Information about the subject

Degree: Bachelor of Science Degree in Biotechnology

Faculty: Faculty of Veterinary Medicine and Experimental Sciences

Code: 1100406 **Name:** Proteomics

Credits: 6,00 **ECTS Year:** 4 **Semester:** 1

Module: Quantitative Instrumental Techniques and Molecular Systems Biology

Subject Matter: Molecular Systems Biology **Type:** Compulsory

Department: Biotechnology

Type of learning: Classroom-based learning

Languages in which it is taught: English, Spanish

Lecturer/-s:

1104	Mónica Díez Díaz **(Responsible Lecturer)**	monica.diez@ucv.es
	Maria Carmen Marques Romero	mc.marques@ucv.es
1105D	Mónica Díez Díaz **(Responsible Lecturer)**	monica.diez@ucv.es
	Maria Carmen Marques Romero	mc.marques@ucv.es
CAUR	Mónica Díez Díaz **(Responsible Lecturer)**	monica.diez@ucv.es
1104GIQ	Mónica Díez Díaz **(English Responsible Lecturer)**	monica.diez@ucv.es
	Maria Carmen Marques Romero	mc.marques@ucv.es

Module organization

Quantitative Instrumental Techniques and Molecular Systems Biology

Subject Matter	ECTS	Subject	ECTS	Year/semester
Instrumental techniques in Biotechnology	12,00	Advanced Instrumental Techniques	6,00	3/1
		Basic Instrumental Techniques	6,00	2/1
Molecular Systems Biology	12,00	Genomics	6,00	4/1
		Proteomics	6,00	4/1

Recommended knowledge

We recommend having passed Biochemistry, Cellular Biology, Microorganisms Molecular Biology , Molecular and Genetic Engineering, Biostatistics, Molecular Genetics and Bioinformatics, recommended. Students can select a teaching group in Spanish or a teaching group in English. A minimum language level of B1 is required to register for each group. Students from the English teaching group can choose to take their written exams in Spanish.

Learning outcomes

At the end of the course, the student must be able to prove that he/she has acquired the following learning outcomes:

R1 The student has understood and assimilated the contents of the subject.

R2 The student is able to solve problems or case studies related to the subject contents, by using different resources (bibliographic, IT, etc.)

R3 The student is able to work in a laboratory, carrying out basic operations correctly and taking into account the corresponding safety standards. He/she understands the planning, development and purpose of the experience, and is able to contrast and validate the obtained results.

R4 The student is able to write an intelligible and organized text on different aspects of the subject.

R5 The student is able to present and defend his/her work adequately.

R6 The student seeks bibliographic information from different sources and can analyze it with a critical and constructive spirit.

R7 The student collaborates with the teacher and his/her peers throughout the learning process; he/she works in a team; treats everyone with respects, is proactive and fulfills the organization rules of the course.

Competencies

Depending on the learning outcomes, the competencies to which the subject contributes are (please score from 1 to 4, being 4 the highest score):

BASIC		Weighting			
		1	2	3	4
CB1	Students acquire and understand knowledge in their field of study based on general secondary education but usually reaching a level that, although supported on advanced text books, also includes aspects involving state-of-the-art knowledge specific to their area.				x
CB2	Students are able to apply knowledge to their work in a professional way and have the competences enabling them to state and defend views and opinions as well as perform problem-solving tasks in their field of study.			x	
CB3	Students are able to collect and interpret relevant data (generally in their field of study) and give opinions that involve reflection on relevant social, scientific or ethical issues.				x
CB4	Students can communicate information, ideas, problems and solutions to a specialized or non-specialized audience.			x	
CB5	Students develop the necessary learning skills to undertake further studies with a high level of autonomy.			x	

GENERAL		Weighting			
		1	2	3	4
CG01	Capacity to analyze and synthesize.				x

SPECIFIC		Weighting			
		1	2	3	4
CE22	Knowing and understanding contents, principles and theories related to biotechnology.			x	

