1. OVERVIEW

Subject Area	Proteomics and Metabolomics
Degree	Bachelor's Degree in Biotechnology
School/Faculty	School of Biomedical and Health Sciences
Year	Fourth
ECTS	6 ECTS
Type	Compulsory
Language(s)	Spanish
Delivery Mode	On campus
Semester	First semester
Academic Year	2024/2025
Coordinating professor	Verónica Moral
Teacher	

2. INTRODUCTION

Proteomics and Metabolomics is a compulsory subject taught in the final year of the degree course. The subject belongs to the Biochemistry and Molecular Biology module which is worth a total of 33 ECTS. This module also includes subjects such as Biochemistry, Molecular Genetics, Molecular Pathology and Functional Genomics and Transcriptomics. It is a compulsory subject (worth 6 ECTS) taught each semester during the fourth year of the Degree in Biotechnology.

The subject has been designed to broaden students' knowledge in the area of omics, allowing them to understand its relationship with genomics and the focus of the global study of the components of a biological system at the different levels of gene expression. As with the Functional Genomics and Transcriptomics subject, the concept is the function from gene to prototype. Students will learn the basic concepts and principles of Proteomics and Metabolomics, as well as the most common technology used and the applications of the studies in the field of biotechnology.

3. LEARNING OUTCOMES (RA, by the acronym in Spanish)

Knowledge (CON, by the acronym in Spanish)

CON04. Identify the techniques and principal methods of cell cultures, protein analysis from a biotechnology standpoint and genetic bases and their application in industry.

- Understand the general strategy for identifying proteins and the characterisation of the proteome.
- Be aware of the latest developments in the study of functional interactions of macromolecules in cells and the metabolome.

- Understand the applications of Proteomics and Metabolomics in the fields of biotechnology and biomedicine.

Abilities (HAB, by the acronym in Spanish)

HAB04. Design experimental procedures and protocols choosing the most suitable technique in the field of biotechnological research, all the while meeting quality and legislative standards.

- Manage the main experimental techniques and strategies used for the global analysis of proteomes and metabolomes.
- Be able to make experimental estimates using omics.
- Be familiar with laboratory work using separation and purification techniques and identification of proteins.

Skills

COMP07. Manage databases and IT programs which could be used in the field of biotechnology and interpret the information extracted.

COMP16. Identify and use the tools and applications of metabolic engineering.

4. CONTENTS

- Proteomics. General concepts. Sample preparation and fractionation. Protein identification.
· Functional proteomic. Differential expression analysis in proteomics. Study of post-translational modifications.
· Interactomics.
· Metabolomics. General concepts. Tools for the global study of metabolites.
· Strategies for studying the metabolome. Directed and undirected analysis. Study of metabolic flow.
· Relationship with other “omic” sciences.

This subject area is divided into five learning units which then contain one or more topics:

Unit 1. INTRODUCTION

- Topic 1. Introduction to Proteomics and Metabolomics. Relationship with other omic sciences.
- Topic 2. Differential expression analysis in omic sciences.

Unit 2. GENERAL CONCEPTS AND APPLIED TECHNOLOGIES IN PROTEOMICS

- Topic 3. General concepts in proteomics.
- Topic 4. Proteome fractionation techniques.
- Topic 5. Mass spectrometry in proteomics.
- Topic 6. Protein identification.

Unit 3. FUNCTIONAL PROTEOMICS

- Topic 7. Differential expression analysis in proteomics.
- Topic 8. Characterisation of post-translational modifications.
- Topic 9. Interactomics.

Unit 4. METABOLOMICS

- Topic 10. General concepts in metabolomics.
- Topic 11. Applied technologies in metabolomics.
- Topic 12. Types of study in metabolomics.
- Topic 13. Analysis of metabolic flow. Fluxomics.

Unit 5. INTEGRATION OF OMIC SCIENCES

- Topic 14. Biology of systems.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Lecture.
- Collaborative learning.
- Problem-based learning.
- Learning based on workshop teaching

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity	Number of hours
Lectures	37
Asynchronous master lectures	15
Case Studies	4
Problem-solving	4
Spoken presentations	4
Written reports and essays	4
Tutorials	15
Independent working	50
Workshops and/or lab work	12
Knowledge tests	5
TOTAL	**150**

7. ASSESSMENT

The assessment methods, together with how much they each count towards the final grade for the subject area, are as follows:

On campus:

Assessment system	Weight
Knowledge tests	50%
Reports and written work	20%
Case study/problem scenario	15%
Laboratory practice	15%

On the Virtual Campus, when you open the subject area, you can see all the details of your assessment activities and the deadlines and assessment procedures for each activity.

7.1. Ordinary exam period

To pass the subject area in the ordinary exam period you must obtain a mark of 5.0 or more out of 10.0 in all assessed parts of the subject. Any part you do not pass in the ordinary exam period will need to be recovered in the extraordinary exam period (resits).

Your final grade will be the average of the partial marks in each of the learning activities you have passed. The continuous assessment system for the learning activities requires attendance to at least 50% of the classes.
It is compulsory for students studying degrees on-campus to accredit attendance to at least 50% of classes. This requirement qualifies students for the right to obtain academic counselling, support and monitoring from the professor. Failure to accredit attendance to at least 50% of the classes by any of the means proposed by the University will mean that the professor awarding a fail to the student for that subject area in the ordinary exam period in accordance with the grading system outlined in these regulations. All of the above, without prejudice to the other requirements or higher attendance percentages that other faculties may stipulate in their learning guides or internal regulations. Regulations for the assessment of official degree programmes, Art. 1 point 4.

