UAB
Universitat Autònoma de Barcelona

Function of Biomolecules in Health and Illness

Code: 42888
ECTS Credits: 9

2025/2026

Degree	Type	Year
Bioquímica, Biología Molecular y Biomedicina	OP	1

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

The requirements for the Master's degree. The classes will be mostly in Catalan, but they will also be taught in Spanish depending on the faculty. Classes could be conducted in English if requested by the students with sufficient advance notice, and if there is consensus within the student group and with the professor.

Objectives and Contextualisation

Upon completion of the module, the student will be able to:

1. Plan experiments for the identification, expression, purification, and functional characterization of biomolecules.
2. Analyze the structure and function of proteins using bioinformatics techniques.
3. Relate structural and functional changes in biomolecules to pathologies.
4. Select and apply methodologies for the design of enzyme inhibitors.
5. Identify and characterize enzyme inhibitors as drugs.
6. Utilize enzymatic technology for biomedical and biotechnological applications.
7. Recognize biomolecules associated with human pathologies and use them as therapeutic targets.
8. Associate specific diseases with the accumulation of misfolded proteins.
9. Understand the molecular basis of diseases caused by dynamic mutations and epigenetic changes.
10. Assess the functional role of membrane lipids and their involvement in specific pathologies.
11. Familiarize themselves with the main techniques and facilities in a reference clinical biochemistry laboratory.

    Competencies

    Advanced Biotechnology

    Apply techniques for modifying living organisms or parts thereof to improve pharmaceutical and biotechnological processes and products, or to develop new products. (Specialization in Molecular and Therapeutic Biotechnology)

    Ability to synthesize, analyze alternatives, and engage in critical debate.

    Integrate the content of metabolic pathways in living organisms under normal, pathological, or exogenously modified conditions (Specialization in Molecular and Therapeutic Biotechnology).

    Apply acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.

    Effectively communicate their conclusions, as well as the knowledge and ultimate reasons underlying them, to specialized and non-specialized audiences in a clear and unambiguous manner.

    Possess learning skills that enable them to continue studying, largely through self-directed and autonomous work.

    Possess knowledge that provides the foundation or opportunity for originality in the development or application of ideas, often in a research context. Utilize and responsibly manage bibliographic information and computer resources related to biotechnology.

    Biochemistry, Molecular Biology, and Biomedicine

    Analyze research results to obtain new biotechnological or biomedical products and transfer them to society.

    Analyze and accurately interpret the molecular mechanisms operating in living organisms and identify their applications.

    Apply techniques for modifying living organisms or parts thereof to improve pharmaceutical and biotechnological processes and products, or to develop new products.

Develop critical reasoning within the field of study and in relation to the scientific or business environment. Identify and utilize bioinformatic tools to solve problems related to biochemistry, molecular biology, and biomedicine.

Integrate content in biochemistry, molecular biology, biotechnology, and biomedicine from a molecular perspective.

Apply acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.

Effectively communicate their conclusions, as well as the knowledge and ultimate reasons underlying them, to specialized and non-specialized audiences in a clear and unambiguous manner.

Possess learning skills that enable them to continue studying, largely through self-directed and autonomous work.

Possess knowledge that provides the foundation or opportunity for originality in the development or application of ideas, often in a research context.

Utilize and manage bibliographic information and computer resources related to biochemistry, molecular biology, or biomedicine. Utilize scientific terminology to argue research results and effectively communicate them orally and in writing.

To understand the genetic mechanisms and laboratory techniques that enable the diagnosis of rare diseases.

Innovation in the development of omics technologies and big data for the research of genomic variants associated with neurodevelopmental disorders.

