COURSE DATA

Data Subject	
Code	34090
Name	Clinical Biochemistry and Hematology
Cycle	Grade
ECTS Credits	6.0
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
1201 - Degree in Pharmacy	Faculty of Pharmacy and Food Sciences	4	Second term
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	Faculty of Pharmacy and Food Sciences	4	Second term

Subject-matter

Degree	Subject-matter	Character
1201 - Degree in Pharmacy	24 - Clinical analysis and laboratory diagnostics	Obligatory
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	1 - Asignaturas obligatorias del PDG Farmacia-Nutrición Humana y Dietética	Obligatory

Coordination

Name	Department
ESTORNELL RAMOS, ERNESTO	30 - Biochemistry and Molecular Biology
SASTRE BELLOCH, JUAN JOSE	190 - Physiology

SUMMARY

The matter comprises part of the vast field of the biological analyses applied to the diagnostic and follow-up of the human illnesses. It is divided in two areas of knowledge: Clinical Biochemistry and Hematology.

The Clinical Biochemistry is an applied science that accomplishes the study of the biochemical alterations that the illness triggers in the maintenance of the homeostatic constants. For this, it is

supported by tests of laboratory that allow us understand the true operation of organs and systems, discern the pathological variations and help, therefore, to the diagnostic, prognosis, control of the evolution, treatment, monitoring of drugs and prevention of the illness.

The Hematology addresses the study of the diagnostic of the pathological processes that produce alterations in the diverse types of blood cells, comprising so much the diagnostic of the different anemia as well as poliglobulies, thrombotic phenomena and alterations of the leucocytes.

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 specially recommended to demonstrate previous knowledge corresponding to the subjects of Biochemistry I, Biochemistry II, Physiology and Physiopathology, in addition to instrumental methods and techniques, to obtain the own level of conceptual understanding of the subject, in addition to the obvious knowledge of the basic matters, like chemistry, physics, mathematics and biology.

OUTCOMES

1201 - Degree in Pharmacy

- To possess and to understand the knowledge in the different areas of study included in the formation of the pharmacist.
- To apply this knowledge to the professional world, contributing to the development of Human Rights, democratic principles, principles of equality between women and men, solidarity, protection of the environment and promotion of a culture of peace with Gender perspective.
- To know how interpret, value and communicate relevant data in the different aspects of pharmaceutical activity, making use of information and communication technologies.
- Skill to communicate ideas, analyze problems and solve them with a critical mind, achieving team-working abilities and assuming leadership whenever required.
- Development of skills to update their knowledge and undertake further studies, including pharmaceutical specialization, scientific research and technological development, and teaching.
- Training in debate and rationally based criticism.
- Designing, implementing and evaluating reagents, clinical analytical methods and techniques, knowing the basics of clinical analyses and the nature and contents of laboratory diagnostic reports.

- Develop health and hygiene analyses
- Master the analytical terminology in clinical chemistry and haematology
- Know and understand the basis of the methods and technique used in clinical chemistry and haematology for the diagnosis of occupational diseases and the basis of their application.
- To know and to develop the necessary techniques in clinical chemistry and haematology for proper processing of any biological sample that may be analysed in a laboratory of clinical chemistry and haematology.
- To know the diagnostic utility of each method and technique in clinical chemistry and haematology, valuing what is your specific use, the prognostic value and the complementary test that requires, considering the gender bias in the clinical diagnoses.
- Know and handle with the documentary sources of Clinical Biochemistry and haematology within the field of diagnosis of human diseases.
- Training in addressing analytical results in an interdisciplinary manner with other professionals.
- Development of future professional awareness based on the relevance of the diagnosis made.

