



## COURSE DATA

### Data Subject

<b>Code</b>	33961
<b>Name</b>	Molecular Pathology
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	4.5
<b>Academic year</b>	2020 - 2021

### Study (s)

Degree	Center	Acad. year	Period
1205 - Grado de Nutrición Humana y Dietética	Faculty of Pharmacy	2	Second term
1211 - PDG Farmacia-Nutrición Humana y Dietética	Faculty of Pharmacy	5	Second term

### Subject-matter

Degree	Subject-matter	Character
1205 - Grado de Nutrición Humana y Dietética	21 - Molecular pathology and physiopathology	Obligatory
1211 - PDG Farmacia-Nutrición Humana y Dietética	1 - Asignaturas obligatorias del PDG Farmacia-Nutrición Humana y Dietética	Obligatory

### Coordination

Name	Department
GUASCH AGUILAR, ROSA	30 - Biochemistry and Molecular Biology
MIRALLES FERNANDEZ, VICENTE	30 - Biochemistry and Molecular Biology
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## SUMMARY

Molecular Pathology is a compulsory second year course (second semester) in the degree of Human Nutrition and Dietetics and in the fifth year (second semester) in the degree of Pharmacy and Nutrition and Dietetics, which is taught in the Faculty of Pharmacy, University of Valencia. This course provides the curriculum for a total of 4,5 ECTS.

The main objective of the course is to understand the molecular and biochemical basis of major endocrine-metabolic syndromes, as well as some of the organic-functional disorders more common in the human population.

The minimum concepts acquired by the student of Molecular Pathology include:

- Basic concepts in molecular pathology.
- The molecular basis of disease.



- Techniques of molecular diagnostics.
- Molecular pathology of metabolic diseases.
- The molecular basis of cancer.
- Nutrition, signal transduction and gene expression.

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

### Other requirements

Before initiating the course in Molecular Pathology it is necessary to have assimilated a series of concepts that the student should have acquired in basic subjects studied during the first year courses as well as in the first semester of the second year. In particular, students must have completed the subjects of Biology, Physiology, Biochemistry I and Biochemistry II.

## OUTCOMES

### 1205 - Grado de Nutrición Humana y Dietética

- Apply scientific knowledge of physiology, physiopathology, nutrition and food to offer dietary planning and advice to both healthy and sick individuals and communities throughout their life cycle.
- Skills in analysis and synthesis.
- Saber cómo plantearse problemas y utilizar los métodos adecuados para su resolución, siendo capaz de llevar a cabo un razonamiento crítico.
- Ser capaz de trabajar en equipo y de organizar y planificar actividades.
- Ser capaz de llevar a cabo una comunicación oral o escrita.
- Develop the capacity to gather and convey information in English at a level equivalent to the B1 level in the Common European Framework of Reference for Languages.
- Know the major diseases at the molecular level.
- Know the molecular basis for applying dietary treatments to diseases.
- Understand the epigenetic regulation of nutrients.
- Know the influence of nutrition on pathological states and vice versa.

## LEARNING OUTCOMES

Learning outcomes to be achieved with the Molecular Pathology course can be summarized as follows:

- Learn and understand human genetic variability, its biological significance, and its relationship and involvement in human pathology and therapeutic response.
- To understand the molecular basis and the biochemical mechanism (genetic, structural and / or functional alterations) of certain diseases, as a rational approach to diagnosis, treatment and prevention.



- To learn the main techniques used in the diagnosis and treatment of certain diseases.
- Understand how different food components, both nutrients and other non-nutrient chemicals, affecting the health of individuals through the alteration of the structure and expression of genes.
- Understand how the genetic variants of individuals influence the metabolic utilization of nutrients.
- Learn the most appropriate nutritional guidelines for the treatment and prevention of certain diseases.

## DESCRIPTION OF CONTENTS

### 1. Molecular basis of disease

General concepts. Genes and chromosomes. Flow of genetic information. Mutations. Genes, environment and disease. Categories of genetic diseases.

### 2. Molecular diagnostic techniques and Treatment of genetic diseases

Tools and methods for detecting mutations. Examples of application of diagnostic techniques. Preimplantation diagnosis. Prenatal diagnosis. Postnatal diagnosis. Treatment of clinical phenotype. Treatment directed to the metabolic/protein defect phenotype. Gene therapy. Therapeutic potential of stem cells.

### 3. Disorders of carbohydrate metabolism.

Metabolism of fructose: essential fructosuria and hereditary fructose intolerance. Metabolism of galactose, galactosemia. Impaired glucose 6-phosphate dehydrogenase. Disorders of glycogen metabolism: glycogen storage disease.

