

## COURSE DESCRIPTION

### COURSE DETAILS

Title (of the course): **BIOQUÍMICA**

Code: 101452

Degree/Master: **GRADO DE VETERINARIA**

Year: 1

Name of the module to which it belongs: FORMACIÓN BÁSICA COMÚN

Field: CIENCIAS BÁSICAS

Character: BASICA

Duration: SECOND TERM

ECTS Credits: 6.0

Classroom hours: 60

Face-to-face classroom percentage: 40.0%

Study hours: 90

Online platform: <http://moodle.uco.es/m2223/>

### LECTURER INFORMATION

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### PREREQUISITES AND RECOMMENDATIONS

#### Prerequisites established in the study plan

Students must have at least a B-1 level certificate in English language.

#### Recommendations

It is convenient for students of this subject to fulfill previously the subjects of Animal, Vegetal and Molecular Biochemistry, and Physics-Chemistry.

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### INTENDED LEARNING OUTCOMES

- CE2 To facilitate the acquisition of knowledge of the physical and chemical principles of biological processes and their applications in Veterinary Science.
- CE3 The molecular foundations of biological processes.

### OBJECTIVES

The main objective of this subject is that students could achieve an integrated vision of biochemistry, which allows them to understand the molecular basis of life, to know the functioning of living organisms at this level, and to perceive their ability of response and adaptation to different physiological and/or environmental variables. More specifically, it is intended that students understand the common molecular logic that underlay the functioning of all living beings, and the differential aspects that lead to biodiversity. On the other hand, students should acquire an overview of some defects in these molecular processes that can lead to various diseases.

In addition students should develop the ability to understand, compare and relate concepts and apply them to a specific problem, as well as acquire skills in basic techniques in a biochemistry laboratory.

### CONTENT

#### 1. Theory contents

##### I. Proteins and enzymes.

1. Amino acids and peptides.
2. Proteins.
3. Enzymes.

##### II. Bioenergetics and metabolic integration.

4. Bioenergetics.
5. Membranes and transport.
6. Intercellular communication.
7. Introduction to metabolism. Krebs cycle.
8. Respiratory chain and oxidative phosphorylation.

##### III. Carbohydrate metabolism.

9. Glycolysis, fate of pyruvate and gluconeogenesis.
10. Glycogen metabolism.
11. Regulation of carbohydrate metabolism.
12. Pentose phosphate pathway.

##### IV. Lipids metabolism.

13. Triacylglycerols catabolism.
14. Biosynthesis of fatty acids.
15. Metabolism of steroids and lipoproteins.

##### V. Metabolism of nitrogenous molecules.

16. Metabolism of amino acids.
17. Nucleotide metabolism.
18. Nitrogen excretion.
19. Integration of metabolism.
20. Short overview of the research carried out by the teachers.

#### 2. Practical contents

##### CLASSROOM PRACTICES



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CP I. AMINO ACIDS AND PEPTIDES. Problems and questions on the acid-base properties of amino acids. Determination of pI and electrophoretic mobility of amino acids and peptides.

CP II. ENZYMATIC KINETICS. Problems and questions on the bioenergetics of enzymatic catalysis. Lineweaver-Burk equation:  $K_m$  and  $V_{max}$  calculation. Effect of inhibitors on the kinetic parameters.

CP III. BIOENERGETICS AND ENERGETIC METABOLISM. Problems and questions on basic thermodynamic concepts, difference of potential between two redox pairs, relationship between variation of free energy, difference of potential,  $K_{eq}$ , activated intermediaries and coupled reactions, Krebs cycle, respiratory chain and oxidative phosphorylation.

CP IV. TRANSPORT. Problems and questions on transport bioenergetics:  $Na^+/K^+$ , ATPase,  $Ca^{2+}$ -ATPase and secondary active transport systems.

CP V. BIOMOLECULES METABOLISM. Problems and questions on carbohydrate, lipids and nitrogenous biomolecules.

### LABORATORY PRACTICES

LP1. Quantitative analysis of proteins by the Lowry method.