CE23	Knowing how to use laboratory equipment and to carry out basic operations for each discipline including: safety measures, handling, waste disposal and activity register.				x
CE24	Knowing basic and instrument laboratory techniques in the different areas of biotechnology.				x
CE25	Knowing how to analyze and understand scientific data related to biotechnology.				x
CE27	Knowing and applying action plans and assessment criteria of biotechnology processes.				x
CE28	Integrating life science and Engineering into processes of development of biotechnological products and applications.			x	
CE29	Contrasting and checking results of biotechnological experimentation.				x
CE30	Solving and analyzing problems posed by biotechnology.				x
CE31	Describing and calculating important variables of processes and experiments.				x
CE32	Knowing how to use different specific operating systems and software packages designed for Biotechnology.				x
CE33	Knowing and complying with legislation and ethics of biotechnological processes and applications.		x		
CE34	Knowing main characteristics of Molecular biosciences and biotechnology communication.			x	

TRANSVERSAL		Weighting			
		1	2	3	4
CT02	Capacity to organize and plan.				x
CT03	Mastering Spanish oral and written communication.				x
CT04	Command of a foreign language (English)				x
CT05	Knowing and applying Basic ITC skills related to Biotechnology.			x	
CT06	Capacity to manage information (capacity to look for and analyze information coming from different types of sources).			x	

CT07	Problem solving.			x
CT09	Capacity to work in interdisciplinary and multidisciplinary team.		x	
CT10	Interpersonal skills.		x	
CT12	Critical and self-critical capacity.			x
CT13	Ethics.			x
CT14	Capacity to learn			x
CT16	Capacity to produce new ideas (creativity)		x	
CT19	Capacity to apply theoretical knowledge			x
CT20	Research skills		x	
CT21	Sensitivity to environmental issues	x		

Assessment system for the acquisition of competencies and grading system

Assessed learning outcomes	Granted percentage	Assessment method
R1, R2, R3, R4, R6	65,00%	Written test
R1, R2, R5, R6	15,00%	Submission of papers
R1, R2, R3, R4, R5, R6, R7	15,00%	Laboratory test
R1, R2, R3, R4, R6	5,00%	Solving problems with the computer

Observations

This course is not eligible for single evaluation. According to the general evaluation and qualification regulations, the preferred evaluation system will be continuous evaluation.
The submission of tasks will be evaluated following a continuous evaluation system through deliveries in which their resolution or evolution will be reviewed.
* In order to pass, a minimal of 5/10 is requires in all tasks.
**Attendance to ALL LABORATORY SESSIONS is mandatory.
***The use of artificial intelligence (AI)-based tools is subject to the discretion of the teacher, who may establish specific limits or conditions depending on the training or assessment activity.

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 9 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.

Learning activities

The following methodologies will be used so that the students can achieve the learning outcomes of the subject:

M1 Teacher presentation of contents, analysis of competences, explanation and in-class display of skills, abilities and knowledge.

M2 Group work sessions supervised by the professor. Case studies, diagnostic tests, problems, field work, computer room, visits, data search, libraries, on-line, Internet, etc. Meaningful construction of knowledge through interaction and student activity.

M3 Activities carried out in spaces with specialized equipment.

M4 Supervised monographic sessions with shared participation..

M6 Personalized and small group attention. Period of instruction and/or guidance carried out by a tutor to review and discuss materials and topics presented in classes, seminars, readings, papers, etc.

M7 Set of oral and/or written tests used in initial, formative or additive assessment of the student

M8 Group preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical , practical and/or small-group tutoring sessions. Work done on the university e-learning.

M9 Student's study: Individual preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical, practical and/or small-group tutoring sessions. Work done on the university e-learning platform.

IN-CLASS LEARNING ACTIVITIES

	LEARNING OUTCOMES	HOURS	ECTS
ON-CAMPUS CLASS M1	R1, R2, R5, R6, R7	30,00	1,20
PRACTICAL CLASSES M2	R1, R2, R3, R5, R6, R7	9,00	0,36
LABORATORY M3	R4	12,00	0,48
SEMINAR M4	R1, R2, R6	6,00	0,24
TUTORIAL M6	R2, R3, R5, R6	1,50	0,06
ASSESSMENT M7	R1, R2, R3, R4, R5, R6, R7	1,50	0,06
TOTAL		**60,00**	**2,40**

LEARNING ACTIVITIES OF AUTONOMOUS WORK

	LEARNING OUTCOMES	HOURS	ECTS
AUTONOMOUS GROUP WORK M8	R1, R2, R3, R4, R5	18,00	0,72
AUTONOMOUS INDIVIDUAL WORK M9	R1, R2, R3, R4	72,00	2,88
TOTAL		**90,00**	**3,60**

Description of the contents

Description of the necessary contents to acquire the learning outcomes.

