VNIVERSITAT DE VALÈNCIA

Course Guide
42599 Biochemistry and molecular biology

COURSE DATA

Data Subject	
Code	42599
Name	Biochemistry and molecular biology
Cycle	Master's degree
ECTS Credits	9.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
2116 - M.U. en Bioinformática 12-V.1	School of Engineering	1	First term

Subject-matter

Degree	Subject-matter	Character
2116 - M.U. en Bioinformática 12-V.1	14 - Biochemistry and molecular biology	Optional

Coordination

Name	Department
RUIZ GARCIA-TREVIJANO, ELENA	30 - Biochemistry and Molecular Biology
TORRES ASENSI, LUIS	30 - Biochemistry and Molecular Biology

SUMMARY

Biochemistry and Molecular Biology is an optional cuatrimestral subject that accounts for a total of 9 ECTS credits. This subject is provided as a complement for graduates without prior training in Health or Experimental Sciences.

The goal of Biochemistry and Molecular Biology as a subject in this Master, is to introduce the student into the molecular basis of the complex mechanisms that govern and regulate the functions of different organisms, the communication pathways between different organs and tissues and the body's adaptation to different situations from exogenous origins.

This subject tries to provide the level of training necessary to understand and analyze the latest trends in Health and Experimental Sciences based on scientific and technological advances. In this sense, it will be study the structure and properties of large biomolecules and their relationship with either the function, the transmission of information or their transformations within the cell.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

A previous and relevant knowledge to understand and follow up the subject is not necessary. To study Biochemistry and Molecular Biology the student will need just the knowledge of a number of basic concepts that are part of the general content from high school courses and therefore, any graduate enrolled in the master will have.

OUTCOMES

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- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Be able to access the information required (databases, scientific articles, etc.) and to interpret and use it sensibly.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.

LEARNING OUTCOMES

- Comprender y manejar la terminología científica básica relacionada con la materia.
- Conocer la estructura de la célula y su evolución.
- Ser capaz de entender dónde tienen lugar los diferentes procesos celulares.
- Comprender de una manera general el funcionamiento celular.
- Conocer las estructuras de las biomoléculas y sus transformaciones en la célula.
- Conocer y comprender los procesos esenciales en la transmisión de la información genética desde el ADN hasta la proteína.
- Comprender el funcionamiento de las enzimas y su regulación.
- Conocer las principales rutas metabólicas y obtener una visión integrada del metabolismo y su regulación.

Entendimiento del origen molecular de las funciones básicas de los seres vivos y de sus principales implicaciones biotecnológicas y médicas.

DESCRIPTION OF CONTENTS

1. Structure and organization of eukaryotic and prokaryotic cells.

Cells as structural and functional units. Features and components of prokaryotic cells. Eukaryotic cells: membranes, organelles and cytoskeleton. Macromolecular constituents of cells. Basic chemical fundamentals of biochemical reactions.

2. Protein structure and structure-function relationship. Interactions between proteins

Aminoacids. Peptide bond. Protein structure levels. Protein folding. Denaturation and renaturation of protein. Functional classification of proteins: globular proteins and fibrous proteins. Protein dynamics. Posttranslational modifications of proteins.

3. Structure, general features and functions of nucleic acids.

Nucleotides chemical structure. Phosphodiester bond. of The nucleic acids chemical composition. Properties and types of nucleic acids. Nucleic acid-protein interactions.

4. Basic concepts in enzymology

Introduction to enzymes: The concept of enzyme. Nomenclature and classification of enzymes. Active center of enzymes: concept and features. Introduction to enzymatic catalysis. Regulation of enzyme activity.

5. Genome organization. Genes and chromosomes

The eukaryotic genome organization. Genomes of viruses and bacteria. Organization of DNA. Eukaryotic chromosome structure.

6. The processes of genetic information transmission: Replication, Transcription and Translation

DNA replication general features and steps. Differences and similarities between replication in prokaryotes and eukaryotes. Transcription in prokaryotes. Major differences in the transcription of prokaryotic and eukaryotic cells. Promoters and proteins involved in transcription. General steps of transcription in prokaryotes and eukaryotes. Maturation and transport of mRNA. Features of protein translation; the genetic code. Components involved in the translation reaction. Protein synthesis in prokaryotes; steps. Translation in eukaryotes.

