Biochemistry II

Code: 103265
ECTS Credits: 6

2025/2026

Degree	Type	Year
Food Science and Technology	FB	2

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Although there are no official prerequisites, it is advisable for the student to review the basic contents of Biology, Chemistry and to have a sufficient level of Biochemistry I.

Objectives and Contextualisation

This subject should allow the student to understand that biological processes, especially those related to food and metabolism, have a chemical basis and that they can be explained in these terms. The student must know the basics of metabolism that allow him/her to understand the biochemical foundations of Nutrition, with special emphasis on the metabolism of different types of biomolecules. Likewise, the student must to know and understand the basic biochemical processes of some important processes in food technology.

The specific training objectives are to know and understand:

- The energy metabolism of carbohydrates.

- The metabolism of lipid reserves, lipoproteins, cholesterol and complex lipids.

- The metabolism of nitrogen compounds: amino acids, porphyrins and nucleotides.

- The main mechanisms for the integration of metabolism, hormonal regulation and molecular bases of adaptations and metabolic alterations.

- The foundations and applications of the main biochemical techniques and methodologies

Competences

- Adopt an ethical stance and attach importance to quality in work.
- Analyse, summarise, resolve problems and make professional decisions.
- Apply knowledge of the basic sciences to food science and technology.
- Apply the scientific method to resolving problems.
- Communicate effectively with both professional and non-professional audiences, orally and in writing, in the first language and/or in English.
- Develop individual learning strategies and planning and organisation skills.
- Display knowledge of nutrients, of their bioavailability and function in the organism, and the bases of nutritional balance.
- Display knowledge of the physical, chemical, biochemical and biological properties of raw materials and foods.
- Search for, manage and interpret information from different sources.
- Stay abreast of new knowledge, adapt to new situations and develop creativity.
- Use IT resources for communication, the search for information within the field of study, data processing and calculations.

Learning Outcomes

1. Adopt an ethical stance and attach importance to quality in work.
2. Analyse, summarise, resolve problems and make professional decisions.
3. Apply the fundamental principles and the applications of biochemistry to food biotechnology.
4. Apply the scientific method to resolving problems.
5. Communicate effectively with both professional and non-professional audiences, orally and in writing, in the first language and/or in English.
6. Describe the reactions of reaction, kinetics and enzyme regulation.
7. Determine the biochemical mechanisms of xenobiotic detoxification.
8. Develop individual learning strategies and planning and organisation skills.
9. Establish the metabolic role of vitamins, oligoelements and other essential nutrients.
10. Explain the principal metabolic pathways of glucids, lipids and proteins.
11. Explain the structures and properties of the principal biological molecules.
12. Integrate the different metabolic elements in a global vision of the organism.
13. Search for, manage and interpret information from different sources.
14. Stay abreast of new knowledge, adapt to new situations and develop creativity
15. Use IT resources for communication, the search for information within the field of study, data processing and calculations.

Content

METABOLISM AND METABOLIC REGULATION

Unit 1.- Study of the regulation of the metabolic pathways. Localization of regulation sites. Study of the properties of the enzymes involved. Crossing points. Creation and verification of a regulatory theory.

Unit 2. Biochemical study of carbohydrates. Generalities. Families of monosaccharide. Natural oligosaccharides. Reserve and structural polysaccharides.

Unit 3.- Glycolysis. Overview and phases. Steps of the process of pyruvate formation from glucose.

Unit 4.- Formation of acetyl CoA from pyruvate and tricarboxylic acids cycle. Anaplerotic reactions. The glyoxylic acid Cycle. Synthesis and degradation of disaccharides. Metabolic pathways for fructose and galactose.

Unit 5.- Oxidation-Reduction and electronic transport. Red-ox potentials and free energy change. Route for electronic transport: the respiratory chain. Inhibitors. The mitochondria and oxidative phosphorylation. Coupling of oxidative phosphorylation to electronic transport. The mechanism of oxidative phosphorylation.

Unit 6. Fermentations. Alcoholic fermentation. Lactic fermentation. Applications in food technology.

