COURSE DATA

Data Subject	
Code	36363
Name	Biological chemistry and Biochemistry
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1212 - Degree in Gastronomic Sciences	Faculty of Pharmacy and Food Sciences	1	Second term

Subject-matter

Degree	Subject-matter	Character
1212 - Degree in Gastronomic Sciences	4 - Chemistry	Basic Training

Coordination

Name	Department
GARCIA MURRIA, MARIA JESUS	30 - Biochemistry and Molecular Biology
ORZAEZ CALATAYUD, MARIA DEL MAR	30 - Biochemistry and Molecular Biology

SUMMARY

Biological Chemistry and Biochemistry I is a first year (second semester) basic subject of the Degree in Gastronomic Sciences (University of Valencia). This subject accounts for a total of 6 ECTS in the curriculum.

The aim of the course is to provide an overview of the fundamentals of biochemistry, including the structure and function of biomolecules, enzymology, the structure and function of nucleic acids, basic concepts of bioenergetics and an overview of metabolism and its regulation.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

To study Gastronomic Sciences, it is recommended to have a basic knowledge about biology, chemistry, physiscs and mathematics.

OUTCOMES

1212 - Degree in Gastronomic Sciences

- Know the structure and properties of biological macromolecules and their relationship with the function that they perform.
- Know the main metabolic pathways and have an integrated view of the processes for obtaining energy.

LEARNING OUTCOMES

- To correlate the structure and properties of biological macromolecules with their function.
- To know how enzymes work and how are them regulated.
- To know the main metabolic pathways and to have an integrated view of metabolism and its regulation.
- To know the essential processes in the transmission of genetic information, from DNA to protein.

DESCRIPTION OF CONTENTS

1. Introduction.

Concept and historical perspective. Biochemical research today and its relationship with Gastronomy. Bibliographic databases.

2. Amino acids and primary structure of proteins.

Amino acids: structure, properties and classification. Peptide bond: characteristics and properties. Protein primary structure.

3. Three-dimensional structure of proteins.

Secondary structure: helix and sheet. Tertiary structure. Quaternary structure. Folding and stabilization of proteins. Denaturation and renaturation of proteins, relevance in gastronomy. Structural classification of proteins: fibrous proteins and globular proteins. Isolation, purification and characterization of proteins. Chromatography and electrophoresis.

4. Enzymes: Basic Concepts and enzyme kinetics.

Active center: concept and general characteristics. Enzymatic catalysis. Coenzymes: an overview. Nomenclature and classification of enzymes. Enzyme kinetics. Effect of substrate concentration: Michaelis-Menten equation. Effect of enzyme concentration, pH and temperature.

5. Regulation of enzyme activity.

Reversible and irreversible enzyme inhibition. Enzymatic regulation by covalent modification. Activation of zymogens.

6. Enzymology of food processing

Characteristics of the industrial enzymes. Aplications. Carbohydrases: amylases, pectinases, cellulases. Proteases. Lipases. Enzymes used in making bread, beer and cheese.

7. Structure and function of carbohydrates and lipids

General classification of carbohydrates and their function. Major monosaccharides and their derivatives. Disaccharides and homopolysaccharides. Complex carbohydrates. Lipids: mportance, functions and general characteristics. Storage Lipids. Membrane lipids.

8. Structure and function of nucleotides and nucleic acids.

Chemical structures of the nucleotides. Chemical composition of nucleic acids. Molecular mechanisms involved in transmission of genetic information. DNA replication. Transcription. Protein synthesis.

9. Introduction to metabolism.

Basic concepts of metabolism. Thermodynamic principles applied to living systems. Potential transfer of phosphate groups. Electronic carriers. Characteristics of the metabolic pathways. Overview of the metabolic pathways. Hormonal regulation of metabolism.

10. Glycolysis and metabolic fates of piruvate

Introduction to the metabolism of carbohydrates. Glucose transporters. React sequence: preparatory phase and phase of benefits. Regulation of glycolysis. Metabolism of other hexoses: fructose, galactose and mannose. Lactic and alcoholic fermentations. Entry of pyruvate into aerobic metabolism: conversion to acetyl-CoA.