7. Regulation of gene expression: regulatory sequences, transcription factors, epigenetics, post-transcriptional regulation.

Transcriptional regulatory elements. Transcription factors: types and mechanisms of activation. Epigenetic regulation of transcription. Chromatin remodeling. Histone modification and DNA methylation. siRNA and miRNA

8. Systems of Inter- and intracellular communication

Types of signals and receptors. Second messengers and effector enzymes. Intracellular signaling pathways. Advantages of cell signaling systems and integration of signals.

9. Concept and overview of intermediary metabolism. Metabolic integration. Metabolic fluxes.

Metabolism basic concepts. Thermodynamic principles applied to living beings. Phosphate group transfer potential. Reduction potential. Metabolic flow concept. Features of metabolic pathways. Overview of metabolic pathways. Intertissue relashionships .

10. Basic Techniques in Biochemistry and Molecular Biology.

Methods for detecting nucleic acids: hybridization, PCR and sequencing. Protein detection methods: western blot, immunoprecipitation, two-dimensional gels. Protein-DNA binding analysis: ChIP assay. Microarrays: types. RNA and DNA-seq. Genetically modified animals: types.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	90,00	100
Development of individual work	10,00	0
Study and independent work	70,00	0
Preparation of evaluation activities	25,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	18,00	0
Resolution of case studies	30,00	0
Resolution of online questionnaires	12,00	0
TOTAL	**270,00**	

TEACHING METHODOLOGY

The teaching method used in this subject is based on the students enforcing of training tasks through expository sessions that will favor the teaching-learning environment interaction in the classroom. Previous assignments include preparation (information search, reading texts supplied by teachers), teaching sessions and the later student's work of deepening on the subject.
In addition, case-study analysis will provide skills to the student that will cover different aspects of the subject. Finally, this methodology includes eventual attendance to courses, conferences or round tables organized by the CEC of the Master and / or performance of a bibliographic work on issues that will contribute to the student integral training. A report of activities will be required.

EVALUATION

The 50% of the final score will be obtained by the evaluation of exams.

Evaluation of general reports or those related to training activities on problems and case studies, transversal activities or others exercises developed during the course, will constitute a 40% of the final score.
Continuous assessment of student interaction in the classroom or on-line activities will account for the rest 10% the total score.

REFERENCES

Basic

- Referencia b1: BERG, J.M., TYMOCZKO, J.L., STRYER, L. Bioquímica. 6ª ed. Ed. Reverté, Barcelona, 2008.
- Referencia b2: CHANDAR N. Y VISELLI S.. Biología Molecular y Celular. Ed Lippincott Williams & Wilkins. 2011.
- Referencia b3: NELSON, D.L., COX, M.M. Lehninger Principios de Bioquímica. 4a ed. Ed. Omega, Barcelona, 2006. (5ª ed. inglés, Lehninger Principles of Biochemistry. Ed. W.H. Freeman and Co., New York, 2008).
- Referencia b4: ALBERTS, B., BRAY, D., LEWIS, J., RAFF, M., ROBERTS, K., WATSON, J.D. Biología Molecular de la Célula. 4ª ed. Ed. Omega, Barcelona, 2004. (5ª ed. inglés, Garland Publishing, Inc., New York, 2007).

Additional

- Referencia c1: DEVLIN, T.M. Bioquímica: libro de texto con aplicaciones clínicas. 4ª ed., Ed. Reverté, Barcelona, 2004. (6ª ed. inglés, Textbook of biochemistry with clinical correlations. Ed. John Wiley & Sons, New York, 2006).

- Referencia c2: LEWIN, B. Genes IX. 9 th ed. Ed. McGrawHill, Madrid, 2008
- Referencia c3: WATSON J.D. Biología Molecular del Gen. 5ª ed. Ed. Panamericana, Madrid, 2006. (6a ed. inglés, Molecular Biology of the Gen. Ed. The Benjamin Cummings Publishing Company, San Francisco, 2008).
- Referencia c4: CHAMPE, P.C., HARVEY, R. A. Lippincotts illustrated reviews: Bioquímica. 4ª ed. Ed. J.B. Lippincott, Philadelphia, 2008.