

**COURSE DATA****DATA SUBJECT****Code:** 33154**Name:** Clinical biochemistry and molecular pathology**Cycle:** Undergraduate Studies**ECTS Credits:** 6**Academic year:** 2025-26**STUDY (S)**

Degree	Center	Acad. year	Period
1109 - Degree in Biochemistry and Biomedical Sciences	Facultat de Ciències Biològiques	4	Second quarter

**SUBJECT-MATTER**

Degree	Subject-matter	Character
1109 - Degree in Biochemistry and Biomedical Sciences	Biomedicina molecular	COMPULSORY

**COORDINATION**

SANCHEZ DEL PINO MANUEL MATEO

GALAN ALBIÑANA AMPARO

**SUMMARY**

Clinical Biochemistry and Molecular Pathology is part of the Matter of Molecular Biomedicine. It is a course of the second quatrimester of the fourth year of the Degree in "Biochemistry and Biomedical Sciences" where it is mandatory with 6 ECTS.

Biochemistry has experienced an extraordinary progress in the last few years that has place it at the cutting edge of current research and opening new possibilities for the development of a scientific and molecular medicine. Clinical biochemistry is a hospital laboratory specialty and, as such, its activity is mainly oriented toward both patient assistance as well as physician's clinical support.

Biomedical research is, nowadays, a molecular science that studies the etiology and the molecular mechanisms responsible for disease. Since most diseases are complex and polygenic, the interactions



between the different factors involved are also studied at a molecular level. The discovery of the molecular mechanism underlying disease allow us, on the one hand, the identification of the most appropriate therapeutic targets and the development of pharmacological agents to restore altered biological functions. On the other hand, it also brings us the opportunity to improve treatments to cure or, at least, to reduce the morbidity associated with disease. Thus, advances in biomedical research contribute, in a decisive manner, to fight disease with more rational approaches that improves quality and life expectancy of patients and population in general.

Clinical Biochemistry and Molecular Pathology are basic and applied sciences. The study of the molecular basis of human diseases is associated with the discovery of new, more sensitive and specific, biomarkers. It is at this point where the applied side comes into play developing new tools for diagnostic, prognostic, monitoring and prevention of disease.

Current medicine is increasingly based on experimental evidence. Many of the physician's decisions are based upon laboratory results, which imply a direct involvement of the clinical biochemist in the management of the disease. Laboratory results have to be interpreted correctly and, very often, in the individual context of each patient.

Based on the abovementioned, the main goals pursued in this course are:

- The study of the physiopathology and the molecular basis of disease
- The knowledge of the laboratory tests and the "diagnostic strategy"
- The knowledge of the analytical methodology
- The knowledge of the treatment and prevention of disease

## PREVIOUS KNOWLEDGE

## RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

## OTHER REQUIREMENTS

## COMPETENCES / LEARNING OUTCOMES

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Be able to use new information and communication technologies.

Capacidad para el trabajo multidisciplinar en equipo y la cooperación.



Have an integrated view of normal and altered cell function, including metabolism and gene expression.

Have capacity for analysis, synthesis and critical reasoning in the application of the scientific method.

Know and understand the molecular bases of genetic information and the mechanisms of its transmission and variation.

Know how to use the different bibliographic sources and biological databases and be able to use bioinformatic tools.

Know how to work responsibly and rigorously in the laboratory, considering the safety aspects in experimentation as well as the legal and practical aspects of the handling and disposal of waste.

Know the common and differential molecular and cellular elements of the different types of living organisms with special emphasis on the human being and model organisms for their study.

Know the usual procedures used by scientists in the area of molecular biosciences and biomedicine to generate, transmit and disseminate scientific information.

Understand experimental approaches and their limitations and interpret scientific results in molecular biosciences and biomedicine.

## DESCRIPTION OF CONTENTS

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

Concept of Clinical Biochemistry and Molecular pathology. Reference values and interpretation of results. Predictive value of analysis.

### 2. Clinical enzymology

Principles of enzymology applied to diagnostic. Enzymes as analytical tools. Seric enzymes and isoenzymes: distribution and clinical utility. Factors that affect enzymatic levels in plasma and sera. Clinical meaning of the seric enzyme determinations.

### 3. Biomarkers

Definition of biomarker. Role in diagnostic, monitoring and prognostic. New technologies in biomarker discovery. ROC curves and biomarker selection.

Drug metabolism and pharmacogenetic disorders. Importance in drug development and personalized



#### **4. Pharmacogenetics and pharmacogenomics**

medicine.

#### **5. Response mechanisms to stress and toxic stimuli**

Causes and mechanisms of cell injury. Cellular mechanisms of adaptation and cell death.

#### **6. Metabolic syndrome**

Diabetes, obesity and insulin resistance. Effect of diet and fructose consumption on the development of metabolic syndrome.