Learning Outcomes

1. CA15 (Competence) Create new biotechnological and biomedical products using advanced processes and technologies for their transfer to society.
2. CA16 (Competence) In the development of relevant biomolecules, act ethically and with respect for fundamental rights and duties, diversity and democratic values, in accordance with the Sustainable Development Goals.
3. KA22 (Knowledge) Identify the molecular mechanisms of key biological functions and those involved in the onset of diseases.
4. KA23 (Knowledge) Identify biomolecules whose function/dysfunction is associated with human pathologies.
5. KA24 (Knowledge) Provide advanced methodologies for the functional study of biomolecules, both in normal and pathological situations.
6. SA22 (Skill) Understand the molecular mechanisms of relevant functions responsible for diseases in the field of biomedicine.
7. SA23 (Skill) Use methodologies, including bioinformatics, to analyse enzyme active sites and to design drugs in the field of biomedicine.
8. SA24 (Skill) Describe the molecular mechanisms of relevant functions in biomedicine.

Content

Block 1: Identification, extraction, and purification of biomolecules. Functional characterization.

- Practical concepts for protein purification.
- Strategies in the search for potential new drugs and in the detection of enzymatic activity.

- Practical considerations for enzyme assays. Applied aspects of enzyme kinetics.
- Identification of enzyme functional regions using bioinformatics tools. Practical session in the computer lab.
- Structural and functional analysis of enzyme inhibitors that act as drugs. Practical session in the computer lab.
- Drug repositioning: Identification and development of new uses for existing drugs.

Block 2: Enzymes associated with human pathologies. Diagnostic and therapeutic applications.

- Enzymes involved in retinoid metabolism. Associated pathologies.
- Urea cycle disorders. Biochemical and computational approaches to assess the cause of the pathology.
- Chromatin-modifying enzymes and their role in human diseases.
- Enzyme replacement therapy. Enzymeactivators. Pharmacological chaperones. Therapeutic applications.
- Enzymes and nanomedicine. Enzyme encapsulation. Controlled drug release. Role of infectious proteins in degenerative diseases.
- Strategies for the treatment of lysosomal diseases: enzyme, cellular, and gene therapy. Proteases and protease inhibitors. Biomedical applications and tight-binding kinetics.
- Yeast as a model organism. Three applications in biomolecule characterization: protein-lipid interactions, protein-protein interactions, and genetic interactions.

Block 3: Conformational diseases.

- Proteostasis and conformational diseases.
- Prions and related diseases.
- Therapies under development for conformational diseases: Introduction to conformational diseases. Light chain amyloidosis. Alzheimer's disease.

Block 4: Membrane lipids in Biomedicine

- Role of lipids in various functions and dysfunctions of biomembranes: dynamics of lipid microdomains (lipid rafts, etc.); endocytosis and exocytosis; oxidative stress; apoptosis. Study techniques.

Block 5: Visits to the Clinical Laboratory Service at the Parc Taulí Health Consortium (Sabadell)

- Visit to the laboratories of genetics, biochemistry, immunology, microbiology, and hematology.

Block 6: In silico strategies for drug identification

- In silico strategies for pharmacological identification.
- Use of virtual screening against a protein involved in antibiotic resistance.
- Docking, molecular dynamics, and binding affinity energy calculations between protein and drug.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Oral presentation	5	0.2	
Practical activities in the computer classroom	8	0.32	
Theory classes	38	1.52	
Visit to clinical laboratories	4	0.16	

Type: Supervised		
Preparation and presentation of an individual work	10	0.4
Type: Autonomous		
Independent work of the student	73	2.92

The module consists of theoretical classes, computer lab practical classes, a visit to a reference Clinical Biochemistry laboratory, and a seminar presentation by the student. The organization and teaching methodology for these educational activities are described below.

Theory classes:

The content of the theory program will be primarily delivered by professors in the form of lectures with audiovisual support. The presentations used by the professor in class will be made available beforehand on the Virtual Campus of the subject. It is recommended that students have access to this material as a support for their classes. It is advised that students regularly consult the recommended books listed in the Bibliography section of this teaching guide to consolidate and clarify, if necessary, the content explained in class. It is also advisable for students to use the links provided in the presentations of different topics, which contain videos and animations related to the processes explained in class.

