Information about the course

Degree: Bachelor of Science Degree in Medicine

Faculty: Faculty of Medicine and Health Sciences

Code: 341105 **Name:** Biochemistry and Molecular Biology

Credits: 9,00 ECTS **Year:** 1 **Semester:** 2

Module: Morphology, structure and function of the human body

Subject Matter: Bioquímica **Type:** Formación Básica

Branch of knowledge: Ciencias de la Salud

Department: Biomedical Sciences

Type of learning: Classroom-based learning

Language/-s in which it is given: Spanish

Teachers:

341A	Jesus Angel Prieto Ruiz **(Profesor responsable)**	jesus.prieto@ucv.es
	Francisco Jose Revert Ros	fj.revert@ucv.es
	Jose Miguel Hernandez Andreu	jmiguel.hernandez@ucv.es
341B	Jesus Angel Prieto Ruiz **(Profesor responsable)**	jesus.prieto@ucv.es
	Francisco Jose Revert Ros	fj.revert@ucv.es
	Jose Miguel Hernandez Andreu	jmiguel.hernandez@ucv.es
341C	Jesus Angel Prieto Ruiz **(Profesor responsable)**	jesus.prieto@ucv.es
	Francisco Jose Revert Ros	fj.revert@ucv.es

341C Jose Miguel Hernandez Andreu jmiguel.hernandez@ucv.es

Module organization

Morphology, structure and function of the human body

Subject Matter	ECTS	Subject	ECTS	Year/semester
Anatomía	27	Anatomy II	9	2/1
		Anatomy III	6	2/2
		Embryology and Anatomy I	12	1/2
Biología	6	Cell Biology	6	1/1
Bioquímica	9	Biochemistry and Molecular Biology	9	1/2
Física	6	Biophysics	6	1/2
Fisología	12	Human Physiology I	6	2/1
		Human Physiology II	6	2/2
Morfología y estructura microscópica del cuerpo humano	6	Histology	6	2/1

Learning outcomes

Al finalizar la asignatura, el estudiante deberá demostrar haber adquirido los siguientes resultados de aprendizaje:

R1 - Know the types and functions of biomolecules.

Learning outcomes of the specified title

Type of AR: Description

- Understanding and recognizing the normal structure and function of the human body, at the molecular, cellular, tissue, organic and systems levels, at the different stages of life and in both sexes

Type of AR: Description

- Students can pass on information, ideas, problems and solutions to both a specialized and non-specialized audience

- Students have developed the learning skills needed to undertake further studies with a high degree of autonomy

- Students have the ability to collect and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical topics

- Students know how to apply their knowledge to their job or vocation in a professional way and possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study

R2 - Identify metabolic pathways and know how to integrate them.

Learning outcomes of the specified title

Type of AR: Description

- Understanding and recognizing the normal structure and function of the human body, at the molecular, cellular, tissue, organic and systems levels, at the different stages of life and in both sexes

Type of AR: Description

- Students can pass on information, ideas, problems and solutions to both a specialized and non-specialized audience

- Students have demonstrated to possess and understand knowledge in a study area that starts from the base of the general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study

- Students have developed the learning skills needed to undertake further studies with a high degree of autonomy

- Students have the ability to collect and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical topics

- Students know how to apply their knowledge to their job or vocation in a professional way and possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study

- Understanding and recognizing the effects of growth, development and aging on the individual and their social environment

R3 - Know the transmission of genetic information.

Learning outcomes of the specified title

Type of AR: Description

- Understanding and recognizing the normal structure and function of the human body, at the molecular, cellular, tissue, organic and systems levels, at the different stages of life and in both sexes

Type of AR: Description

- Students can pass on information, ideas, problems and solutions to both a specialized and non-specialized audience

- Students have demonstrated to possess and understand knowledge in a study area that starts from the base of the general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study

- Students have developed the learning skills needed to undertake further studies with a high degree of autonomy

- Students have the ability to collect and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical topics

- Students know how to apply their knowledge to their job or vocation in a professional way and possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study

- Understanding and recognizing the effects of growth, development and aging on the individual and their social environment

R4 - Know how to use different working techniques in the laboratory.