### 4. Diabetes mellitus.

Definition. Biosynthesis and secretion of insulin. Intracellular effects of insulin. Carbohydrate homeostasis. Classification: diabetes mellitus type I, diabetes mellitus type II, other specific types, gestational diabetes. Diagnosis. Metabolic abnormalities in diabetes. Complications. Control of the diabetic patient

### 5. Hypoglycemia. Metabolic syndrome

Hypoglycemia. Definition. Regulatory responses. Causes. Classification. Biochemical diagnosis. Definition, epidemiology and biochemical profile Metabolic syndrome. Diagnostic criteria. Treatment.

### 6. Metabolism of plasma lipoproteins: dyslipoproteinemias. Hypercholesterolemia and atherosclerosis.

Characteristics of plasma lipoproteins. Lipoprotein metabolism. Alterations in lipoprotein metabolism: dyslipoproteinemias. Diagnosis. Hypercholesterolemia and atherosclerosis. Dyslipoproteinemias treatment. Dietary factors in the regulation of cholesterol and triglycerides.



### 7. Disorders of amino acid metabolism

Disorders of amino acid catabolism. Hyperphenylalaninemia and phenylketonuria. Hyperhomocysteinemia and homocystinuria. Alkaptonuria. Disorders of urea cycle. Nutritional treatments

### 8. Disorders of purine metabolism

Disorders of pyrimidine nucleotides metabolism: hereditary orotic aciduria. Disorders of purine nucleotides metabolism: immunodeficiencies. Alterations of the salvage pathway: Lesch-Nyhan syndrome. Hyperuricemia and gout.

### 10. Molecular pathology of iron metabolism.

Importance of iron in humans. Metabolism and regulation associated genetic pathologies: Hemochromatosis. Nutritional anemias.

### 11. Calcium and phosphate metabolism. Molecular basis of genetic and nutritional bone disease.

Calcium and phosphate metabolism. Nutritional interest. Bone remodeling. Molecular pathology of genetic bone diseases (Osteogenesis imperfecta, osteopetrosis) and nutrition (rickets, osteomalacia, osteopenia and osteoporosis)

### 12. Molecular pathology membrane transport: Cystic fibrosis

Molecular basis of cystic fibrosis pathology associated model membrane transport. Classification of mutations. Clinical phenotypes. Nutritional interest of phenotypes with pancreatic insufficiency. Diagnosis and Treatment.

### 13. Molecular basis of celiac disease

Definition. Clinical manifestations. Etiopathogenesis. Diagnosis. Treatment.

### 14. Regulation of gene expression by nutrients

Introduction. Concepts of nutrigenomics, nutrigenetics and nutriepigenética. Regulation of gene expression by carbohydrates. Regulation of gene expression by lipids. Regulation of gene expression by amino acids and other nitrogen-containing compounds. Regulation of gene expression by vitamins and minerals. Regulation of gene expression by other food components. Nutritional influences on epigenetic patterns, gene expression and phenotypes.

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Tutorials	2,00	100
Seminars	2,00	100
Development of group work	6,00	0
Development of individual work	6,00	0
Study and independent work	29,50	0
Preparing lectures	26,00	0
<b>TOTAL</b>	<b>109,50</b>	

**TEACHING METHODOLOGY**

The course is structured as follows:

**Lectures:** consists of 38 sessions of one hour in which they will be presented with the concepts necessary to enable students to learn each of the concepts. These concepts will be reinforced with other proposed activities, including individual study, the resolution of problems, preparation of seminars by students and tutorials as well as attendance at both.

**Specialized group Tutorials:** There will be 2 compulsory sessions of one hour, in groups of 16 students, distributed throughout the semester to cover the different thematic blocks of the course. These sessions reinforce the concepts presented in the lectures and encourage the active participation of students. To do this, the teacher will pose questions to be discussed during the session.

**Coordinated Seminars:** Presentation of the seminar will be compulsory and cover topics proposed by the professor. The presentations will be organized in groups of students. Each of these groups must submit a written report on the proposed topic, including references used for the preparation thereof. The seminar will be public and may employ any means of presentation that the group members see fit. The presentation will be followed by discussion among the audience, moderated by the professor.

The seminars will follow the respective guidelines on coordinated seminars of the Degree in Human Nutrition and Dietetics and of the Double Degree (Pharmacy and Human Nutrition and Dietetics) available at the web page of the faculty.

The DG seminars, which are not coordinated, will cover current topics, student expositions, lectures and / or clinical case defense.