11. The citric acid cycle.

Overview. Reaction sequence and energy conservation. Control mechanisms of the citric acid cycle. Amphibolic nature and anaplerotic reactions.

12. Electronic transport and oxidative phosphorylation.

Overview. Mitochondrial electron transport chain. Chemiosmotic theory. Oxidative phosphorylation. Mitochondrial transport systems. Energy efficiency of oxidative phosphorylation. Integrated control of the ATP synthesis. Inhibitors and uncoupling molecules.

13. Gluconeogenesis, glycogen metabolism and the pentose phosphate pathway

General features of gluconeogenesis. Precursors for the synthesis of glucose. Specific reactions of gluconeogenesis. Regulation of gluconeogenesis. Intertissue relationships in the hepatic synthesis of glucose. Glycogen breakdown. Glycogen synthesis. Control of glycogen metabolism. Pentose phosphate pathway: functions, tissue and subcellular localization. Reaction sequence. Regulation.

14. Lipid metabolism

Lipid transport: lipoproteins. Mobilization of triacylglycerols stores. Fatty acid oxidation. Metabolism of ketone bodies. Lipogenesis: biosynthesis of fatty acids and triacylglycerols. Regulation of fatty acid metabolism. Coordinated regulation of synthesis and degradation of fatty acids.

15. Metabolism of nitrogenous compounds

Introduction to amino acid metabolism. Origin and fate of amino acids in mammals. Catabolism of amino acids. Nitrogen excretion and the urea cycle. Nucleotide metabolism: an overview.

16. Integration of metabolism and tissue and organ specialization

Introduction. Interdependence of the major organs in fuel metabolism. Main processes of fuel storage, mobilization and use during the well-fed state, starvation, diabetes mellitus and exercise.

17. Laboratory sessions

Isolation and purification of the enzyme invertase. Determination of enzymatic activity and protein concentration. Evaluation of the purification process. Viewing the activity of protease from their natural source. Determination of the presence of starch in food.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	45,00	100
Laboratory practices	15,00	100
Development of group work	2,00	0
Study and independent work	58,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	5,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Lectures. The will develop the essential concepts of the subject.

Classroom practicals: resolution of problems, resolution of cases and teamwork. During these classes, the students will specifically apply the knowledge that they have acquired during the lectures. The resolution of problems with a critical spirit will be potentiated.

Practicals. They will be held in groups of 16 students. They should allow students to become familiar with some basic techniques of biochemistry and molecular biology, to acquire some skills in lab work and to critically analyze the results, as well as to complement the concepts learned during the lectures. Attendance will be compulsory. There will be 3 laboratory sessions in groups of 2 students. Once finished, each working group should elaborate and present a written results report.

Seminars. All students should prepare and give a seminar, which should focus on issues raised by the teacher responsible for the subject within the overall objectives of the course. Each group must hand in a written report on the proposed topic, including references used for the preparation thereof and a copy of the artwork used in the presentation. The exhibition theme will be proposed in public session and it will use any means of presentation that the group members see fit. After the presentation, open discussion among participants, moderated by the teacher.

EVALUATION

1. Theory. Written exam: short questions and multiple choice questions. **65 points**. To pass the course, a minimum of 32,5 points must be obtained in the examination of theory.

2. Practicals: Written exam: problems and short questions or multiple choice questions. Laboratory practices represent **15 points** of the final grade for the course. Attendance at practical classes is mandatory. The practical classes will be evaluated by conducting a written test (10 points) on the content of the practical sessions, which may take place at a different call of the final theory exam date, and a memory with the results obtained in the practices (5 points). To pass the course must have obtained a **minimum score on the written exam of 5 points (out of 10)**.

3. Seminars. 10 points. Evaluation of the preparation, contents and presentation of the work; progress in the appropriate use of scientific language; raising doubts; critical thinking and ability to collaborate with the rest of the group. The possibility of implementation and evaluation of written memories by students will be contemplated.

4.Continuous assessment. 10 points.

It will be assessed directly of the work and student's attitude in lectures, practical, in solving issues, problems and seminars.

To pass the course a **50 points** of the total score is required, with a **minimum of 32 points in the theory exam and of 5 points in the practicals exam**. If these minimum scores are not achieved, the final score will be the one corresponding to the written exam, without considering the remaining parts.