Learning outcomes of the specified title

Type of AR: Description

- Handling basic laboratory materials and techniques. Interpreting a normal analysis

Type of AR: Description

- Performing functional tests, determine vital parameters, and interpret them. Basic physical examination

R5 - Interpret obtained results during practices

Learning outcomes of the specified title

Type of AR: Description

- Understanding and recognizing the normal structure and function of the human body, at the molecular, cellular, tissue, organic and systems levels, at the different stages of life and in both sexes

Type of AR: Description

- Performing functional tests, determine vital parameters, and interpret them. Basic physical examination

- Understanding and recognizing the effects of growth, development and aging on the individual and their social environment

R6 - Be able to produce documents on biochemistry and work as a team.

Learning outcomes of the specified title

Type of AR: Description

- Students can pass on information, ideas, problems and solutions to both a specialized and non-specialized audience

- Students have demonstrated to possess and understand knowledge in a study area that starts from the base of the general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study

- Students have developed the learning skills needed to undertake further studies with a high degree of autonomy

- Students have the ability to collect and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical topics

- Students know how to apply their knowledge to their job or vocation in a professional way and possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study

- Understanding and recognizing the effects of growth, development and aging on the individual and their social environment

R7 - Search for information in bibliographic sources, and know how to analyze them.

Learning outcomes of the specified title

Type of AR: Description

- Understanding and recognizing the normal structure and function of the human body, at the molecular, cellular, tissue, organic and systems levels, at the different stages of life and in both sexes

Type of AR: Description

- Students can pass on information, ideas, problems and solutions to both a specialized and non-specialized audience

- Students have demonstrated to possess and understand knowledge in a study area that starts from the base of the general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study

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Assessment system

Modalidad presencial

Assessed learning outcomes	Granted percentage	Assessment tool
R1, R2, R3, R4, R5, R6, R7	60,00%	Tests
R4, R5	35,00%	Practices
R6, R7	5,00%	Participation in class

Observations

i. At the end of the first semester there will be a partial exam that will be eliminatory for students who obtain a minimum grade of 5/10. Completion of the first partial implies the renunciation of taking the entire subject at the end, except in the case that the grade is less than 5. There will be no compensation in the grade of those who, having passed the first partial, present themselves to the second and do not approve. The mark of the first partial **will not be saved** for the second call.
ii. Attendance at practices is compulsory. At the end of the practices, the completion of a Practice Report will be requested. Failure to attend a practice prevents the presentation of the corresponding report. The notes of the practices will only be saved from one year to the next, so that any student of the SP group who has the subject two or more years pending, must do the practices.
iii. Deliveries of work will not be accepted on the platform outside of the periods established for each activity. Sending jobs by email is not allowed
Criteria for granting honors:
Honors may be awarded to the best students, who must have obtained a minimum grade of at least 9, as a requirement to be eligible for it.
If circumstances require it, a special test may be established to determine those students

deserving of honors, taking into account the 5% limit of enrolled students.
In second and subsequent calls, only honors that may be available after the first call may be awarded.

Notes:

Single assessment is **not** permitted in this course.

Use of AI: Students may use AI for personal study of the subject. Students may not use AI for assessable assignments, unless required in a specific activity and instructed by the instructor. If AI is used in any activity, the specific part of the activity, the AI ??tool used, and the purpose must be stated.