Unit 7.- Lactate formation and gluconeogenesis. Use of energy by the muscle. Anaerobic glycolysis. Destination of lactate. Gluconeogenesis. Other precursors. Distinctive reactions of gluconeogenesis.

Unit 8.- The pentose Phosphate pathway. The generation of reducing power. Biosynthesis of glucuronic acid.

Unit 9.- Metabolism of glycogen. Glycogen as a form of glucose storage. The degradation and synthesis of glycogen and its control.

Unit 10.- Biochemical study of lipids. Fatty acids. Waxes. Triglycerides. Phosphoglycerides. Sphingolipids and glucolipids. Cholesterol.

Unit 11.- Oxidation of fatty acids. Mobilization of lipid reserves. The path of fatty acids oxidation. Metabolism of the ketone bodies.

Unit 12.- Biosynthesis of lipid reserves. Biosynthesis of saturated fatty acids. The formation of malonyl CoA. The fatty acid synthase complex. Essential fatty acids. Prostaglandins and leukotriens.

Unit 13.- The biosynthesis of cholesterol and its derivatives. The route to mevalonate and the formation of prenyl groups and synthesis of polyprenyl chains. Cholesterol formation. Bile acids and sex hormones. Importance of isoprenoids in plant metabolism and their interest in food technology.

Unit 14.- Digestion and absorption of lipids. Lipoproteins Composition and metabolism. Molecular bases of arteriosclerosis.

Unit 15.- Metabolism of structural lipids. Phosphatidylglycerides. Sphingolipids: sphingomyelin, cerebrosides and gangliosides. Phosphatidyl-inositol cycle. Generation of IP_3.

Unit 16.- Degradation of amino acids. Release and elimination of nitrogen. Desamination and transamination. Urea cycle.

Unit 17.- Catabolism of the carbon skeletons of the amino acids. Cetogenic and gluconeogenic amino acids The integration of the side chains into the different metabolic pathways. Aminoacidopathies. The pool of monocarbon groups and their relationship to the metabolism of amino acids and their regulation. Derivatives of folic acid and S-adenosylmethionine. Essential amino acids.

Unit 18.- Nitrogen fixation and general vision of amino acid biosynthesis and its regulation. Indispensable and not indispensable amino acids.

Unit 19.- The turnover of porphyrins. Nomenclature and synthesis of porphyrins. Degradation of hemoglobin. The bile pigments.

Unit 20.- The metabolism of nucleotides. Biosynthesis of nucleotides: purines and pyrimidines. Biosynthesis of deoxyribonucleotides. Degradation of purines and pyrimidines.

Unit 21.- Integration of metabolism: Overview of the relationships between the different organs and main metabolic adaptations. Fasting. Obesity. Diabetes

Unit 22. Biochemical mechanisms of detoxification of xenobiotics. Oxidative stress and mechanisms of antioxidant defense.

LABORATORY SESSIONS.

Session 1. Study of the metabolic cycle of yeast. Different use of carbon sources: fermentation and oxidation.

Session 2.- Determination of the levels of cholesterol in eggs.

Session 3.- Applications of the electrophoresis in the determination of the composition of proteins in several fish species and substitute products.

Session 4.- Simulation of metabolic pathways: gluconeogenesis.

SEMINARS

Seminar 1: Radioactive techniques

Seminar 2: Electrophoretic techniques

Seminar 3: Molecular Bases of Hormone Action I

Seminar 4: Molecular bases of hormonace model.l action II.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory Practical Course	12	0.48	10
Lectures	31	1.24	7, 10, 12
Seminars	4	0.16	12
Type: Supervised			
Self-learning topic, team working	21.5	0.86	7, 10, 12
Type: Autonomous			
Study and literature search	75	3	7, 10, 12

The methodology used in this subject to accomplish the learning process combines the theory classes, where the teacher exposes the most relevant aspects of each unit, and the active self-learning of the student on topics of interest.