LP2. Kinetic characterization of alkaline phosphatase.

LP3. Quantitative analysis of glucose by the glucose oxidase method.

LP4. Hydrolysis of glycogen with chlorhidric acid. Enzymatic hydrolysis with alpha amylase.

The practical content of this subject will be adapted according to the number of students and the availability of teaching spaces, and of the availability of materials and instruments.

## SUSTAINABLE DEVELOPMENT GOALS RELATED TO THE CONTENT

Good health and well-being

Quality education

Gender equality

Clean water and sanitation

Industry, innovation and infrastructure

## METHODOLOGY

### General clarifications on the methodology (optional)

Lecture sessions using the master class system. There are 19 units which will be taught in classrooms to full groups, stimulating the participation through questions and dialogue with students. Presentations will be used, and the corresponding pdf handouts will be available for students in the moodle platform.

Classroom practices to solve numeric problems and practical cases related to metabolism: topics requiring biochemical calculations are explained, in order to allow students to solve quantitative problems, and realistic questions on different metabolic situations are posed. Related topics will be taught, asking for volunteers to solve problems in the blackboard. There will be problem collections with their solutions available in moodle.

Laboratory practices: Laboratory practices introduce students in the methodologies used in Biochemistry, getting them familiar with the experimental procedures with different biomolecules. Protocols of practices will be available in moodle. It is compulsory to attend each practice with its protocol and a laboratory coat!

Analysis of cases: Students will analyze practical cases proposed by teachers, related to the concepts studied in this subject.

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### Methodological adaptations for part-time students and students with disabilities and special educational needs

Part-time students will be provided with the necessary information, in addition to the attention in the tutorial session timetable, to ensure that they will have all the resources required to pass the subject.

The methodological strategies contemplated in this course will be adapted according to the needs presented by students with disabilities and special educational needs in the cases that are required.

### Face-to-face activities

Activity	Large group	Medium group	Total
Assessment activities	3	-	3
Case study	-	11	11
Lab practice	-	10	10
Lectures	36	-	36
<b>Total hours:</b>	<b>39</b>	<b>21</b>	<b>60</b>

### Off-site activities

Activity	Total
Activities	21
Reference search	9
Self-study	60
<b>Total hours</b>	<b>90</b>

## WORK MATERIALS FOR STUDENTS

Case studies - <http://moodle.uco.es/moodlemap/>

Exercises and activities - <http://moodle.uco.es/moodlemap/>

Oral presentations - <http://moodle.uco.es/moodlemap/>

Placement booklet - <http://moodle.uco.es/moodlemap/>

References - <http://moodle.uco.es/moodlemap/>

## EVALUATION

Intended learning	Case Studies	Exams	Laboratory Practice
CE2	X	X	X
CE3	X	X	X

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Intended learning	Case Studies	Exams	Laboratory Practice
<b>Total (100%)</b>	<b>12%</b>	<b>68%</b>	<b>20%</b>
<b>Minimum grade</b>	<b>4.5</b>	<b>4</b>	<b>5</b>

(\*)Minimum mark (out of 10) needed for the assessment tool to be weighted in the course final mark. In any case, final mark must be 5,0 or higher to pass the course.

### Method of assessment of attendance:

Participation and active attendance to classroom practices and laboratory practices will be taken into account, as well as to the discussion sessions of clinical cases.

### General clarifications on instruments for evaluation:

A Final exam will be made on the date determined by the Faculty of Veterinary Medicine. In this exam the concepts taught in lectures and the resolution of numerical problems will be evaluated. It will be up to 68 % of the total mark of the subject.

Laboratory practices: Each practice will be evaluated by the student's participation and the interest demonstrated during its execution. Laboratory practices will be also evaluated by the obtained results and by a test that will be made immediately after each practice. This qualification will be up to 20% of the total.

Case Studies (analysis of cases): Analysis of cases will be evaluated in written. The mark of this part will be the 7 % of the final mark of the subject. In classroom practices, attendance, participation and resolution of questions will be evaluated. The mark of this part will be the 5% of the final mark of the subject.

