



Universitat de Lleida

DEGREE CURRICULUM
**PROTEOMICS AND PROTEIN
ENGINEERING**

Coordination: TAMARIT SUMALLA, JORDI

Academic year 2023-24

Subject's general information

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|---|--|--------|------------|------------------|
| Subject name | PROTEOMICS AND PROTEIN ENGINEERING | | | |
| Code | 101652 | | | |
| Semester | 2nd Q(SEMESTER) CONTINUED EVALUATION | | | |
| Typology | Degree | Course | Character | Modality |
| | Bachelor's Degree in Biomedical Sciences | 2 | COMPULSORY | Attendance-based |
| Course number of credits (ECTS) | 6 | | | |
| Type of activity, credits, and groups | Activity type | PRALAB | PRAULA | TEORIA |
| | Number of credits | 1.2 | 1.8 | 3 |
| | Number of groups | 3 | 2 | 1 |
| Coordination | TAMARIT SUMALLA, JORDI | | | |
| Department | BASIC MEDICAL SCIENCES | | | |
| Teaching load distribution between lectures and independent student work | Lectures, 60 hours. Avaluation, 4 hours. Stimulated independent student work, 90 hours | | | |
| Important information on data processing | Consult this link for more information. | | | |
| Language | Catalan. Capacity to read in english is required. | | | |

| Teaching staff | E-mail addresses | Credits taught by teacher | Office and hour of attention |
|------------------------|-----------------------|---------------------------|------------------------------|
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| TAMARIT SUMALLA, JORDI | jordi.tamarit@udl.cat | 6,6 | |

Learning objectives

Proteins are the executors of virtually all biological processes. Knowing its structure and function is key to understanding the functioning of biological systems. Also, proteins are not only a subject for study; they can also be used for medical or industrial purposes. Indeed, molecular biology allows us to modify the structure of the proteins in order to give them new functions that are useful in biotechnology or in medicine. These approaches are known as **protein engineering**. On the other hand, it should be noted that the focus we take to study biological systems has changed in recent years. Until the end of the 20th century, research in Biochemistry and Molecular Biology followed a reductionist approach, focusing on the individual characterization of the function and structure of genes and proteins. The ability to carry out large-scale DNA sequencing and the exponential increase in computing capacity, allowed starting a new revolution, the consequence of which is the ability to carry out global studies of biological systems. Today we can talk about **Systems Biology**, as an approach that aims to study biological systems in a holistic way. In this context, **Proteomics** is the branch of research that focuses its objectives on the systematic study of the levels of expression, post-translational modifications and the interactions that are established between proteins. In this subject the student will receive an up-to-date vision of the main tools that allow the study of the proteome and will learn to interpret and design experiments that lead to a greater understanding of the functioning of biological systems through the systematic study of their proteome

Competences

CB1 That students have demonstrated that they have and understand knowledge in an area of study that is based on 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

CB2 That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the development and defense of arguments and problem solving within their area of stud

CE46. Apply the basic criteria for the quantitative validation of analysis at the global level of cell or organism.

CE47. Assess the techniques of analysis of the structure and expression of genomes.

CE48. Assess the techniques of studying the cellular proteome.

CE49. Evaluate the study techniques of cellular metabolites.

CE56. Distinguish the fundamentals of programming languages that allow the extraction of information from

genomics, proteomics and metabolomics databases.

CE57. Apply and evaluate electrophoretic methods for the separation of proteins and nucleic acids

CE58. Apply and evaluate qualitative and quantitative immunological techniques applied to the analysis of molecules and cells

CE59. Apply techniques of luminometry, cytometry, chromatography and spectrometry.

Subject contents

Theory (30h)

Part I: Protein Chemistry and Engineering

1. Analysis of protein structure
2. Metalloproteins
3. Liquid Chromatography
4. Protein production and purification
5. Applications of protein engineering in biocatalysis and medicine

Part II: Proteomics

6. Protein electrophoresis
7. Principles of mass spectrometry of peptides and proteins
8. Gel free proteomics
9. Clinical proteomics
10. Analysis of protein interactions
11. Posttranslational modifications
12. Protein Arrays

Practical program (30 hours)

Informatics sessions (14h)

Activity I: protein sequence similarity searches and alignment using BLAST

Activity II: protein identification by mass spectrometry (peptide mass fingerprinting and MS/MS-Ion search)

Activity III: proteomic databases (Peptide Atlas and PaxDb)

Laboratory sessions (12h)

Spectrophotometry of proteins and aminoacids

Liquid Chromatography

Protein electrophoresis

Critical reading of scientific articles (4h)

Methodology

To achieve the objectives and acquire the attributed competencies, the following methodology will be used:

- Theory: master classes

They have the purpose of giving an overview of thematic content, highlighting those aspects that will be useful in their training.

- Critical review of scientific articles.

Two scientific articles will be discussed. The seminars are intended for students to observe how to apply theoretical concepts to practice and to explore in depth the most relevant and most complex aspects of the subject

- Activities in computer classroom.

The students will carry out some activities with computer in order to apply and work some theoretical concepts.

- Practical laboratory. .

The laboratory practices have the purpose to help the students to become familiar with some basic proteomics and protein chemistry techniques. They will be performed in groups of two or three students.

Development plan

The following development plan will be used:

- Theory: master classes

These will be done with all the students and they are not compulsory.

- Critical review of scientific articles.

These will be done with 1/2 of the students. In them, scientific articles related to the topic of the subject will be analyzed.

- Activities in computer classroom.

These will be done with 1/2 of the students and they are compulsory.

- Practical laboratory. .

These will be done with 1/2 of the students, they are compulsory. Students who do not perform 90% of the practices will not be evaluated.

LABORATORY SAFETY RULES

In the script of each practice, the required individual protection equipment for each session will be indicated. This script will be available in the "Recursos" section of the virtual campus.

The general safety rules are as follows:

- Maintain the work place clean and tidy. The work table must be free of backpacks, folders, coats ...
- Bring closed and covered shoes during the performance of the practices.

- Keep the lab coat tied to protect against spills of chemical substances.
- Do not wear wide bracelets, pendants or sleeves that can be trapped by the equipment.
- Avoid wearing contact lenses, since the effect of chemicals is much greater if they are introduced between the contact lens and the cornea.
- Do not eat or drink in the laboratory
- Smoking is prohibited within laboratories
- Wash your hands whenever you have contact with a chemical and before leaving the laboratory.
- Follow the teacher's instructions and ask him any question you may have about security

Evaluation

Evaluation will consist of two partial examinations, the presentation of several practical exercises and oral presentations.

The details of how the assessment will be structured will be detailed in the introductory document for the subject, which can be found in the resources section of the virtual campus. As an indication, each type of exercise will compute the following percentage in the final grade:

- Partial 1, 35%
- Partial 2, 35%
- Activities 17,5%.
- Laboratory 12,5%

To pass the subject, all the following conditions must be met:

- Overall mark greater than 5
- Weighted average mark of partials greater than 5 and minimum mark of each partial superior to 4.

Unique assessment

If opting for the single assessment, this will consist of a single exam that must be passed with a minimum grade of 5

Bibliography

Principles of Proteomics; Edition:2nd; Author(s):[Richard Twyman](#); ISBN:9780815344728; Publication Date:September 15, 2013

Biochemistry / Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto, Jr., Lubert Stryer; Publicació/producció New York : W.H. Freeman, cop. 2015; Edición Eighth edition; ISBN 9781464126109

[Introduction to protein structure:](#) Branden, Carl New York : Garland, cop. 1999