

COURSE DATA

Data Subject				
Code	34448		0	
Name	Biochemical involv	ement and clinical biochemi	stry	
Cycle	Grade	~200Kr		
ECTS Credits	6.0	A A A A A A A A A A A A A A A A A A A		
Academic year	2022 - 2023			
Study (s)				
Degree		Center	Acad. Period year	
1204 - Degree in M	edicine	Faculty of Medicine and C	Odontology 2 Second term	
Subject-matter				
Degree	~86 BB	Subject-matter	Character	
1204 - Degree in Medicine		4 - Biochemistry	Basic Training	
Coordination				
Name		Department		
JOVER ATIENZA, I	RAMIRO	30 - Biochemistry	and Molecular Biology	
SAUS MAS, JUAN	BAUTISTA	30 - Biochemistry	and Molecular Biology	

SUMMARY

In the last years, the extraordinary advance and development of the biomedicine has greatly completed our vision of the functioning of the human being, being the principles that guide it increasingly evident: integration, utilization and economy. From a limited number of biomolecules, and thanks to the numerous layers of control, flux and partitioning, our organism is able to synthesise and use an enormous diversity of metabolites that make possible its functioning and adaptation to the different physiopathological situations. Thus, the integration in the human organism of the basic knowledge of biochemistry and molecular biology is essential to understand the bases of our functioning (healthy or ill) (basic interest), and to analyse their possible responses against nutritional or pharmacological interventions (applied interest).

The molecular biology along with the clinical biochemistry and its integration in the human being constitute a basic area of the Medicine in which quantum leaps are produced with technological and social impact. The subject of Biochemistry and Clinical Biochemistry Integration highlights the importance of the molecular level in the modern clinical context and tries to provide knowledge, attitudes and skills to the future doctors to place them in an advanced position in a formative, scientific and professional context. The general goal of this subject is to acquire knowledge in depth of the metabolism



regulation, as well as of the metabolic interrelations that are established between the different tissues in the mammals and in the human being in particular.

Its main objective is to understand the study of the biochemistry and molecular foundations of the human pathology and the diagnosis of diseases through the clinical laboratory in the current and future environment of the molecular medicine. With this objective in the different units of the subject, the following points will be highlighted: (1) Mechanisms that determine the metabolic phenotype of each tissue, (2) Regulation of the metabolism based on the control of the gene expression, (3) The importance of the genetic and epigenetic regulation, (4) Short-term and long-term regulation, (5) Tissue differences and metabolic flow among tissues and (6) how these processes are regulated and coordinated in different situation both physiological and pathological. The knowledge, attitudes and scientific language acquired will provide the necessary foundations to understand entirely the more practical and advanced clinical teachings.

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

1204 - Degree in Medicine

- Understand and recognise the effects of growth, development and aging which affect individuals and their social environment.
- Know how to use the sources of clinical and biomedical information available, and value them critically in order to obtain, organise, interpret and communicate scientific and sanitary information.
- Know how to use IT in clinical, therapeutic and preventive activities, and those of research.
- In the professional practise, take a point of view which is critical, creative, constructive and researchoriented.
- Be able to formulate hypothesis, gather information and evaluate it critically in order to solve problems by following the scientific method.
- Establish a good interpersonal communication which may allow professionals show empathy and talk to the patients efficiently, as well as to their relatives, the media and other professionals.
- Proper organisation and planning of the workload and timing in professional activities.
- Team-working skills and engaging with other people in the same line of work or different.
- Criticism and self-criticism skills.



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- Capacity for communicating with professional circles from other domains.
- Acknowledge diversity and multiculturality.
- Consideration of ethics as a fundamental value in the professional practise.
- Working capacity to function in an international context.
- Knows the cell structure and its function. Implication of biomolecules. Knows the metabolism, its regulation and metabolic integration.
- Knows the procedures in cell communication and the function of excitable cell membranes.
- Knows the mechanisms of information, expression and genetic regulation. Inheritance patterns.
- Knows the processes of growth, maturation and aging of the different organs and systems. Homeostasis. Adaptation to the environment.

LEARNING OUTCOMES

Once the subject is completed, students must be able to:

- Understand the importance of metabolic integration on the functioning of the organism.
- Understand the role of gene expression in the regulation of metabolism.
 - Understand the role of epigenetic factors in gene expression.
- Understand the molecular mechanisms of metabolic adaptations to different pathophysiological states.
- Understand and recognize the effects, mechanisms and manifestations of disease at the molecular level (as well as the mechanism of injury, response and repair).

DESCRIPTION OF CONTENTS

1. THEORETICAL LESSONS (Part I)

- I. THE REGULATION OF METABOLISM
- 1. Metabolic regulation: Tissue-specific mechanisms and short- and long-term adaptations.
- II. THE REGULATION OF GENE EXPRESSION
- 2. Transcriptional regulation: prokaryotic and eukaryotic.
- 3. Molecular bases of tissue phenotype: tissue-specific transcription factors and epigenetics.

4. Regulation of transcription by nuclear receptors in response to hormones, vitamins and metabolic signals.

- 5. Post-transcriptional regulation of mRNA levels.
- 6. Regulation of protein synthesis and degradation.

III. METABOLIC FLOW BETWEEN TISSUES AND ADAPTATION OF METABOLISM

- 7. Metabolic integration: adaptation to fasting.
- 8. Intertissue flow of nutrients (I): carbohydrates.
- 9. Intertissue flow of nutrients (II): triacylglycerides, free fatty acids and ketone bodies.
- 10. Intertissue flow of nutrients (III): amino acids.



