

**COURSE DATA****Data Subject**

<b>Code</b>	34105
<b>Name</b>	Clinical Biochemistry and Molecular Pathology
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	4.5
<b>Academic year</b>	2021 - 2022

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
1201 - Degree in Pharmacy	Faculty of Pharmacy and Food Sciences	5	First term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1201 - Degree in Pharmacy	42 - Clinical biochemistry and molecular pathology	Optional

**Coordination**

<b>Name</b>	<b>Department</b>
LOPEZ GARCIA, MARIA PILAR	30 - Biochemistry and Molecular Biology

**SUMMARY**

*Clinical Biochemistry and Molecular Pathology* is one of the optional subjects that conform the intensification in “Clinical Training” of the degree in Pharmacy of the University of Valencia. From an essentially molecular perspective, this subject proposes an integral and updated approach to the comprehensive understanding of (i) the causes and mechanisms that trigger human disease and explain their clinical signs (the rational basis for its diagnosis and treatment), (ii) the biochemical changes that the disease causes in our organism, and, (iii) the different biochemical markers and the functional tests currently used in clinical practice and their application to the diagnosis, prognosis, control of evolution, therapeutic monitoring, prevention, and research of disease.

The programme, that is particularly focused on developing practical skills, presents an integrated view of the molecular basis and the clinical biochemistry of the endocrine-metabolic syndromes and the organic-functional pathologies of greater prevalence in the human population, in which the clinical biochemistry laboratory plays a particularly relevant role, emphasizing the importance of these knowledge in the professional activity of the pharmacist.



## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

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

### Other requirements

It is recommended:

- Basic knowledge of Physiology, Physiopathology, Biochemistry and Molecular Biology
- Students must have completed the subject Clinical Biochemistry and Haematology (4th year)
- English language (scientific, at translation level)

## OUTCOMES

### 1201 - Degree in Pharmacy

- Reinforce the acquisition of the general competences of the Curriculum of Degree in Pharmacy.
- To know the molecular basis and the biochemical mechanism (genetic, structural and/or functional abnormalities) of disease as a rational approach to diagnosis, treatment and prevention, the identification of new therapeutic targets, and the selection and identification of new biomarkers of potential clinical interest
- To know the foundation and clinical utility of the different biochemical markers and functional tests currently applied to diagnosis, prognosis, disease evolution and therapeutic monitoring
- Identify and know how to apply the appropriate specific biochemical markers for the evaluation of population health level (individual and collective) and for prevention of disease in primary and secondary care
- Know and understand the mechanisms responsible for the genetic variability that characterizes the human being, and the involvement of genetic polymorphism in human pathology and response to drug therapy
- Ability to interpret, in a global and integrated way, the overall laboratory results of a particular patient, and to understand the analytical strategy for the differential diagnosis of the different entities
- To know the analytical techniques of the Clinical Biochemistry laboratory and be able to assimilate and incorporate future innovations, both in its technical aspect and in relation to the clinical utility of each new biomarker
- To develop the capacity for informed scientific argumentation and the habit in the use of clinical terminology as a natural means of communication with other professionals in the health field
- Develop the necessary skills to communicate and inform the patient and/or user of the contents and implications of laboratory reports in the appropriate terms



## LEARNING OUTCOMES

The **ultimate goal** of this course is to enable students to the practical, sensible and competent application of the knowledge and skills acquired in their future professional activity as pharmacists, also emphasizing the particular interest of “Clinical Biochemistry” as an specific field of postgraduate specialization.

As **specific learning outcomes**, on successful completion of the course the student will be able to:

- *Demonstrate a working knowledge and confident use of the medical language and terminology*, as essential condition in the health care interface (physician-patient) in which the pharmacist develops his activity,
- *Understand and describe the molecular mechanisms underlying the pathogenesis of most major human diseases and its clinical/biochemical features*, as a rational basis for its diagnosis and treatment
- *Appreciate the contribution of Clinical Chemistry and Molecular Pathology to the current advances in several areas of biomedical research*
- *Show and apply the necessary practical skills for the integration of laboratory results in a general diagnostic strategy, the correct interpretation of the biochemical tests, and their application in the differential diagnosis, monitoring or prevention of human disease, and the screening of individuals/populations at risk of a particular clinical condition*

Teaching design will train the students in the logical and orderly approach to the disease and its exploration, and in the efficient identification of the best scientific evidence (reliable sources), in order to develop and enhance their competence and capacity for *self-learning and continuous updating*, essential capabilities in all healthcare professional against foreseeable obsolescence of the university formation received.