Theoretical contents:

Content block	Contents
DIDACTIC UNIT 1: INTRODUCTION TO PROTEOMICS	Chapter 1: The –omic era: The scale change in Life Sciences. Introduction to Proteomics
DIDACTIC UNIT 2: MAIN TECHNIQUES	Chapter 2: Protein extraction techniques Chapter 3: Immunologic protein analysis techniques Chapter 4: Protein two-dimensional electrophoresis Chapter 5: Mass spectrometry MALDI-TOF. Fingerprint protein identification Chapter 6: Tandem Mass spectrometry (MS/MS) Chapter 7: Post-translational modifications analysis Chapter 8: DIGE: Differential expression proteomics using fluorochromes Chapter 9: Chromatographic methods for protein quantification
LABORATORY SESSIONS:	Phylogenetic characterization approach based on the proteomics techniques: protein quantification, electrophoresis and Western-blot.
DIDACTIC UNIT 3: ADVANCED TECHNIQUES AND PRACTICAL CASES	Chapter 10: Protein microarrays Chapter 11: Protein interaction studies: Y2H, PD, CoIP, TAP Chapter 12: Practical cases

Organization of the practical activities:

	Content	Place	Hours
PR1.	Protein extraction	Laboratory	2,00
PR2.	Protein quantification	Laboratory	2,00
PR3.	Protein electrophoreis and Western blot	Laboratory	8,00
PR4.	Phylogenetic tree	Computer	2,00
PR5.	MS and MS/MS results analysis	Computer	2,00
PR6.	Practical cases	Lecture room	5,00

Temporary organization of learning:

Block of content	Number of sessions	Hours
DIDACTIC UNIT 1: INTRODUCTION TO PROTEOMICS	2,00	4,00
DIDACTIC UNIT 2: MAIN TECHNIQUES	17,00	34,00
LABORATORY SESSIONS:	6,00	12,00
DIDACTIC UNIT 3: ADVANCED TECHNIQUES AND PRACTICAL CASES	5,00	10,00

References

Books:
Proteins and Proteomics. A laboratory manual. Simpson, RJ (Ed). Cold Spring Harbor Laboratory Press, 2003.
Principles of proteomics. Richard M. Twyman. Garland Science, 2013. ISBN: 9780815344728.
Computational Methods for Mass Spectrometry Proteomics. Ingvar Eidhammer, Kristian Flikka, Lennart Martens, Svein-Ole Mikalsen. Wiley, 2008. ISBN-10: 0470512970.
Mass Spectrometry Data Analysis in Proteomics. Methods in Molecular Biology™ 367. Rune Matthiesen, Humana Press, 2007. https://doi.org/10.1385/1597452750.
Articles:
Eisenberg,D., Marcotte,E.M., Xenarios,L.,Yeates,T.O. (2000) “Protein function in the postgenomic era”. Science 405:837.
Gevaert,K., Vandekerckhove,J. (2000) “Protein identification methods in proteomics” Electrophoresis 21:1145.
Pandey,A., Mann,M. (2000) “Proteomics to study genes and genomes”. Nature: 837-846.
Bjellqvist,B., Ek,K., Righetti,P.G., Gianazza,E., Gorg, A, Westermeier,R., Postel,W. (1982) “Isoelectric focusing in immobilized pH gradients: principle, methodology and some applications”. J Biochem Biophys Methods 6: 317.
Choe, L.H., Lee,K.H. (2000) “A comparison of three commercially available isoelectric focusing units for proteome análisis: The multiphor, the IPGphor and the protean IEF cell”. Eletrophoresis 21:993.
Görg, A., Obermaier, C., Boguth,G., Harder, A., Scheibe, B., Wildgruber, R. Weiss, W. (2000) The current state of two dimensional electrophoresis with immobilized pH gradients”. Electrophoresis 21, 1037.
Aebersold, R. Mann, M. (2003) Mass spectrometry-based proteomics. Nature 422:198-207.
Yates, J.R. (2004). “Mass spectral analysis in proteomics. Annu. Rev. Biophys. Biomol. Struct. 33:297-316.