Students who fail to pass in the first call will keep for the second call the score obtained in the theory written exam if they reach 35 points or the score of the practicals written exam if they reach 7.5 points. In addition, they will keep the score of the seminar and the Practicals Results Report in the remaining calls.

REFERENCES

Basic

- Referencia b1: NELSON, D.L. y COX, M.M.: Lehninger. Principios de Bioquímica. 6ª ed. Ediciones Omega, Barcelona, 2014.
  Referencia b2: VOET, D.; VOET, JG. and PRATT, CW. Fundamentos de Bioquímica. La vida a nivel molecular. 2ª ed., Ed. Panamericana. Madrid, 2007 (4ª ed. en inglés, 2011).
  Referencia b3: FEDUCHI, E., ROMERO, C., BLASCO I., S. y GARCIA-HOZ, C.: Bioquímica Conceptos esenciales. 2ª ed., Ed. Panamericana. Madrid, 2015.
  Referencia b4: STRYER, L.; BERG, J.M.; TYMOCZKO, J.L. Bioquímica. 7ª ed., Ed. Reverté,

Barcelona, 2013.
Referencia b5: VOET, D. and VOET, J.G.: Bioquímica. 3ª ed., Ed. Panamericana, Madrid, 2006.
Referencia b6: WATSON J.D.: Biología Molecular del Gen 5ª ed, Ed. Panamericana, Madrid, 2006.
Referencia b7: DEVLIN, T.M.: Bioquímica: libro de texto con aplicaciones clínicas. 4ª ed., Ed. Reverté, Barcelona, 2004. (7ª ed. en inglés, 2010).

Additional

- Referencia c1: ALBERTS, B. Biología Molecular de la célula. 5ª ed. Ediciones Omega, Barcelona, 2010.
Referencia c2: HORTON, H.R., MORAN, L.A., SCRIMGEOUR, K.G. y RAWN, J.D.: Principles of biochemistry. 4th ed., Prentice-Hall, New Jersey, 2006.
Referencia c3: LODISH, BERK, MATSUDAIRA, KAISER; KRIEGER; SCOTT; ZIPURSKY, DARNELL. Biología Celular y Molecular. 5ª ed., Ed. Panamericana, 2005
Referencia c4: MATHEWS, C.K., VAN HOLDE, K.E., AHERN, K.G.: Bioquímica. 3ª ed., Pearson Education (Addison Wesley), Madrid, 2002.
Referencia c5: McKEE, T. y McKEE, J.R. Bioquímica. Las bases moleculares de la vida. 4ª ed. McGraw-Hill/Interamericana, Madrid, 2009.
Referencia c6: STRYER, L.; BERG, J.M.; TYMOCZKO, J.L. Bioquímica. 6ª ed., Ed. Reverté, Barcelona, 2013 (versión en catalán).
Referencia c7: PERETÓ, J., SENDRA, R., PAMBLANCO, M. i BAÑÓ, C.: Fonaments de bioquímica. Servei de Publicacions de la Universitat de València, Valencia, 2005.

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

The 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 conventional teaching guide, due to the current situation that makes it necessary to adopt a hybrid teaching model

3. Teaching methodology

- Theoretical teaching: it will be carried out through face-to-face sessions
- Seminars: They will all be face-to-face on the dates agreed with the students.

• Practical classes: They will be face-to-face and according to the course calendar, but with the appropriate modifications to comply with the safety regulations against CoVid19. These may consist of:

- Limitation of the capacity of the laboratories to 50%, establishing shifts in each group

- Use of audiovisual descriptions that serve as an introduction prior to the practice (virtual classroom)

- Reduction of sample processing times by showing the student the result that would be obtained if the standard incubation times (24 hours) had elapsed, etc.

If a state of total confinement were to occur, all face-to-face teaching would be carried out online and, in the case of seminars, students must upload their narrated presentation.

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 is not possible, the evaluation will be carried out through the virtual classroom with tasks or online questionnaires with single or multiple choice questions, which can be complemented with short questions and/or on certain occasions through an oral exam through video conferencing.

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

5. Bibliography

It is not modified