## DESCRIPTION OF CONTENTS

### 1. Introduction to Clinical Biochemistry and Molecular Pathology

This unit will introduce the discipline, and will cover the definition and scope of study of Clinical Biochemistry and Molecular Pathology, its integration into the Pharmacy degree, the general learning objectives pursued, and the character of Clinical biochemistry as a biomedical specialty. We will consider the relationship between genes, environment and disease, the current concept of genetic and acquired disease, and the general molecular mechanisms involved in the pathogenesis of human disease.

### 2. Molecular basis of human disease

The unit features functional and methodological aspects of human genome, the genetic basis of the disease (causal genes vs. susceptibility genes), and the application of these concepts to the molecular description and diagnosis of the disease. We will review the general sources of variation in the human genome, the polymorphisms with greater clinical interest, the different types of genetic disease and its inheritance pattern, and the general methods applied for the study and diagnosis of genetic disease.



### **3. Clinical Biochemistry and Molecular Pathology of endocrine-metabolic diseases**

The unit will develop an integrated view of the molecular basis and current laboratory testing of the endocrine-metabolic syndromes more commonly found in clinical practice in our environment, including clinical and research aspects, with special attention to the latest developments in the field. Topics will include metabolic fuel homeostasis in humans, etiopathogenesis and differential diagnosis of hypoglycemia, molecular pathology of diabetes mellitus, insulin resistance and metabolic syndrome, molecular pathology and clinical biochemistry of ethanol consumption, etiopathogenesis and differential diagnosis of metabolic comas, and molecular basis of iron homeostasis and haemochromatosis.

### **4. Clinical Biochemistry and Molecular Pathology of organ systems**

The unit will introduce the course on biochemical aspects and molecular basis of the major disorders that involve organ systems. Topics will cover the revision of common renal tubular disorders, biochemical investigation of blood gases and acid-base disorders, and the molecular pathology and laboratory role in the acute coronary syndrome

### **5. Clinical endocrinology**

This module will introduce students to the essential role of the laboratory in the investigation, diagnosis and management of endocrine diseases. Considering that some issues have already been addressed in the previous units (3 and 4), the program will focus specifically on the study of the major endocrine axes. Topics will cover hypothalamic-pituitary function (including growth disorders), thyroid function, and adrenocortical function.

### **6. Special topics**

This section includes some of the questions/topics (complementary to subjects covered in the previous units) which optionally could be developed in the seminars of the course:

Recent advances in biochemical markers, Analytical artifacts or interferences, Oxidative stress and disease, Differential diagnosis of NASH-ASH, Aldosterone resistance, Diabetes insipidus and SIADH, Porphyrrias, Hyperkalemia, Newborn screening, Inherited dyslipidemia, Inborn metabolic disorders ...



**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	35,00	100
Tutorials	4,00	100
Seminars	3,00	100
Development of group work	3,00	0
Development of individual work	3,00	0
Study and independent work	52,50	0
Readings supplementary material	4,00	0
Resolution of case studies	4,00	0
Resolution of online questionnaires	1,00	0
<b>TOTAL</b>	<b>109,50</b>	

**TEACHING METHODOLOGY**

Instruction will be class-based, supported by *online* material prepared by the professor. The course combines lectures with practical exercises and activities that will be developed by the students (individual / group).

Lectures: it is conceived as the best way to transmit a large amount of information (of good quality, and in our case, particularly complex) quickly and effectively, to a large number of students, and should also arouse an active interest in the matter. The learning objectives for each specific topic will be clearly defined, and the concepts and essential content as well as the integration of these knowledge in the context of other matters of the degree, will be fully covered. Attendance if not mandatory, is highly recommended.