Computer lab practical classes:

Students will be directly called to the classroom for the development of the session. The work will be individual, and it will be important for the student to have prior knowledge of the software to be used.

Visit to a reference Clinical Biochemistry laboratory:

The session will take place at the Clinical Analysis Laboratory of the Parc Taulí Hospital in Sabadell, where the student will receive explanations about the functioning of all the facilities and the methodologies used by healthcare professionals. After the visit, a multiple-choice knowledge test will be conducted.

Seminar presentation:

Each student will be required to give a seminar presentation.

The student will prepare a seminar on a topic agreed upon with a tutor professor and will present it publicly in class using audiovisual means.

Preparation tutorials for the seminar:

There will be a group tutorial session led by the module coordinator to distribute the seminar topics and propose the general organization of the material to be presented. Students may also have individual tutorials with professors directly involved in the chosen topic to guide them in the preparation of the material.

Note: 15 minutes of a class, within the schedule established by the institution/program, will be reserved for students to complete evaluation surveys of the faculty's performance and evaluation of the subject/module.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Attendance and active class participation	10%	38	1.52	CA15, CA16, KA22, KA23, SA22
Continous assessment	20%	30	1.2	KA22, KA23, SA23, SA24
Fieldwork evaluation	10%	4	0.16	KA24
Presentation of a seminar	20%	5	0.2	KA22, KA23, KA24, SA24
Theory exams	40%	10	0.4	KA22, KA23, SA22, SA24

- ***Attendance and active participation in class:***

  In addition to attendance, the level of participation, discussion, and problem-solving of the questions posed by the instructor in the different teaching areas of the subject will be assessed. This activity will be monitored and reported to the module coordinator after each class by the instructor. This assessment will account for 10% of the final grade.

  Preparation and oral presentation of a seminar:

  Students will present a seminar publicly in class, followed by a discussion. This component will represent 20% of the final grade for those who present.

  Written assessments:

  The submission of assignments or written tests requested by the instructors of each part of the subject will be assessed.

  In addition, participation in seminar sessions will be evaluated through written questions. This part will contribute 10% to the test grade.

  Altogether, this component will account for 40% of the final grade.

  Continuous assessment:

  Continuous assessment includes activities proposed during theory sessions and practicals in the computer lab.

  The collection of all these activities will account for 20% of the final grade.

  Fieldwork:

  A visit to the Clinical Laboratory Service of the Parc Taulí Hospital Consortium (Sabadell) will be scheduled.

  A multiple-choice test will be administered to evaluate the learning outcomes from the visit. This test will represent 10% of the final grade.

  Final evaluation:

  The final grade will be calculated using the following formula:

  Final grade = T***0.40 + CA***0.20 + S***0.20 + AP***0.10 + FW*0.10

  Where:

  - T = Theory

- CA = Continuous Assessment
- S = Seminar
- AP = Attendance and Active Participation
- FW = Fieldwork

A student will be considered "Not Assessable" when the evaluation activities (final exam, field visit test) do not allow a minimum global grade of 5.0 to be obtained.

Attendance at classroom practicals and fieldwork sessions is mandatory. Students will receive a "Not Assessable" grade if absences exceed 20% of the scheduled sessions.

Important: If plagiarism is detected in any submitted assignment, it may result in the student failing the entire module.

This subject/module does not allow for a single final assessment system.

Bibliography

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Software

Pymol vs 2.5

Autodock Vina

Gromacs

VMD (Visual Molecular Dynamics)

https://www.uniprot.org/ (online database)

https://www.rcsb.org/ (online database)

https://www.ebi.ac.uk/Tools/msa/clustalo/ (online tool)

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https://www.ebi.ac.uk/pdbe/emdb/empiar/ (online database)

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLABm) Practical laboratories (master)	1	Catalan	annual	afternoon
(SEMm) Seminars (master)	1	Catalan/Spanish	annual	afternoon
(TEm) Theory (master)	1	Catalan/Spanish	annual	afternoon