(https://universidadeuropea.com/documents/1798/6._Reglamento_evaluacion_titulaciones_oficiales_grado_UEM_v2.pdf)

7.2. Extraordinary exam period (resits)

To pass the subject area in the extraordinary exam period (resits), the students must obtain a mark equal to or above 5.0 out of 10.0 in all parts of the subject assessment they did not pass during the ordinary exam period.

The student must submit the activities not passed in the ordinary exam period taking into account the corrections or comments made by the teacher. The student must also submit any activities which were not submitted.

The final grade will be the average of the partial marks in each of the activities passed (with a mark equal to or higher than 5 out of 10). The marks for the assessable activities the student passed in the ordinary exam period will be maintained for calculating this grade.

8. TIMELINE

The timeline with delivery dates of assessable activities in the subject area is indicated in this section:

Assessable activities	Date
Activity 1. Solving practical cases and application exercises	Weeks 5, 6, 7, 8, and 12
Activity 2. Laboratory work	Week 3, 4 and 9
Activity 3. Objective knowledge test	Weeks 11 and 17/18
Activity 4. Integrated knowledge activity	Week 15

The timeline may be subject to modifications for logistical reasons of the activities. Students will be informed of any changes in due time and course.

9. BIBLIOGRAPHY

- Introduction to Proteomics: Principles and Applications. Mishra, N. Wiley. 2010. ISBN 9780471754022.
- Genomics and Proteomics for Clinical Discovery and Development. Marko-Varga G. 2014. ISBN 9789401792028.
- Mass Spectrometry: Developmental Approaches to Answer Biological Questions. Pottiez G. Springer, 2015. ISBN 9783319130873
- Handbook on Mass Spectrometry: Instrumentation, Data and Analysis, and Applications. Lang, J.K. Nova Science Publishers, Incorporated, 2009. ProQuest Ebook Central. ISBN 9781612096926.
- Medical Applications of Mass Spectrometry. Karoly Vekey, et al., Elsevier Science & Technology, 2007. ProQuest Ebook Central. ISBN 9780080554655.
- Protein Analysis Using Mass Spectrometry: Accelerating Protein Biotherapeutics from Lab to Patient. Mike S. Lee, and Qin C. Ji, John Wiley & Sons, Incorporated, 2017. ISBN 9781119359357.

- Protein phosphorylation analysis by electrospray mass spectrometry a guide to concepts and practice. Wolf D. Lehmann, 2010. Royal Society of Chemistry. ProQuest Ebook. ISBN 9781849732208
- Analyzing Biomolecular Interactions by Mass Spectrometry. Jeroen Kool, and Wilfried M. A. Niessen, John Wiley & Sons, Incorporated, 2015. ISBN 9783527673421.
- Metabolomics: Practical Guide to Design and Analysis. Wehrens, R; Salek, R. Chapman & Hall/CRC Computational Biology Series, 2019. ISBN 9781498725279.
- Methodologies for metabolomics experimental strategies and techniques. Norbert W. Lutz, Jonathan V. Sweedler, Ron A. Wevers. Cambridge University Press, 2013. ISBN 9781139611619.
- A Systems biology approach to study metabolic syndrome. Matej Oresic, Antonio Vidal-Puig. Springer, Cham., 2014. ISBN: 9783319010083.

ADDITIONAL BIBLIOGRAPHY:

- Discovering genomics, proteomics and bioinformatics. Campbell, A. Malcolm & Laurie J. Heyer. 2007. ISBN 0805382194.
- Introduction to molecular biology, genomics, and proteomics for biomedical engineers. Northrop, Robert B. 2009. ISBN 97814200061192
- Proteomics in Practice: A Guide to Successful Experimental Design. Westermeier, R; Naven T; Rudolf Höpker, H. 2nd Edition. 2008. ISBN 9783527319411.1.
- Mass Spectrometry in Metabolomics. Methods and Protocols. Raftery, D. 2014. ISBN 9781493912582
- NMR-Based Metabolomics. Methods and Protocols. Gowda, G. A. N, Raftery, D. 2019. ISBN9781493996902.

10. EDUCATIONAL GUIDANCE AND DIVERSITY UNIT

The Educational Guidance and Diversity Unit (ODI in Spanish) offers support throughout your time at university to help you with your academic achievement. Other cornerstones of our educational policy are the inclusion of students with special educational needs, universal access in all our university campuses and equal opportunities.

This ODI unit offers students:

1. Support and monitoring through counselling and personalised student plans for those who need to improve their academic performance.
2. Curricular adaptations to uphold diversity, with assistance for those students who require specific educational support, leading to equal opportunities without significant changes to methodology or evaluation.
3. We offer students a range of extracurricular educational resources to reinforce skills which will enhance their personal and professional development.
4. Career guidance by offering tools and advice to students with doubts regarding their professional careers or those who believe they have chosen the wrong line of study.

Students who need educational support can contact us at:
orientacioneducativa@universidadeuropea.es

11. SATISFACTION SURVEYS

Your opinion matters!

Universidad Europea encourages you to complete our satisfaction surveys to identify strengths and areas for improvement for staff, degree courses and the learning process.

These surveys will be available in the surveys area of your virtual campus or by email.

Your opinion is essential to improve the quality of the course.

Many thanks for taking part.