

**Metabolism of Biomolecules**

Code: 101915  
ECTS Credits: 6

Degree	Type	Year	Semester
2501230 Biomedical Sciences	FB	1	2

**Contact**

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**Use of Languages**

Principal working language: catalan (cat)  
Some groups entirely in English: No  
Some groups entirely in Catalan: No  
Some groups entirely in Spanish: No

**Other comments on languages**

Students will be asked to volunteer to an English group of "Seminaris d'autoaprenentatge Tutoritzat"

**Teachers**

José Miguel Lizcano de Vega  
Carles Gil Giró  
Francisco Blanco Vaca  
Jose Ramon Bayascas Ramirez  
Maria Antonia Baltrons Soler

**Prerequisites**

Although there are no official prerequisites, it is highly recommended to have passed Structure and function of Biomolecules and Organic Chemistry.

It is convenient to review the following subjects of the baccalaureate program:

- Chemical reactions of oxidation-reduction and nucleophilic substitutions
- Cell metabolism: Glicolysis, Krebs cycle and ATP synthesis

**Objectives and Contextualisation**

In the context of Basic Biochemistry, the Metabolism of Biomolecules subject focuses on knowledge of sources, forms of storage and use of energy and nutrients for human body cells. The catabolic and anabolic pathways of carbohydrates, lipids, amino acids and nucleotides, and their hormonal regulation, are studied. Emphasis is placed on the mechanisms of metabolic regulation, differentiating states of good nutrition and fasting, and on the discussion of biochemical changes present in common metabolic pathologies.

The aim is for the student to achieve a global understanding of human metabolism that integrates their main mechanisms, functions and regulation. This understanding will be used as a basis to be able to deepen in specific subjects during the rest of the degree studies with the help of textbooks, in particular in subjects such

as Molecular Biology of the Cell, Systems Physiology, Pharmacology, Clinical Biochemistry and Biological Bases of Pathology. Critical reading of the bibliography and tutored discussions should be used to describe molecular processes that cause pathologies using a correct biochemical terminology.

## Competences

- Describe biomedical problems in terms of causes, mechanisms and treatments.
- Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
- Develop independent learning habits and motivation to continue training at postgraduate level.
- Develop independent learning strategies.
- Display knowledge of the basic life processes on several levels of organisation: molecular, cellular, tissues, organs, individual and populations.
- Display knowledge of the concepts and language of biomedical sciences in order to follow biomedical literature correctly.
- Display theoretical and practical knowledge of the major molecular and cellular bases of human and animal pathologies.
- Generate innovative and competitive proposals for research and professional activities.
- Identify and understand the advances and challenges of research.
- Read and critically analyse original and review papers on biomedical issues and assess and choose the appropriate methodological descriptions for biomedical laboratory research work.
- Respect diversity in ideas, people and situations.
- Show respect for the ethical and legal aspects of research and professional activities.
- Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

## Learning Outcomes

1. Correctly describe the principal metabolic pathways and their mechanisms of control and integration.
2. Correctly use the terminology of biochemistry and its text and reference books.
3. Define alterations of the cell redox balance and oxidative stress caused by free radicals.
4. Describe correctly the structural and thermodynamic bases of cell bioenergetics and transport across membranes.
5. Describe the basic structural and functional characteristics of amino acids, proteins, glucids, lipids and biological membranes, nucleotides and nucleic acids.
6. Describe the components of the electronic transport chain, its coupling with oxidative phosphorylation and the generation of metabolic energy.
7. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
8. Develop independent learning habits and motivation to continue training at postgraduate level.
9. Develop independent learning strategies.
10. Explain the principal molecular mechanisms responsible for signal transduction.
11. Generate innovative and competitive proposals for research and professional activities.
12. Identify and understand the advances and challenges of research.
13. Identify molecular processes that could be a cause or a consequence of pathological processes.
14. Identify the principal alterations of the metabolism of glucids, lipids, amino acids and nucleotides, and their pathological implications.
15. Identify the principles that govern electron transfer and its role in metabolism.
16. Infer physiological and clinical correlations from the intermediate metabolism in cases of fasting, muscular fatigue diabetes and cancer.
17. Interpret the parameters that define the binding of ligands to macromolecules.
18. Respect diversity in ideas, people and situations.
19. Show respect for the ethical and legal aspects of research and professional activities.
20. Understand and critique scientific articles on biochemistry.
21. Understand cell metabolism and gene expression by relating the activity of the different cell compartments to their control by the action of hormones, neurotransmitters and growth factors.

22. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

## Content

Topic 1. Introduction to metabolism.

Bioenergetics. Molecular mechanisms of intercellular communication. Interaction between hormones and receptors. Main intracellular signaling pathways. Control of energy metabolism.

Topic 2. Common phase of oxidative metabolism.

Mitochondrial energy metabolism. Cycle of tricarboxylic acids. Electron transfers. ATP synthesis. Free radicals

Topic 3. Structure and metabolism of carbohydrates.