## EVALUATION

The knowledge gained by the student will be assessed by a final evaluation. The final score is 100, broken down into:

- **Evaluation of the theoretical knowledge:** There will be an exam consisting of any combination of multiple-choice and/or short answer questions. The score for this exam is 75.
- **Evaluation of the seminars:** The preparation and presentation of the seminars is mandatory for the student. It will be graded by 10 in the final score. The student's ability to obtain information from bibliographic sources, prepare a team work, present it in public and discuss different aspects of it with the classmates and the teacher will be evaluated.
- **Written assignments:** During the semester, the student will be required to make written assignments on topics related to the content of the course, subjects of current interest in biochemistry, etc., which will contribute 15% to the final score.

**It will be necessary to pass each of the sections separately in order to pass the course.** Thus, it will be necessary to obtain a minimum of 37.5 in the theoretical exam, 5 in the seminar and 7.5 in written assignments.

**Attendance at tutorials and seminars is mandatory** (except for students who did not pass the course). Non-attendance could result in a 10% penalty in the final score.

Students who do not pass the course in the first call will be able to save each part that obtained the minimum score to pass the course for the second call.

## REFERENCES

### Basic



- Burtis CA, Ashwood ER, Bruns DE (eds.) Tietz textbook of clinical chemistry and molecular diagnostics 4 ed. Saunders Company. 2006.
- Devlin TM. Bioquímica: libro de texto con aplicaciones clínicas. 4ª ed. Ed. Reverté, Barcelona, 2004 (6ª ed. en inglés, 2006)
- Gil A. Tratado de Nutrición Tomo I. Bases Fisiológicas y Bioquímicas de la Nutrición. Ed. Panamericana. 2ª ed. 2010.
- González de Buitrago JM, Medina-Jiménez JM. Patología Molecular. McGraw-Hill Interamericana. 2001.
- González Hernández A. Principios de Bioquímica Clínica y Patología Molecular. Ed. Elsevier 2ª ed. 2018.
- Henry JB. Clinical diagnosis and management by laboratory methods 20th ed. W.B. Saunders Company, 2001.
- Kaplan LA, Pesce AJ Kazmierczak Sc (eds.) Clinical chemistry. Theory analysis, correlation 4ª ed. Mosby, 2003.
- Kasper DL., et al. Harrison: Principios de Medicina Interna 16ª ed. McGraw-Hill, 2006.
- Lieberman M, Marks AD. basic medical biochemistry. A clinical approach. 3ª ed. Lippincott Williams & Wilkins, 2009.
- Marshall WJ, Bangert SK Clinical Chemistry 5ª ed. Elsevier Health Science, 2006.
- Rosenthal MD, Glew RH. medical Biochemistry. Human metabolism in health and disease. Jhon Wiley & Sons, Inc. 2009.
- Scriver CR., et al. The metabolic and molecular bases of inherited disease 8ª ed. McGraw-Hill, 2001.
- Smith C., et al. Bioquímica básica de Marks. Un enfoque clínico. 2ª ed. McGraw-Hill Interamericana, 2006.

#### **Additional**

- Lodish H., et al. Biología celular y molecular 5ª ed. Editorial Médica Panamericana, 2005.
- Nelson DL, Cox MM. Lehninger. Principios de Bioquímica 5ª ed. Ediciones Omega, Barcelona, 2009.
- Voet D, Voet JG, Pratt CW. Fundamentos de bioquímica. La vida a nivel molecular. 2ª ed. Ed. Panamericana, Madrid, 2007.

## **ADDENDUM COVID-19**

**This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council**

### **1.- CONTENT**

The course contents are kept as initially included in the syllabus.

### **2. WORKLOAD AND TEMPORARY PLANNING OF THE TEACHING**

The student workload is kept as in the syllabus. However, the methodology of the activities is changed respect to the conventional syllabus. This is due to the adapted hybrid teaching model because of the current situation.

### **3.- TEACHING METHODOLOGY**



1.- Theoretical teaching: it will be carried out by both synchronous sessions (synchronized videoconferences on the BBC, or other technology indicated by the Center) and in-person learning. In order to have fewer students per classroom their distribution will be, in alternate weeks, as follow: 50% of students will be in classroom while the other 50% will attend on line. Classes will be held following the schedule (date and time) approved by the Center Board. All teaching will be on line in case of shutdown restrictions.

2.- Tutorials: They will be in-person learning according to the schedule (date and time).

3.- Coordinated or non-coordinated seminars: They will be in-person learning according to the schedule (date and time).

#### **4.- EVALUATION**

If pandemic circumstances allow it, the knowledge gained by the student will be assessed by an in-person evaluation according to the syllabus. There will be an on-line exam consisting of any combination of multiple-choice and/or short answer questions, in case the pandemic circumstances do not allow in-person learning. Alternatively, oral evaluation by videoconference could also be possible.

Grading for theory and tutorials will be kept as in the syllabus.