The subject is based on the following activities:

. Classes with ICT support, where the basic concepts of the subject are explained. It is complemented by gamification techniques as well as the possibility of carrying out self-assessment tests through the Virtual Campus just a few weeks prior to the partial exams.

. Doubts class sessions, if required (on a defined date and time)

. Seminars and discussion of problems: Presentation by the teacher of specific topics and discussion in reduced groups.

. Laboratory sessions: Acquisition of laboratory work skills and experimental understanding of concepts explained in classes and seminars.

. Independent student work, individually or in groups, leading to the preparation of topics proposed by the teacher or the student This work involves the search and selection of information from various sources of scientific information. Presentations are public, they must include multimedia material and ICT support and are followed by a discussion of the subject.

In this subject, the use of Artificial Intelligence (AI) technologies is allowed as an integral part of the development of the work, provided that the final result reflects a significant contribution of the student in the analysis and personal reflection.The student must clearly identify which parts have been generated with this technology, specify the tools used and include a critical reflection on how these have influenced the process and the final result of the activity.The lack of transparency in the use of AI will be considered a lack of academic honesty and may lead to a penalty in the grade of the activity, or greater sanctions in serious cases.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final and Partial tests	70%	3	0.12	3, 7, 9, 11, 10, 12
Laboratory exam	10%	1	0.04	2, 4, 6, 7, 10, 12
Self-learning presentation	20%	2.5	0.1	1, 13, 5, 8, 7, 10, 12, 14, 15

The maximum score that can be obtained is 10 points. This course will be passed with an overall score of 5.0 or higher.

The evaluation system is organized in three modules. The final score is obtained with the sum of the marks of the different modules, with the conditions described below.

Module 1. Theory, seminars and problems.

Evaluation system: tests with multiple choice answers. Weight in the overall rating:

• partial exam I: 35%

• partial exam II: 35%

-Evaluated skills: CE1, CE2, CE11, CT1, CT2, CT9

Students can opt for partial exams of the program. There will be two partial tests throughout the course. The first test includes topic 1 to topic 10 (depending on the calendar of the specific year). The second includes from theme 10 to the end of the program.

The scheme (see Virtual Campus) includes the different possible situations:

1) Both partials are passed with a grade > or = 4.5 (out of 10): the final grade is obtained by adding the

a) the average of both partials (weight: 70%),

b) the qualification of the practical exam (weight: 10%), and

c) the mark obtained in the self-study presentation (weight: 20%).

If this sum is = or > 5, the subject will be passed. If the sum is less than 5, the part(s) with a grade <5 mustbe recovered.

2) If a grade <4.5 is obtained in one or more partials, the recovery exam must be taken for these partials. In case of recovering the two partials, the minimum grade required in each of them to be able to average and calculate the final grade according to the weighting described, will be 4.5. If a grade equal to or greater than 4.5 (out of 10) is obtained in the recovery exam, the final grade will be the sum of the average of the two partials (weight: 70%), the practical exam grade (weight: 10%) and the note of self-learning (weight: 20%). If this value is equal to or greater than 5, the subject will have been passed. If the sum is less than 5, the final qualification will be "suspense".

Module 2. Laboratory practices:

The realization of all sessions of laboratory practices is mandatory to be able to carry out the evaluation test and, consequently, to pass the subject. Failure to carry out these laboratory practices implies a grade of No evaluable or Suspense, depending on the situation.

- Assessment system: written test on the activities carried out during the practices in a practice exam to be done in the last session of the practices.

- Weight in the overall rating: 10% (Maximum score: 1.0)

- Evaluated skills: CE1, CE2, CE11, CT2, CT8, CT9

Module 3. Self-learning.

Failure to carry out theself-study work and its presentation and defense will be evaluated as Not Evaluable or Failed, depending on the situation, regardless of the grades obtained in the exams.

Assessment system: Oral presentationand defense.

- The written and oral presentation will be evaluated, as well as the competence at the time of the topic discussion.

