COURSE DATA

Data Subject	
Code	33154
Name	Clinical biochemistry and molecular pathology
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1109 - Degree in Biochemistry and Biomedical Sciences	Faculty of Biological Sciences	4	Second term

Subject-matter

Degree	Subject-matter	Character
1109 - Degree in Biochemistry and Biomedical Sciences	12 - Biomedicina molecular	Obligatory

Coordination

Name	Department
MARIN NAVARRO, JULIA VICTORIA	30 - Biochemistry and Molecular Biology
SANCHEZ DEL PINO, MANUEL MATEO	30 - Biochemistry and Molecular Biology

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

OUTCOMES

1101 - Degree in Biochemistry and Biomedical Sciences

- Have capacity for analysis, synthesis and critical reasoning in the application of the scientific method.
- Capacidad para el trabajo multidisciplinar en equipo y la cooperación.
- Be able to use new information and communication technologies.
- Know how to use the different bibliographic sources and biological databases and be able to use bioinformatic tools.

- Know the usual procedures used by scientists in the area of molecular biosciences and biomedicine to generate, transmit and disseminate scientific information.
- 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.
- Understand experimental approaches and their limitations and interpret scientific results in molecular biosciences and biomedicine.
- 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 and understand the molecular bases of genetic information and the mechanisms of its transmission and variation.
- Have an integrated view of normal and altered cell function, including metabolism and gene expression.

LEARNING OUTCOMES

Learning results

The course is oriented for the student to acquire, in the learning process, the following skills:

- To learn the molecular basis of the studied pathologies as well as the biochemical alterations of human homeostasis due to disease.
- To identify and analyze the markers associated to different pathologies.
- To interpret the laboratory results in the context of controlling, prognostic, treatment, and pharmacological monitoring of disease.

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.

4. Pharmacogenetics and pharmacogenomics

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

5. Response mechanisms to stress and toxic stimuli

Causes and mechanisms of cell injury. Cellular mechanisms of adaptation and cell death. Acute and chronic inflammation.

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 plasma samples.

16. Laboaratoy 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 various biomarkers to determine their clinical utility by generating ROC curves.

18. Laboratory 4.- Classifiers and biomarker selection

Data analysis of multiple biomarkers to generate classifiers for a hypothetical disease. Use of analytical tools for the selection of the most determining biomarkers.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	44,00	100
Laboratory practices	16,00	100
Study and independent work	35,00	0
Readings supplementary material	10,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	25,00	0
Preparation of practical classes and problem	10,00	0
TOTAL	**150,00**	

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

1.- Evaluation of knowledge:

Theory exam: 80% of the student's final grade (80 points). The evaluation of the concepts taught in the lecture sessions will be performed in an exam consisting of multiple choice questions and short development questions.

2.- Evaluation of laboratory sessions: 20% of the final grade (20 points). The written exam of the laboratory sessions will consists of short questions, calculations of some biochemical parameters determined in the laboratory, and their interpretation. Attendance at the laboratory sessions is mandatory; NO FULFILLMENT of this requirement shall preclude the pass the course.

3.- Final evaluation. It will be the sum of the scores obtained in the theory and laboratory sessions exams.

To pass the course it is required an overall score of 50 out of 100.

In order to compensate theory and laboratory sessions scores, it is required a minimum of 32 points out of 80 in the theory exam and 8 points out of 20 in the laboratory sessions exam.

A student who does not pass the exam in the first call will keep the score of the part that has been passed for the second call.

REFERENCES

Basic

- 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)

Additional

- Se proporcionarán en cada capítulo.