#### **7. Atherosclerosis and myocardial infarction**

Endothelial dysfunction and atherosclerotic plaque formation. Role of cholesterol and alternative mechanisms. Ischemia-reperfusion injury. Clinical markers of myocardial infarction.

#### **8. Cancer as a metabolic disease**

Origin of cancer. Metabolism, longevity and cancer. Metabolic alterations in cancer. Metabolic regulation of gene expression. Possible therapeutic role of diet.

#### **9. Molecular pathology of nitrogenous compound metabolism**

Pathologies associated with the metabolism of amino acids and nitrogenous bases. Alterations of the urea cycle and its relationship with cancer. Severe combined immunodeficiency and hyperuricemia.

#### **10. Iron homeostasis, erythrocyte abnormalities and hemoglobinopathies**

Molecular basis of the porphyrias. Iron homeostasis and hemochromatosis. Hemoglobinopathies: thalassemias and sickle cell anemia.

#### **11. Clinical biochemistry of liver function**

Liver function. Alterations in bilirubin metabolism. Plasma proteins. Biochemical tests of liver function.



## 12. Molecular pathology of muscular dystrophies

Molecular basis of Duchenne and Becker dystrophies.

## 13. Molecular basis of membrane transport disorders: study of cystic fibrosis

Molecular basis of Cystic Fibrosis . Pharmacological treatment.

## 14. Calcium and phosphate metabolism. Bone diseases

Pathologies associated with calcium and phosphorus metabolism. Importance in bone biology. Pathological changes in the process of bone formation and resorption: osteoporosis.

## 15. Laboratory 1.- Quantification of metabolites and enzymatic activities

Experimental determination of the concentration of different metabolites and enzymes in serum samples.

## 16. Laboarotoy 2.- Analysis of experimental results

Brief review on the use of excel and analysis of the results obtained the previous day. Analysis of results from previous years to determine reference intervals, as well as to detect outliers and discuss their possible causes.

## 17. Laboratory 3.- Biomarker analysis

Data analysis of biomarkers to determine their clinical utility by generating ROC curves.

## 18. Laboratory 4.-Visit to the Clinical Analysis Service of the General University Hospital of Valencia

Visit to the different sections of the Clinical Analysis Service of the General University Hospital of Valencia.

### WORKLOAD

#### PRESENCIAL ACTIVITIES

Activity	Hours
Theory	44,00
Laboratory	16,00



	<b>Total hours</b>	<b>60,00</b>
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### NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	45,00
Preparation of lessons	35,00
Preparation for assessment activities	10,00
Resolution of case studies	0,00
<b>Total hours</b>	<b>90,00</b>

### TEACHING METHODOLOGY

#### Teaching methodology

- In the weekly sessions in the classroom, it will be used primarily lecture, which will allow to emphasize the most important aspects of each topic. It will be encouraged student participation by interleaving along sessions short questions related to the subject, interesting news, etc.
- In the laboratory sessions, students will come into contact with the methodology used in clinical biochemistry laboratories. They will also become familiar with the use of excel for data analysis. Thus, they will consolidate the knowledge acquired in the theoretical sessions.
- Seminars relating to novel aspects of the topics.
- Finally, students' own work will be used to consolidate the acquired knowledge and will be assessed through a written test.
- Optionally and as far as possible it will be scheduled attendance at conferences and seminars on topics related to the subject.

### EVALUATION

The evaluation of the course will be carried out in the following way:

#### 1.- Objective tests on the contents of the subject:

The theoretical contents of the subject will be evaluated by means of an exam that will represent 80% of the final grade.

#### 2.- Individualized follow-up in practical activities:

Attendance to the practical classes is mandatory. The content of the practical classes will be evaluated by means of a practical exam that will represent 20 % of the final grade.

#### 3.- Final evaluation. It will be the sum of the practical and theory grades.



In order to pass the course, it will be necessary to obtain an overall grade higher than 50 out of 100.

To compensate the theory and practical grades, it will be necessary to obtain a minimum of 28 points out of 80 in theory and 7 out of 20 in practical.

Students who do not pass the course in the first exam will be able to keep for the second exam that part of the course they have passed.

## REFERENCES

- Se proporcionarán en cada capítulo.
- Burtis, C.A. et al. Tietz textbook of clinical chemistry and molecular diagnostics. 6a ed. Elsevier/Saunders (2018)
- González Hernández, A. Principios de bioquímica clínica y patología molecular Elsevier (2019)
- Kumar, V. et al. Robbins and Cotran pathologic basis of disease Elsevier-Saunders, Co. (2020)
- McPherson, R.A. and Matthew R. Pincus "Henry's clinical diagnosis and management by laboratory methods". Elsevier (2017)