fibrosis.

9.4. Stem cells in regenerative medicine.

**10. Consequences of the accumulation of lesions: cell aging. 10.1.Definition of aging and senescence**

10.2.Causes, characteristics and molecular mechanisms of cell aging.

**11. Consequences of the accumulation of lesions: oncological pathologies.**

11.1.Neoplasms: definitions and terminology. Epidemiology of cancer.

11.2 Molecular bases of cancer.

11.3.Biology of tumor growth.

**RESEARCH AND DIANÒSTIC AND TREATMENT OF PATHOLOGIES.**

**12. Application of new technologies in the detection and treatment of pathologies.**

**13. Treatment of pathologies: introduction to personalized medicine.**

**14. Morphological diagnosis of pathologies: I. Cytological studies. II. Biopsies**

**LABORATORY PRACTICES**

1. Microscopic observation of samples with cell pathologies: proliferation, differentiation and cell death, cell

adaptations, subcellular alterations, inflammation.

2. Determination of molecular alterations by PCR

3. Immunohistochemistry and Immunofluorescence of biomarkers. Determination of tumor invasion in the sentinel node.

## **SEMINARS**

Problem solving seminars based on the concepts taught in the theoretical classes.

## Methodology

- Master classes (3.5 ECTS). They are performed with all students in the course. They aim to teach the theoretical concepts of the different aspects in the study of cancer. Although the classes are scheduled to be in class attendance, in the course 2020-21, due to the situation of Covid-19 pandemic, the master classes could happen to have semipresentative format. This will be applicable to seminars and practices.
- Laboratory practices (1.5 ECTS). They are done with half the class. The purpose of laboratory practices is for students to become familiar with the basic techniques of work in research and diagnosis in molecular pathology. Students must acquire skill and skill in handling samples and executing laboratory protocols.
- Seminars (1.5 ECTS). They are performed with half of the class. In seminars, we will deepen in theoretical concepts taught in the master classes and we will solve problems based on the basic molecular and cellular pathology concepts.

## Development plan

In the 2020-21 academic year, due to health recommendations due to the Covid-19 pandemic situation, lectures and seminars will be held virtually through the visual campus video conferencing application.

The first class of theory, and thanks to having a classroom large enough that allows us to respect the capacity limits, we will do it in person, in order to get to know us and be able to present the subject and how we will try to develop it during this very special course.

For the practices, given the limited capacity of the laboratories, they groups corresponding half class will be subdivided into two groups, one of the two subgroups will work in person while the other will do it on a virtual way.

## Evaluation

The final grade will be the sum of the different aspects evaluated:

- Theory concepts knowledge will be evaluated by means of two tests exams. The result obtained in this exam will constitute 60% of the final grade.
- The completion and participation in all the scheduled activities (seminars and virtual activities) will represent 15% of the final grade.

- Practical activities will be evaluated by assistance and a test test that will represent 25% of the final grade.
- As far as possible the examinations will be carried out in person. Only in the event that the situation generated by the Covid-19 does not allow it, will they be done virtually.

## Bibliography

Rubin's Pathology. Clinicopathologic foundations of Medicina. 7th Edition. Ed Wolters Kluwer, 2015

Robins and Cotran. Pathologic Basis of Disease. 9th Edition. Ed Elsevier Saunder, 2015.

Coleman and Tsongalis. (2010) -Essential concepts in molecular pathology. Elsevier Academic press corp.

Tubbs and Stoler. (2009). Cellular and Tissue Based Molecular Pathology. Elsevier

Cagle et al. (2009) - Basic Concepts of Molecular Pathology. Springer.