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11. Oxygen metabolism and its reactive species: biochemical and molecular bases of oxidative stress.

2. THEORETICAL LESSONS (Part II)

IV. METABOLIC INTEGRATION IN TISSUES, ORGANS AND SYSTEMS

- 12. Metabolic integration in the kidney.
- 13. Metabolic integration in the erythrocyte.
- 14. Biochemistry of the blood and vascular system.
- 15. Metabolic integration in the brain.
- 16. Metabolic integration in adipose tissue.
- 17. Skeletal muscle: metabolic aspects.
- 18. Heart muscle: biochemical aspects.
- 19. Biochemistry of the extracellular matrix.
- 20. Hepatic biochemistry (I): glycemia, nitrogen metabolism and plasma proteins.
- 21. Hepatic biochemistry (II): lipid metabolism and fatty liver.
- 22. Hepatic biochemistry (III): metabolism of bile acids, cholesterol, bilirubin, iron and copper.
- 23. Hepatic biochemistry (IV): xenobiotic metabolism and hepatotoxicity.

V. THE BIOCHEMISTRY OF THE DISEASE

- 24. Biochemistry of inflammation.
- 25. Biochemistry of fibrosis of organs and tissues.
- 26. Biochemistry of protein misfolding.
- 27. Biochemistry of peripheral insulin resistance.
- 28. Molecular biology of cancer I: the microevolutionary advantages of the tumor cell.
- 29. Molecular Biology of cancer II: altered genes and pathways in cancer.
- 30. Biochemistry of aging.

3. PRACTICES

SEMINARIES

1. Introduction to clinical biochemistry laboratory: collection and storage of samples. Handling and biological hazards. Quality control.

- 2. Introduction to clinical enzymology: enzyme markers in biological samples.
- 3. Study of plasma protein electrophoretic patterns in different pathologies.
- 4. Polymerase chain reactions and their application to biomedical research and clinical diagnosis.

5. Advanced techniques for clinical diagnosis: the omics and its application to molecular study of diseases.

LABORATORY PRACTICES

1. Introduction to clinical biochemistry laboratory: handling and storage of samples. Handling and biological hazards. Quality control.

2. Introduction to clinical enzymology: enzyme markers in biological samples.



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TUTORIALS

Los Experimental models in biomedicine: from laboratory database to the clinic.

ACTIVITY	Hours	% To be attended
Theory classes	33,00	100
Laboratory practices	12,00	100
Seminars	11,00	100
Tutorials	4,00	100
Development of group work	17,50	0
Development of individual work	10,00	0
Study and independent work	45,00	0
Preparation of evaluation activities	7,50	0
Preparation of practical classes and problem	10,00	0
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TEACHING METHODOLOGY

The **attending formative activities** of this subject will include theoretical lessons, practical lessons, seminars, regulated tutorials and exams.

In the **theoretical lessons**, the professor will expose the content and the methodology for the knowledge and skills that the students must acquire. The theoretical lessons will be taught through oral master class.

In the **practical lessons**, the student will fulfill both laboratory practices, which will analyze the foundations and the application of usual and advanced techniques in Biomedicine, and the problem solving according to the objectives and specific content of each of the sessions. In the lessons, the student will work in small groups following a pattern delivered by the professor. The sessions will be initiated with a brief theoretical-practical explanation, but the objective is to boost the autonomous and in group work of the student, in such a way that at the end of the practice the student will show concrete results that will be contrasted by the professor. These practical sessions are reinforced with the methodological Seminars where the professor will use the master class, but boosting the student's participation with questions. Lastly, personal and in-group tutorials will be held, as well as the elaboration and exposition of guided topics (tutored works) that will be about problems of Biomedicine research.



EVALUATION

The evaluation of the learning of theoretical, seminars and practices teachings is carried out through a final written exam whose grade represents 90% of the overall grade of the subject that is completed with the grade obtained in the regulated tutoring (tutored group), a voluntary practical teaching activity whose assessment represents 10% of the overall grade of the subject.

The final written exam comprises a first part with 6 written development questions that will deal with the contents of the theoretical program and will aim to evaluate the acquisition of knowledge and exhibition level of the student with a maximum value of 0.5 points per question and a maximum total of 3 points (30% of the overall grade); and a second part with 60 objective questions with 4 possible answers and only one of them correct, which will evaluate both the acquisition of skills from theoretical teaching and teaching given through seminars and practices. Each correct answer is worth 0.1 point, each incorrect answer subtracts 0.025 points and blank answers do not penalize. The proportion of questions that evaluate theoretical teaching or seminars and practices will be approximately 50%.

To pass the subject, the grade obtained in the first and second part of the exam must be at least 1 and 2 points, respectively.

The regulated tutorials (tutored groups) will have a continuous evaluation of the attendance, participation, and acquisition of skills by the student to react to complex specific situations. The grade obtained by the student will have a maximum final value of 1 point, 10% of the overall grade of the subject.

As a whole, the learning acquired in theoretical teaching represents 60% of the overall grade of the subject while the remaining 40% will depend on the learning of practical teachings (seminars, laboratory practices and regulated tutorials).

Attendance to practical sessions (seminars and laboratory practices) is mandatory. Unjustified nonattendance to more than 20% of the sessions will make it impossible to pass the course.

Students are reminded of the importance of carrying out evaluation surveys on all the teaching staff of the degree subjects.

REFERENCES

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Additional

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