LEARNING OUTCOMES

The basic result of learning is to train future pharmacist in the field of laboratory analysis applied to the diagnosis and monitoring of human diseases, especially those of nutritional, metabolic and degenerative origin. In particular, this training will deepen in the methodological and technical aspects to the correct implementation and interpretation of laboratory tests. The selection of topics for each of the disciplines that is specified in the following sections, specific, qualifies and outlines these overall objectives. Each module of the course presents its particular thematic program, in which a careful selection allowing the student to have a sufficiently broad view of the extensive field of diagnostic laboratory tests, has continued as a main criterion but focusing and focusing on those aspects which by its frequency or relevance they will require a greater knowledge of the student for further professional development. All this trying, from individual cases, students can draw conclusions, procedures and general operating modes that can be subsequently applied to those aspects that have fallen off the agenda or have been addressed more generally. After having completed this course, the student should be capable of: dominate the analytical terminology in all fields. Acquire and develop relevant skills for proper management of all inventory materials and expendable for use in the field of diagnosis. Understand the foundations of the methods and techniques used in the diagnosis of diseases and the foundations of its implementation. Mastering the techniques needed for proper processing of any biological sample may be analyzed in a laboratory of clinical analyses; Learn about the utility of each method and technique, appreciating what their specific use, the prognostic value and complementary tests that require. Know and handle approach documentary sources of all kinds within the field of diagnosis of human diseases. Also noteworthy is the achievement of the capacity for rational criticism and reasoned argument, capacity in order to address the resolution of analytics in an interdisciplinary way with other professionals and develop awareness future professional on the significance of the diagnosis to make.

DESCRIPTION OF CONTENTS

1. Diagnosis of laboratory of the alterations of the red series

- General aspects of the diagnostic of anemia.
- Diagnostic of laboratory of the ferropenic anemia.
- Diagnostic of laboratory of the megaloblastic and aplasic anemia.
- Diagnosis of laboratory of the hemolytic anemia. Hemoglobinopathia.
- Diagnosis of laboratory of polyglobulia.

2. Diagnosis of laboratory of the alterations of hemostasia

- Diagnosis of laboratory of the hemorrhagic diathesis.
- Diagnosis of laboratory of the thrombosis and control of the patient with thrombotic phenomena.

3. Diagnosis of laboratory of the alterations of the white series

- Diagnosis of laboratory of the quantitative alterations of the leukocytes.
- Diagnosis differential of the leucocytosi.
- Diagnosis differential of leucopenia.
- Diagnosis of laboratory of the qualitative alterations of the leukocytes.
- Diagnosis of laboratory of leukemia and the mielodisplasic syndromes.

4. Laboratory of Hematology

- Differential hematologic analyzer. Count of reticulocytes.
- Sideremia. Index of hemolysis.
- Leukocite Formula.
- Coagulation.

5. Clinical Biochemistry concepts

Definition and scope of Clinical Biochemistry. Concept of analyte. Biochemical parameters in the diagnosis. Specimens and their handling classes. Analytical process: phases. Analytical methods and techniques. Quality control.

6. Interpretation of results in Clinical Biochemistry.

Reference population. Values and reference intervals. Interpretation of results. Biomarkers. Distributions of values in populations. Diagnostic sensitivity and specificity. Predictive value of biochemical determinations. ROC curves and comparisons.

7. Evaluation and alterations of glycid metabolism.

Glycid metabolism: Main causes of alteration. Selection of analytes. Methods and analytical techniques. Differential diagnosis of Diabetes mellitus and hypoglycemia.

8. Alterations and evaluation of plasma lipoproteins.

Alterations and evaluation of plasma lipoproteins. Characteristics, origin, function and destiny of plasma lipoproteins. Main alterations of the lipid transport. Biochemical diagnosis of hypo- and hyperlipoproteinemias. Evaluation of the aterogenic risk.

9. Alterations and evaluation of nitrogen metabolism.

Alterations and evaluation of nitrogen metabolism. Application to the diagnosis of the renal excretion function. Urea, creatinina and proteinurias.

10. Alterations of the metabolism of purines.

Alterations of the metabolism of purines. Biochemical evaluation of hiperuricemias.

11. Plasma proteins.

Plasma proteins. Metabolism. Techniques of analysis. Diagnosis.

12. Clinical Enzymology.

Clinical Enzymology. Value of enzyme and isoenzyme determination for diagnosis. Concept of biomarker.

13. Biochemical tests of the hepatic function.

Biochemical tests of the hepatic function: diagnostic value and methods of measurement. Diagnosis of laboratory of the main acute and chronic hepatic diseases.

14. Alterations and evaluation of the bone and mineral metabolism.

Alterations and evaluation of the bone and mineral metabolism. Main mineral elements and their hormonal control. Diagnostic implications.

15. Tumor markers.

Biochemical diagnosis of the cancer. Tumor markers: concept and clinical application. Limitations and perspective.