MENTION OF DISTINCTION:

In accordance with the regulations governing the assessment and grading of subjects in force at UCV, the distinction of "Matrícula de Honor" (Honours with Distinction) may be awarded to students who have achieved a grade of 9.0 or higher. The number of "Matrículas de Honor" (Honours with Distinction) may not exceed five percent of the students enrolled in the group for the corresponding academic year, unless the number of enrolled students is fewer than 20, in which case a single "Matrícula de Honor" (Honours with Distinction) may be awarded. Exceptionally, these distinctions may be assigned globally across different groups of the same subject. Nevertheless, the total number of distinctions awarded will be the same as if they were assigned by group, but they may be distributed among all students based on a common criterion, regardless of the group to which they belong. The criteria for awarding "Matrícula de Honor" (Honours with Distinction) will be determined according to the guidelines stipulated by the professor responsible for the course, as detailed in the "Observations" section of the evaluation system in the course guide.

Actividades formativas

The methodologies to be used so that the students reach the expected learning outcomes will be the following:

M1	Masterclass
M2	Problems resolution and practical cases
M4	Content presentations by teacher
M5	Knowledges and skills explanation
M6	Laboratory practices
M14	Online activity on e-learning

M15 Personal study

M16 Information research

IN-CLASS TRAINING ACTIVITIES

ACTVITY	RELATIONSHIP WITH THE COURSE LEARNING OUTCOMES	METHODOLOGY	HOURS	ECTS
Theory class	R1, R2, R3, R6, R7	Masterclass Problems resolution and practical cases Content presentations by teacher Knowledges and skills explanation	54,00	2,16
Seminar and group practices	R4, R5	Content presentations by teacher Knowledges and skills explanation Laboratory practices	13,50	0,54
Practices in small groups	R1, R2, R3	Problems resolution and practical cases	6,80	0,27
Tutoring	R1, R2, R3, R7	Knowledges and skills explanation	2,30	0,09
Evaluation	R1, R2, R3, R4, R5, R6, R7	Problems resolution and practical cases Knowledges and skills explanation	2,30	0,09
TOTAL			**78,90**	**3,16**

TRAINING ACTIVITIES OF AUTONOMOUS WORK

ACTVITY	RELATIONSHIP WITH THE COURSE LEARNING OUTCOMES	METHODOLOGY	HOURS	ECTS
No attendance	R1, R2, R3, R5, R6, R7	Problems resolution and practical cases Online activity on e-learning Personal study Information research	146,10	5,84
TOTAL			**146,10**	**5,84**

Description of contents

Descripción de contenidos necesarios para la adquisición de los resultados de aprendizaje.

Theoretical content:

Block of content	Contents
BLOCK I: STRUCTURAL BIOCHEMISTRY	Unit 1. Introduction to the chemistry of life. Cellular fundamentals. Chemical fundamentals. Genetic Foundations. Evolutionary foundations. Unit 2. Water. Structure. Water as a solvent. The hydrophobic effect. Ionization of water. Weak acids and bases. Water as a reagent. Buffer solutions. Unit 3. Amino acids, peptides and proteins. Protein characterization. The covalent structure of proteins. Sequences protein and evolution. Unit 4. The three-dimensional structure of proteins. Primary, secondary, tertiary and quaternary structure. Denaturation and protein folding. Unit 5. Functions of proteins. Oxygen-binding proteins. Protein-Ligand Interactions: System immune. Interactions between proteins modulated by chemical energy: actin, myosin and molecular motors. Unit 6. Collagen. Structure. Composition of Tropocollagen. Synthesis of Collagen. Link types in the Mature collagen. Unit 7. Enzymes. Introduction to enzymes. Kinetic enzyme. Mechanisms. Regulatory enzymes. Unit 8. Carbohydrates and glycobiology. Monosaccharides and disaccharides. Polysaccharides. Glucoconjugates: proteoglycans, glycoproteins and glycolipids. Unit 9. Nucleotides and nucleic acids. Structure and functions. Unit 10. Lipids. Storage lipids. Lipids in membranes. Lipids as pigments, cofactors and signals. Unit 11. Biological membranes and transport. Composition and architecture of the membranes. Dynamics of the membranes. Solute transport through membranes. Biosignalization. Molecular mechanisms of signal transduction.

