Universitat Autònoma de Barcelona

**2020/2021**

# Biochemistry I

Code: 103266
ECTS Credits: 6

| Degree | Type | Year | Semester |
|---|---|---|---|
| 2501925 Food Science and Technology | FB | 1 | 2 |

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

## Contact

Name: Anna Maria Bassols Teixidó
Email: Anna.Bassols@uab.cat

## Use of Languages

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

## Teachers

Néstor Gómez Trias
Antonio Casamayor Gracia
Jorge Perez Valle

## Prerequisites

There are no official prerequisites. However, it is advisable to review the basic contents of Biology and Chemistry of the first semester and the Baccalaureate.

## Objectives and Contextualisation

This subject should allow the student to understand that biological processes, especially those related to food an
The student must understand the structural bases of these processes, as
Likewise, the student must understand the molecular basis of the transm
The specific training objectives are to know and understand:
- The structure and function of proteins, carbohydrates, lipids, nucleotide
- The structure of nucleic acids and the processes of replication, transcri
- The foundations and applications of the main biochemical and molecula

## 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 mechanisms of transmission and regulation of genetic information in the cell.
7. Describe the reactions of reaction, kinetics and enzyme regulation.
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 structures and properties of the principal biological molecules.
11. Search for, manage and interpret information from different sources.
12. Stay abreast of new knowledge, adapt to new situations and develop creativity
13. Use IT resources for communication, the search for information within the field of study, data processing and calculations.

## Content

Attention:
The contents can be partially modified in case of sanitary crisis

PART 1. THE CHEMISTRY OF LIFE
Unit 1.- Introduction to the chemistry of living beings. Biomolecules. Properties of water and importance of the aq
Unit 2.- Constituents of proteins: amino acids. Structure and properties.
Unit 3.- The amino acid sequence of proteins. The peptide bond. The primary structure of proteins. Sequencing o

Unit 4.- Three-dimensional structure of proteins. Secondary structure. The α-helix and the β-sheet. Tertiary struct

Unit 5.- Fibrous proteins. α-keratin, collagen and others.

Unit 6.- Oxygen-transport proteins. Structure of myoglobin and hemoglobin. The center of oxygen binding. Coope

Unit 7.- Catalytic proteins: enzymes. General properties. Classification. Substrates and coenzymes or cofactors.

Unit 8.- Enzyme kinetics. The Michaelis-Menten equation. Meaning of Km and Vmax. Effects of pH and temperat

Unit 9.- Mechanisms of regulation of enzymatic activity: Regulation of enzyme concentration. Allosteric enzymes.

Unit 10.- Vitamins and trace elements. Structure, function, requirements and avitaminosis.

Unit 11.- Biochemical study of carbohydrates. Generalities. Families of monosaccharides. Natural oligosaccharid

Unit 12.- Biochemical study of lipids. Fatty acids. Triglycerides. Phosphoglycerides. Sphingolipids and glucolipids

Unit 13.- Nucleotides and derivatives. Purines and pyrimidines and their nucleotides. The nucleotides as enzyma

PART 2. REPLICATION, TRANSCRIPTION, SYNTHESIS OF PROTEINS

Unit 14.- Nucleic Acids. DNA and its structure. Base equivalence. Double helix. Nucleosomes.

Unit 15.- DNA replication. Semiconservative replication. DNA polymerases. Okazaki fragments. DNA replication:

Unit 16.- RNA and transcription. RNA polymerase and synthesis of RNAs. Prokaryotes and eukaryotic promoters

Unit 17.-
The genetic code. The nature of the code and its main features. The base triplets. tRNA as an adapter in protein

Unit 18.- The synthesis of proteins. Activation of amino acids. Characteristics of aminoacyl tRNA synthase. Initia

Unit 19.- Control of gene
expression. Induction and gene repression. Lac operon. Control of gene expression in eukaryotes.

Unit 20.-
Introduction to food biotechnology. Introduction to recombinant DNA techniques. Biotechnological applications of

LABORATORY PRACTICES.

Practice 1. Separation of a mixture of amino acids by ion exchange chromatography and identification by thin lay

Practice 2. Enzymes: determination of the Km.

Practice 3. Bioinformatic applications in bibliographic research.

Practice 4 (2 days). Applications of PCR to food biotechnology.

SEMINARS

Seminar 1: Chromatographic techniques.

Seminar 2: Spectrophotometric techniques.

Seminar 3: Enzymatic analysis.

Seminar 4: Discussion of a scientific article.

Seminar 5: PCR, cloning, recombinant protein expression.

Seminar 6: Sequence of DNA,microarrays.