16. Clinical Biochemistry Laboratory

Determination of metabolites:
Glucose.
Triacylglycerols.
Cholesterol.
HDL-cholesterol: evaluation of aterogenic risk.
Urea.
Creatinine.
Proteins.

Enzyme determination and isoenzymes of clinical interest:
Aspartate aminotransferasa (ASAT).
Alanina aminotransferasa (ALAT).
Gamma-Glutamyl transpeptidase (GGT).
Serum phosphatases.
Total lactate deshidrogenasa (LDH).
Heat-resisting lactate deshidrogenasa.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	28,00	100
Laboratory practices	25,00	100
Tutorials	3,00	100
Seminars	2,00	100
Attendance at events and external activities	4,00	0
Development of group work	4,00	0
Preparing lectures	52,00	0
Preparation of practical classes and problem	30,00	0
TOTAL	**148,00**	

TEACHING METHODOLOGY

The actual hours of theory, raised as a theoretical and practical classes, teacher explain the problems surrounding the diagnosis of diseases, as well as the basic methodology for the correct processing of all and each one of the biological materials liable to be processed in a laboratory dedicated to the diagnosis of diseases. Meanwhile, the students should take notes from the information received, while they should try to ask all those questions and issues that arise at the time. In actual practice hours, activity in the laboratory focuses on two parts: teacher will present the objectives, will inform about the handling of the material, will oversee the completion of the work and help the interpretation of the results; on the other hand, students will be carried out individually or in pairs, the technical procedure. In the hour of tutoring, the student must raise their needs, while the teacher must guide and resolve doubts; alternately the teacher will propose questions and problems to be solved under his/her supervision by the students. All this in order to achieve an adequate technical knowledge of the module. Finally, in the review will be raised a number of issues involving single answer but also issues of reasoning which induce the student to reflect and think about the issue.

EVALUATION

For the learning evaluation it is essential to directly verify the level of knowledge and skills acquired by the students through the continuous obsrevation of their evolution during the theoretical and laboratory classes. This will provide the teacher with a dynamic idea of each student evolution along the corresponding thematic block.

However, the numerical evaluation of the knowledge and skills acquired by the student must be based on methods which allow their comparable and objective measurement. This needs the valuation of a written exam. Thus, through a theoretic-practical exam on the whole subject, containing multiple choice test, short and long answer questions, and clinical assumptions, the student will show the acquired knowledge. To pass the exam will require at the very least to obtain 50 % of the maximum score.

Taking into account the division of the subject in two areas of knowledge, the distribution of the total score must be weighted according to the thematic content of each area. Therefore, the following criteria and standards of evaluation must be fulfilled:

1. The two thematic blocks that comprise the subject, Clinical Biochemistry and Hematology, will be evaluated in a single final exam. This exam will include and evaluate indistinctly both the theoretical and practical contents of the subject. The attendance to laboratory classes is compulsory for all students unless they did it in the previous year.

2. For the final grade, the score in each block will be normalizde according to the credits offered in each of them. Thus, the percentage of contribution to the final grade for the two thematic blocks shall be as follows: Hematology, 40%; Clinical Biochemistry, 60%

3. The subject is passed or failed globally. In order to pass the subject, it must be obtained at least 50% of the total score in the written exam and 40% of its maximum score in each of the two thematic blocks:

	Total score	50%	40%
Hematology	4.0	2.0	1.6
Clinical Biochemistry	6.0	3.0	2.4
TOTAL	10.0	5.0	

4. If the score of the exam in the first call in June does not fulfil the conditions specified in section 3, but the score ot one of the thematic blocks is equal to or greater than 50 % of its maximun, this score will be kept for the second call during the same academic course. Therefore, in the second call it will be only required to take the exam of the faile block. The conditions of section 3 must also be fulfilled for passing the Hematology and Clinical Biochemistry subject in the second call.

5. It will be possible to get up to a maximum of 1.0 extra-point (shared alike between the two areas of knowledge) taking into account the contnuous assessment by teachers of the attitude and active participation of students in the classroom during both theoretical and practical classes, and the valuation of the Laboratory Report. Similarly, if it is the case it will be also possible to get up to a maximun of 1,0 extra-point through oral presentation seminars. These additional points will be only applied when the exam fulfil the conditions of sections 3 and 4.