In order to pass the subject, it is essential to obtain at least 40% of the final exam points, **being all parts of the program compensated**. It is also compulsory, to obtain 50% of the laboratory practice points. The score of the different activities will compute in the final mark only when the above mentioned requirements have been achieved and the minimum score required in each of the items reached. In order to pass the subject it is necessary to obtain a score equal to or greater than 5 points out of 10.

Teachers can select specific students for oral examination, and even to carry out a second oral examination, upon suspicion of fraud.

Students who took the module in Spanish in previous years and decide to enroll the bilingual group, will need to do and pass all evaluation activities in English.

The marks obtained in the different evaluation sections will be valid only for the calls of the current course, as long as the required minimum has been reached.

### Clarifications on the methodology for part-time students and students with disabilities and special educational needs:

Part-time students will follow the same evaluation system as the rest of students. Nevertheless, particular considerations of students with the formal consideration of part-time students will be taken into account.

The recommendations from the Inclusive Education Unit of the UCO will be followed for the attention and evaluation of students with disabilities and special educational requirements.

### Clarifications on the evaluation of the extraordinary call and extra-ordinary call for completion studies:

The evaluation of these extraordinary calls will consist of several parts in which the competences corresponding to the different activities of the course will be evaluated, and it might include laboratory, and/or clinical and practical

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cases. However, the marks of the previous course will be kept for all those activities in which the required minimum had been reached. Students who took the module in Spanish in previous years and decide to enroll the bilingual group, will need to do and pass all evaluation activities in English.

### Qualifying criteria for obtaining honors:

*It will be awarded to students with the maximum mark, provided it is equal or higher than 9. The number of students passing the subject with honors will depend on the total number of students registered at the subject.*

## BIBLIOGRAPHY

### 1. Basic Bibliography

#### Español

**Nelson DL, Cox MM (2018)** Lehninger, Principios de Bioquímica (7ª edición). Ediciones Omega.

**Stryer L, Berg JM, Tymoczko JL (2013)** Bioquímica con aplicaciones clínicas (7ª edición). Editorial Reverté.

**Tymoczko JL, Berg JM, Stryer L (2014)** Bioquímica. Curso Básico (2ª edición). Editorial Reverté.

**Voet D, Voet JG, Pratt (2016)** Fundamentos de Bioquímica: La vida a nivel molecular (4ª edición). Editorial Médica Panamericana.

#### English

**Nelson DL, Cox MM (2021)** Lehninger Principles of Biochemistry (8th edition). MacMillan.

**Berg JM, Gatto GJ, Hines J, Tymoczko JL, Stryer L (2023)** Biochemistry (10th edition). MacMillan.

**Voet D, Voet JG, Pratt (2016)** Fundamentals of Biochemistry: Life at the Molecular Level (5th edition). Wiley.

### 2. Further reading

#### Español

Devlin TM (2015) Bioquímica. Libro de texto con aplicaciones clínicas (5ª edición). Editorial Reverte.

#### English

Devlin TM (2020) Textbook of Biochemistry with clinical correlations (8th edition). Blackwell.

Garrett RH, Grisham CM (2023) Biochemistry (7th edition). Cengage Learning, Inc.

## COORDINATION CRITERIA

Common evaluation criteria

Tasks deadlines

Tasks performance

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## SCHEDULE

Period	Assessment activities	Case study	Lab practice	Lectures
1# Fortnight	0,0	3,0	2,5	5,0
2# Fortnight	0,0	2,0	2,5	6,0
3# Fortnight	0,0	2,5	0,0	6,0
4# Fortnight	0,0	0,0	2,5	6,0
5# Fortnight	3,0	1,5	0,0	3,0
6# Fortnight	0,0	0,0	0,0	5,0
7# Fortnight	0,0	2,0	2,5	5,0
<b>Total hours:</b>	<b>3,0</b>	<b>11,0</b>	<b>10,0</b>	<b>36,0</b>

The methodological strategies and the evaluation system contemplated in this Course Description will be adapted according to the needs presented by students with disabilities and special educational needs in the cases that are required.