## Methodology

Attention:
The methodology can be partially modified in case of sanitary crisis

The methodology of the learning process combines the theoretical classes where the teacher exposes the most r

- Presential lectures with ICT support explaining the basic concepts of the subject.
- Seminars and problem solving: Presentation by the teacher of specific topics and discussion in small groups.
- Laboratory practices: Acquisition of work skills in the laboratory and experimental understanding of concepts explained in face-to-face classes and seminars.
- Autonomous work of the student, individually or in groups, for the preparation of topics proposed by the teacher or the student. This work involves the search and selection of information in various sources of scientific databases. Presentations are public, they must include multimedia material and ICT support and are followed by a discussion.

## Activities

| Title | Hours | ECTS | Learning Outcomes |
|---|---|---|---|
| Type: Directed | | | |
| Laboratory practices | 12 | 0.48 | 2, 4, 3, 1, 8, 10 |
| Seminars and problem solving | 6 | 0.24 | 2, 4, 3, 9, 10 |
| Theoretical lectures | 31 | 1.24 | 2, 4, 3, 1, 7, 6, 9, 10 |
| Type: Supervised | | | |
| Self-learning preparation | 22.5 | 0.9 | 3, 1, 11, 5, 7, 6, 8, 9, 10, 13 |
| Type: Autonomous | | | |
| Study and bibliographic searching | 74 | 2.96 | 2, 4, 3, 11, 7, 6, 8, 9, 10, 13 |

## Assessment

Attention:
The evaluation tipology can be modified in case of sanitary crisis that would not allow presential exams

The maximum score is 10 points. Students will pass the subject with an overall score of 5.0 or higher. The evalua

• Module 1. Theory, seminars and problems. - Evaluation system: test with multiple choice answers. - Weight in t

2) If the average of the two partial exams is less than 5, the student will have to retake the partial / partial with a s

If in the retake of the partial exam the student obtains a mark less than 4.5 (out of 10), the partial exams will not c
3) In case the student has to retake the two partial exams, the exam will

• Module 2. Laboratory practices:

Laboratory practices are mandatory. The student who has not completed
- Assessment system: Multiple choice test about the activities carried out
- Weight in the global rating: 10% (Maximum score: 1,0)
- Competences evaluated: CE1, CE2, CE11, CT2, CT8,CT9

• Module 3. Self-learning.

Theself-learning work is compulsory and, therefore, the student who doe
- Evaluation system: papers presented.
- The written and oral presentation will be evaluated, as well as the comp
- Weight in the global rating: 20% (Maximum score: 2.0)
- Skills evaluated: CE1, CE2, CE11, CT4, CT5, CT6, CT8, CT10

Retake exam

In the retake exam the student will be able to take the failed partial exam

Any student regardless of the score obtained in the partial tests may cho

Non-gradable: A student is not gradable if he has participated in assessm

## Assessment Activities

| Title | Weighting | Hours | ECTS | Learning Outcomes |
|---|---|---|---|---|
| Exam of laboratory practices | 10 | 0 | 0 | 2, 4 |
| Partial and final exams | 70 | 2 | 0.08 | 2, 3, 1, 7, 6, 8, 9, 10 |
| Presentation and discussion of self-learning project | 20 | 2.5 | 0.1 | 2, 4, 3, 11, 5, 7, 6, 9, 10, 12, 13 |

## Bibliography

Basic bibliography:

*a) Anàlisi química quantitativa.* D.C. Harris, tred. 6a ed., Reverté, 2006.
b) *Fundamentos de Química Analítica,* D. Skoog, D.M. West, F.J. Holler i S.R. Crouch, 8a ed. Thomson, 2005.
*c) Química General*, Petrucci, Harwood, Herring, trad. 8a ed, Prentice Hall, 2007.

Main textbooks:

1.- Stryer, L., Berg, J.M. & Tymoczko, J.L. BIOQUIMICA. CURSO BASICO. 1ª edició. Ed. Reverté 2014

2.- Nelson, D.L., & Cox, M.M. Lehninger Principles of Biochemistry. 5ª edició. Freeman ed. 2009.

3.- Fennema, O.R. Química de los Alimentos. 2ª edició. Ed. Acribia. 2000.

4.- Sanchez de Medina F. Tratado de Nutrición. Tomo I: Bases fisiológicas y bioquímicas de la nutrición. 2ª edición. Ed. Panamericana.

Others:

5.- Berg, J. M., Tymoczko, J. L. & Stryer, L. Bioquímica. 6ª edició. Ed. Reverté. Barcelona, 2007.

6.- Voet, D., Voet, J.G & Pratt, C.W. Fundamentos de Bioquímica. 2ª edición. Ed. Panamericana. 2007.

7.- P. C. Champe & R.A. Harvey. Biochemistry. 3ª edició. Lippincott's Illustrated Reviews. 2004

8.- Mathews, Van Holde & Ahern. Bioquímica. 3ª edició. Adison-Wesley, 2002.

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