- Weight in the overall rating: 20% (Maximum score: 2.0)

- Evaluated skills: CE1, CE2, CE11, CT4, CT5, CT6, CT8, CT10

Unique assessment system:

Regarding the single evaluation test of the theoretical part (module 1) it will be done coinciding with the same date fixed in the calendar for the last continuous evaluation test (second partial) and the same system of assessment and recovery than for continuous assessment.

Students who take the single assessment mustdo the laboratory practices (module 2) in face-to-face sessions at the time setin the calendar according to their practice group. The in-person presentation of the Self-Learning Work (module 3) will also be mandatory, to which you will have to attend the entire session on the indicated day. The assessment of modules 2 and 3 will take place on the day of the single assessment.

The same non-assessable criteria will be applied as for continuous assessment.

The review of the final grade follows the same procedure as for the continuous evaluation.

RECOVERY EXAM

Students that do not pass partial exams will be examined in the entire Module 1 program in the recovery exam where the two partial exams are considered individually. The mark obtained (up to a maximum of 7.0 points) (Module 1) will be added to that obtained in Modules 2 and 3.

Regardless of the grade obtained in the partial tests, students may choose to be examined for the entire program in the recovery exam to obtain a new grade. In this case, the mark obtained in this last exam will be considered.

Not evaluable: It will be considered non-evaluable if you have only participated in evaluation activities that represent $\leq$ 15% of the final score.

Bibliography

Information on the most recent editions of the textbooks, as well as links to their location, is available in the Moodle's classroom, which is regularly updated as new editions or UAB agreements with publishers appear.

1.- Tymoczko, John L.; Berg, Jeremy M.; Stryer, Lubert L. *Bioquímica. Curso Básico.* Ed. Reverté. Barcelona, 2014 (versión "light" del Stryer, más económica, suficiente para el curso). (https://elibro.net/es/lc/uab/titulos/147925).

2.- Jeremy Berg, Gatto Jr. Gregory, Hines Justin, Tymoczko John, Stryer Lubert. *Biochemistry.* 10th Ed. Macmillan Learning, 2023.

3.- D.L. Nelson y M.M. Cox (2018). Lehninger - Principios de Bioquimica (7ª ed.). Ed. Omega

4.- L. Stryer, Jeremy M. Berg and John L. Tymoczko. Bioquímica (7ª ed.). (2015). Ed. Reverté.

5.- Voet, D., Voet, J.G & Pratt, C.W. *Fundamentos de Bioquímica*. 4ª edición. Ed. Panamericana. 2016.

6.- D. R. Ferrier. *Biochemistry.* 6ª edició. Lippincott's Illustrated Reviews. 2014.

7.- Mathews, Van Holde, Appling & Anthony-Cahill. *Bioquímica*. 4ª edició. Pearson Educación, 2014.

8.- DAMODARAN, S., PARKIN, K. L. y FENNEMA, O. R. *Química de los Alimentos.* 3ª edició. Ed. Acribia. 2010.

9.- Wong D.W.S . Mechanism and Theory in Food Chemistry, 2nd Edition. Springer, 2017

10.- Gil, A. Bases Fisiológicas y Bioquímicas de la Nutrición. 3ª edició. Editorial Panamericana. 2017.

11.- McKee, T; McKee, J.R.. Bioquímica, las bases moleculares de la vida. 4ª Ed. McGraw-Hill, 2009.

12.- John W. Baynes and Marek H. Dominiczak. Bioquímica médica (4ª ed.). Elsevier 2015. (https://ebookcentral-proquest-com.are.uab.cat/lib/uab/detail.action?docID=3429739).

13.- http://www.biorom.uma.es/indices/index.html

Software

No specific software is required, beyond an office suite to prepare the exhibitions and the "GLUCO" software (University The University of Edinburgh). Version 1.2b), installed in the Windows 7 emulator of computers in the Computer Room.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Spanish	first semester	afternoon
(PAUL) Classroom practices	2	Spanish	first semester	afternoon
(PLAB) Practical laboratories	1	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	2	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	3	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	4	Catalan	first semester	morning-mixed
(TE) Theory	1	Spanish	first semester	afternoon