BLOCK II: Metabolism	Unit 12. Principles of bioenergetics. Bioenergetics and thermodynamics. Importance of ATP. Redox reactions. Unit 13 Glycolysis, gluconeogenesis and the pentose phosphate pathway. Glycolysis. Routes of entry to glycolysis. Fermentation. Gluconeogenesis. The pentose phosphate pathway. Unit 14 Principles of metabolic regulation: glucose and glycogen. Glycogen metabolism in animals. Regulation of metabolic pathways. Coordinated regulation of glycolysis and gluconeogenesis. Coordinated regulation of glycogen synthesis and degradation. Unit15 The citric acid cycle. Acetyl-CoA production. Reactions and regulation of the citric acid cycle. Cycle of glyoxylate. Unit 16 Catabolism of fatty acids. Digestion, mobilization and transport of fats. Fatty acid oxidation. Ketone bodies. Unit 17 Amino acid oxidation and urea production. Metabolic destinations of amino groups. Excretion of nitrogen and urea cycle. Pathways of degradation of amino acids. Unit 18 Oxidative phosphorylation. Electron transfer reactions in the mitochondria. ATP synthesis. Regulation of oxidative phosphorylation. Mitochondrial genes: origin and effects of mutations. The role of the mitochondria in apoptosis and oxidative stress. Unit 19 Lipid biosynthesis. Biosynthesis of fatty acids and eicosanoids. Triglyceride biosynthesis. Biosynthesis of membrane phospholipids. Cholesterol, steroid, and isoprenoid biosynthesis. Unit 20 Biosynthesis of amino acids and nucleotides. Nitrogen metabolism. Amino Acid Biosynthesis. Derived molecules of amino acids. Nucleotide biosynthesis and degradation. Unit 21 Hormonal regulation and integration of metabolism. Structure and function of hormones. Tissues with metabolism specific. Hormonal regulation of metabolism. Obesity and regulation of body mass.

BLOCK III: Genetic Information. Molecular Biology Techniques.	Unit 22 Flow of genetic information. Replication. Repair. Transcription. Maturation. The genetic code. Protein biosynthesis. Protein transport and degradation. Principles of regulation of gene expression. RNA interference. Unit 23 Recombinant DNA technology. Cloned. From genes to genomes. From genomes to proteomes. Alteration of genomes and biotechnology. Genetic engineering.

Temporary organization of learning:

Block of content	Sessions	Hours
BLOCK I: STRUCTURAL BIOCHEMISTRY	13	26,00
BLOCK II: Metabolism	15	30,00
BLOCK III: Genetic Information. Molecular Biology Techniques.	11	22,90

References

- **LEHNINGER. PRINCIPIOS DE BIOQUÍMICA**. Cox, M.M. - Nelson, D.L. Editorial Omega, 2014 Sexta edición.
- **BIOLOGÍA MOLECULAR DE LA CÉLULA**. Alberts, B., et al. Editorial Omega, 2016. Sexta Edición.
- **BIOQUÍMICA**. Curso Básico. Tymoczko, John L.; Berg, Jeremy M.; Stryer, Lubert L. Editorial Reverté. 2014
- **BIOQUÍMICA**. Matthews, C.K., et al. Editorial PEARSON, 2013. Cuarta Edición
- **BIOQUÍMICA**. Tymoczko, John L.; Berg, Jeremy M.; Stryer, Lubert L. Editorial Reverté. 2013. Séptima Edición.
- **BIOQUÍMICA MÉDICA.** Baynes JW, Dominiczak. Elsevier 2011. Tercera Edición.
- **NETTER, BIOQUÍMICA ESENCIAL.** Peter Ronner. Elsevier 2020.
- **HARPER. BIOQUÍMICA ILUSTRADA.** Murray et al.Ed. Mc Graw Hill. 28ª edición. 2010