6. The overall score will be the sum of the weighted score of the exam and the additional evaluations as specified in section 5.

7. According to the guidelines of the CAT of the Faculty of Pharmacy (May 14, 2012), the student who do not enter for the theory exam in the first call but has participated and been marked in any of the other learning activities (seminars, laboratory, tutorials, etc.), will be graded as **not shown**. If still not entered for the theory exam in the second call, the grade will be based on the marks obtained in the other learning activities carried out by the student.

REFERENCES

Basic

- Rifai, N., Horvath, R. and Wittwer, C.T. (eds) Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics, 7th ed, Saunders-Elsevier (2019).
- Henry, J.B. (ed) El laboratorio en el diagnostico clínico (Edición homenaje a Todd-Sanford & Davidsohn), Marbán (2017).
- Murphy, M.J., Srivastava, R. y Deans, K (eds) Bioquímica Clínica. Texto y atlas en color, 6ª ed, Elsevier (2020).

- Lichtman, M.A., Kaushansky, K., Kipps, T., Prchal, J.T. y Levi, M.M. (eds) Manual de Hematología, 8ª ed, McGraw Hill (2014).
- Prieto Valtueña, J.M. y Yuste, J.R.(eds) Balcells. La clínica y el laboratorio, 23ª ed, Elsevier (2019).
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- González Hernández, A. (ed) Principios de bioquímica clínica y patología molecular, 3ª ed, Elsevier (2019).
- Bain, B.J., Bates, I. y Laffan, M.A. (ed) Dacie y Lewis. Hematología pràctica, 12ª ed, Elsevier (2018).

Additional

- Rifai, N., Horvath, R. and Wittwer, C.T. (eds) Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, 7th ed, Saunders-Elsevier (2017).
- Kaushansky, K., Lichtman, M.A., Prchal, J.T., Levi, M.M., Burns, L.J. and Linch, D. (eds) Hematology, 10th ed, McGraw Hill (2021).
- Hoffmann, G.F. F., Zschocke, J. and Nyhan, W.L. (eds) Inherited Metabolic Diseases: A Clinical Approach, Springer (2017).
- Marshall, W.J., Lapsley, M., Day, A. and Shipman, K. (eds) Clinical Chemistry, 9th ed, Elsevier (2020).
- Jameson, J.L., Fauci, A., Kasper, D., Hauser, S., Logo, D. y Loscalzo, J. (eds) Harrison Principios de Medicina Interna, 20ª ed, McGraw Hill (2019).

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. Contents

Contents initially included in the teaching guide are maintained

2. Volume of work and temporal planning of teaching

The workload for the student is maintained, derived from the number of credits, but the methodology of the activities changes with respect to the teaching guide, due to the current situation that makes it necessary to adopt a hybrid teaching model

3. Teaching methodology

- Theoretical teaching: Lessons will be face-to-face and in accordance with the course calendar, but with the appropriate modifications to comply with the safety regulations against CoViD19. If classroom capacity does not allow the presence of the entire group of students, they will be distributed by groups, so that 50% will be in the Faculty classroom while the other 50% will connect online (from home), alternating their attendance for weeks. The class will always be held following the schedule (date and time) approved by the *Junta de Centre*

- Tutorials and Seminars: They will all be face-to-face according to the dates set by the course calendar
- Practical classes: They will be face-to-face and in accordance with the course calendar, but with the appropriate modifications to comply with the security regulations against CoViD19, with limitation of the capacity of laboratories and computer rooms to 50%, establishing attendance shifts in each group. Audiovisual material will be used to cover the non-face-to-face teaching of the sessions, the students will be supplied with data to perform calculations or any other material that allows complementing what was seen in the laboratory sessions.

If there were a worsening of the situation or a state of total confinement, all face-to-face teaching would be carried out online with synchronous teaching in accordance to the approved schedule

4. Evaluation

If the evolution of the current pandemic allows it, it will be face-to-face and in the terms indicated in the teaching guide. Only in case this were not possible, the evaluation will be carried out online, using multiple-choice questions in the virtual classroom that can be supplemented with short questions and, if necessary, with an oral exam via videoconference.

The relative weight of theory, practices and seminars is maintained as indicated in the teaching guide