Individual/group assignments: during the course the teacher may propose additional issues and activities of various kinds, which, depending on its complexity, will be developed individually or in group (1-4 students); its objective is to promote independent learning, efficiency in the search of the literature and adequate online resources, progress in the use of language and terminology, and where appropriate, the ability to work in teams. Written work must be submitted at the deadline, and their credits will be taken into account in the ongoing assessment of the matter. Some of the proposed activities will be selected for oral presentation.

Tutorials: conceived as interactive workshops (groups of 4-5 students), attendance is mandatory. Oriented to problem-based learning, workshops are designed to develop competence and confidence in interpreting laboratory tests and in practical resolution of clinical cases. Each session will present short case studies relevant to each unit that the students should discuss, solve and present, in a cooperative and shared responsibility. Likewise, the tutorials will serve to answer questions and respond to the needs raised by the student throughout the course.



Seminars: designed to deepen in more specific aspects of the subject, they will include the students' oral presentations of the topics selected by the teacher for this purpose. Their goal: to complement the training acquired in the lectures, to develop the ability / clarity in the public presentation of ideas or information, encouraging critical thinking, creativity and interactivity with students. Attendance at the seminars is also mandatory.

## EVALUATION

Assessment of the subject, with an indication of their weighting towards the final grade, will be performed according to the following (described for a final grade = 100 marks):

**1) Final written examination**: mandatory, to be done by the end of the semester, which will consist of two parts:

- Assessment of acquired knowledge (60 marks), comprising both test-type questions and short-answer questions
- Assessment of acquired practical skills (25 marks), based on the resolution of clinical cases

**2) Continuous assessment** (15 points): the teacher will credit the participation and interest of students in the subject throughout the semester. To this end, the regular attendance to lectures and classroom activities (a 100% attendance at tutorials is required) will represent up to 6 points; and the active participation of students in the workshops/tutoring groups and their contribution to any of the assessable tasks/activities proposed by the teacher will be valued with a maximum of 9 points.

To pass the course it will be necessary to achieve a minimum score of 40 points on the final examination, and an overall total score equal or above 50 marks.

The student who fails to attend the final examination (1st and 2nd call), will be graded as "*Not examined*". The credits obtained on the assessable tasks during the course will be retained only for the current academic year.

## REFERENCES

### Basic

- GAW, A. et al. Clinical Biochemistry 4th ed. Elsevier (2008).
- MARSHALL, W. et al. "Clinical Chemistry". 7th ed. Elsevier (2012)
- TIETZs Fundamentals of Clinical Chemistry, 6th ed. Saunders-Elsevier (2008)
- GONZALEZ HERNANDEZ, A. Principios de Bioquímica Clínica y Patología Molecular. Elsevier (2010)



- HARRISON : Principios de Medicina Interna, 18th ed. McGraw-Hill (2012). Accesible online UV
- AHMED, N. "Clinical Chemistry" 1st ed. Oxford University Press (2010)
- Diversos recursos de consulta online, específics per a cada tema, indicats en el seu moment pel professor

#### **Additional**

- EVANS, J. Lo esencial en: Célula y genética. Serie Crash, 3ª ed. Mosby (2011)
- BAYNES, JV y DOMINICZAK, MH. Bioquímica medica, 2nd ed. Elsevier Mosby (2006)
- SAUDUBRAY, JM. et al. Inborn metabolic diseases: diagnosis and treatment, 5th ed. Springer (2012). Accesible online UV
- HOFFMANN, GF et al. Inherited metabolic diseases: a clinical approach Springer (2009). Accesible online UV
- McPHERSON, RA y PINCUS, MR. HENRYs Clinical Diagnosis and Management by Laboratory Methods". 22ª ed. Saunders Co. (2011)

#### **ADDENDUM COVID-19**

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

#### ***Teaching methodology***

All the different aspects described in the Teaching Guide are maintained. The teaching material needed for the development of the different activities will be uploaded to the Virtual Classroom. Classroom teaching can be reinforced by:

- Proposal of activities in the Virtual Classroom
- BBC videoconferences (synchronous and / or asynchronous)
- Use of Powerpoint recordings and / or educational videos

The tutorials of the subject will be carried out through the Virtual Classroom Forum (or Chat), by email, or where appropriate, by videoconference.

#### ***Evaluation***

The criteria included in the Teaching Guide are maintained.