Characteristics, origin and function of carbohydrates. Digestion and absorption of carbohydrates. Glycolysis. Gluconeogenesis. Glycogen metabolism. Pentose phosphate pathway. Common alterations in the regulation of carbohydrate metabolism.

Topic 4. Structure and metabolism of lipids.

Energy reserve. Obtaining energy from fatty acids. Synthesis of fatty acids and triacylglycerides. Metabolism of lipids with structural function. Cholesterol metabolism. Transport of lipids in blood by lipoproteins. Common alterations in the regulation of lipid metabolism.

Topic 5. Metabolism of nitrogen compounds.

Metabolism of amino acids. Urea cycle. Metabolism of nucleotides. Derivatives of amino acids and nucleotides.

Topic 6. Integration and control of metabolism.

Metabolic particularities of some tissues. Interrelationships between tissues during the feed-fast cycle and in various nutritional or hormonal states. Physical exercise. Obesity. Diabetes

## Methodology

The teaching methodology will consist of theory classes, of tutored self-study seminars where practical and clinical cases will be discussed, and of laboratory practices. The main teaching material for these activities will be provided through the UAB virtual campus.

The theoretical classes will be taught in the form of lectures to the entire group. The teachers will also comment on the material available for the other activities, including materials for self-learning.

When finishing each subject, the students will be tutored in smaller groups to discuss cases of practical or clinical application. This activity will be called "Tutored Self-Study Seminars" as students will have a script with questions that will have to be solved, prior to the class or in the same class, where they will discuss them with their peers with the tutor acting as moderator,

The laboratory practices will consist of a script and a list of questions that students will have to solve during the practice. In order to be able to attend the practical sessions, the student must justify having passed the biosafety and security tests that he will find in the Virtual Campus and be familiar with and accept the rules of operation of the Faculty's laboratories.

Additionally students will be able to have specific tutor sessions.

## Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
"Tutored Self-Study Seminars" on practical or	17	0.68	21, 20, 3, 4, 1, 6, 5, 8, 7, 10, 15, 12, 14, 13, 16,

clinical cases			17, 22, 2
Laboratory practices	6	0.24	1, 8, 12, 16, 22
Lectures (theory classes)	27	1.08	21, 3, 4, 1, 6, 5, 10, 15, 14, 16
Type: Supervised			
Preparation of practical or clinical cases	17	0.68	21, 20, 3, 4, 1, 6, 5, 8, 7, 10, 15, 12, 14, 13, 16, 17, 22, 2
Type: Autonomous			
Personal study	71	2.84	21, 20, 3, 4, 1, 6, 5, 8, 7, 10, 15, 12, 14, 13, 16, 17, 22, 2

## Assessment

There will be 3 continuous assessment exercises corresponding to the first 5 topics. Assessment 1 will correspond to topics 1 and 2, assessment 2 to topic 3 and first laboratory practice and assessment 3 to topics 4 and 5 and the second laboratory practice. Each continuous assessment exercise will have a value of 15% of the total grade.

Attendance to laboratory practices is mandatory. Students will obtain the "Non-Assessed" qualification if the absence to practices exceeds 20% of the scheduled hours. During the practical sessions, students will be assessed whether they work in groups (T01), respect for norms (T05), and self-learn (T04, G02). The evaluation of competences during the practical sessions will have a value of 5% of the total grade. Additionally, the content of the practices related to the theoretical subject will be evaluated in the continuous, global and final evaluation exercises.

There will be an overall exam that will have a value of 50% of the total grade with questions of the entire syllabus. To pass it is necessary to obtain at least 5 out of 10 in the total grade. It will also be essential to obtain at least 4 out of 10 points in the overall exam.

There will be a final exam to recover failed students. The grade obtained in this exam will be 100% of total grade. This exam will include contents of the entire syllabus and will be in written form, although the teachers can complete the assessment with oral questions.

The students will obtain the "Non-Assessed" qualification when the evaluation activities carried out have a weigh of less than 67% of the total grade.

The assessments will be done mainly by means of written exams to reflect the achievement of learning results, with a limited space to answer. Written answers that demonstrate a lack of required knowledge may justify a decrease of the grade. In addition, there may be multi-answer tests, oral and expositive activities, and the student's active participation in the activities of the subject can be evaluated.

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Continuous assessment	45% total grade	3	0.12	19, 21, 20, 3, 4, 1, 6, 5, 9, 8, 7, 10, 11, 15, 12, 14, 13, 16, 17, 18, 22, 2
Laboratory practices	5%	6	0.24	19, 21, 1, 9, 8, 14, 13, 16, 18, 22, 2
Overall exam	50% total grade	3	0.12	21, 20, 3, 4, 1, 6, 5, 7, 10, 15, 14, 13, 16, 17, 2

## **Bibliography**

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