



## Information about the subject

**Degree:** Bachelor of Science Degree in Biotechnology

**Faculty:** Faculty of Veterinary Medicine and Experimental Sciences

**Code:** 1100101 **Name:** Biostatistics

**Credits:** 6,00 **ECTS Year:** 1 **Semester:** 2

**Module:** Physics, Mathematics and Informatics for Molecular Biosciences

**Subject Matter:** Biostatistics **Type:** Compulsory

**Field of knowledge:** Science

**Department:** Basic and Cross-disciplinary Sciences

**Type of learning:** Classroom-based learning

**Languages in which it is taught:** Spanish

**Lecturer/-s:**

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## Module organization

### Physics, Mathematics and Informatics for Molecular Biosciences

Subject Matter	ECTS	Subject	ECTS	Year/semester
Physics	6,00	Physics	6,00	1/1
Mathematics	6,00	Mathematics	6,00	1/1
Biostatistics	6,00	Biostatistics	6,00	1/2
Bioinformatics	6,00	Bioinformatics	6,00	2/2

## Recommended knowledge

To follow the course, it is essential to handle the basic mathematics techniques that are given in compulsory education and high school with ease.



## 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 write an intelligible and organized text on different aspects of the subject.
- R4 The student is able to present and defend his/her work adequately.
- R5 The student seeks bibliographic information from different sources and can analyze it with a critical and constructive spirit.
- R6 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	



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	
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
CT08	Decision making				X
CT09	Capacity to work in interdisciplinary and multidisciplinary team.		X		
CT10	Interpersonal skills.		X		



CT11	Understanding multicultural and diverse environment		X	
CT12	Critical and self-critical capacity.			X
CT13	Ethics.	X		
CT14	Capacity to learn		X	
CT15	Capacity to adapt to new situations			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, R5, R6	60,00%	Written test
R1, R2, R3, R4, R5, R6	20,00%	Submission of papers
R1, R2, R3, R4, R5, R6	20,00%	Solving problems with the computer

### Observations

According to the general evaluation and qualification regulations, the preferred evaluation system will be by means of continuous evaluation. The Biostatistics course will implement a system of continuous assessment, complemented by a final examination. This system is designed to ensure ongoing monitoring of student progress and to promote a deep and progressive understanding of the course content throughout the semester. The components of this continuous assessment system will include the following:

- **Self-assessments:** Four self-assessments will be conducted via the online platform during the semester. Each self-assessment will cover a specific section of the syllabus and will consist of multiple-choice questions, statistical problems, and short-answer questions aimed at evaluating both theoretical understanding and the practical application of the concepts learned. Additionally, these self-assessments will be preceded by the completion of specific problem sets related to each section of the syllabus, which may also be subject to evaluation.
- **Practical sessions:** Three practical sessions will be conducted in which students will apply statistical techniques using specialized software (R software). Each session will culminate in the submission of a report, which will be assessed at the end of the semester.
- **Class participation:** Participation in class, including problem-solving during sessions and engagement in discussions, will also contribute to the continuous assessment.

In order to pass the course, it will be necessary to obtain a mark of 5 in each of the assessment instruments.



## 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.
- M4 Supervised monographic sessions with shared participation..
- M5 Application of multidisciplinary knowledge.
- 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, R3, R4, R5, R6	33,00	1,32
PRACTICAL CLASSES M2	R1, R2, R3, R4, R5, R6	15,50	0,62
SEMINAR M4	R1, R2, R3, R4, R5, R6	5,00	0,20
TUTORIAL M6	R1, R2, R3, R4, R5, R6	3,00	0,12
ASSESSMENT M7	R1, R2, R3, R4, R5, R6	3,50	0,14
<b>TOTAL</b>		<b>60,00</b>	<b>2,40</b>

## LEARNING ACTIVITIES OF AUTONOMOUS WORK

	LEARNING OUTCOMES	HOURS	ECTS
AUTONOMOUS GROUP WORK M8	R1, R2, R3, R4, R5, R6	18,00	0,72
AUTONOMOUS INDIVIDUAL WORK M9	R1, R2, R3, R4, R5, R6	72,00	2,88
<b>TOTAL</b>		<b>90,00</b>	<b>3,60</b>



## Description of the contents

Description of the necessary contents to acquire the learning outcomes.

Theoretical contents:

Content block	Contents
DESCRIPTIVE STATISTICS	Description of samples and populations Types of variables Frequency distribution Location and dispersion measurements Representation of experimental data using statistical graphs Description of a population: population parameters
PROBABILITY	Introduction to probability. Dependent and independent events: Bayes formula Random sampling: types and characteristics Discrete and continuous probability distributions
DISTRIBUTION IN SAMPLING	Sample distribution: mean, variance, proportion Distribution in the sampling of the difference of sample means: paired and independent sample
CONFIDENCE INTERVALS	Obtaining and interpreting confidence intervals for different population parameters Determination of the sample size
HYPOTHESIS CONTRASTS	Hypothesis contrasts: stages. Types of errors in contrast Test t, test Z, and test $\chi^2$ . Prerequisites for these tests Concept of p-value: meaning and calculation
ANOVA	Analysis of the variance of a factor ANOVA's fundamental relationships: the F test Assumption to apply ANOVA Multiple Comparison Procedures



## Organization of the practical activities:

	Content	Place	Hours
PR1.	Descriptive Statistics	Computer	4,00
PR2.	Confidence intervals	Computer	4,00
PR3.	Test t, test Z, test chi2, and ANOVA	Computer	7,50

## Temporary organization of learning:

Block of content	Number of sessions	Hours
DESCRIPTIVE STATISTICS	8,00	16,00
PROBABILITY	3,00	6,00
DISTRIBUTION IN SAMPLING	2,00	4,00
CONFIDENCE INTERVALS	2,00	4,00
HYPOTHESIS CONTRASTS	9,00	18,00
ANOVA	6,00	12,00



## References

- Martín González, Germán. Introducción a la estadística. Editorial Universidad Católica de Valencia. Valencia 2009
- Wonnacott, T.H., Wonnacott, R.J. Introducción a la estadística. Editorial LIMUSA, S.A. De C.V. México 1999
- Pagano, Marcelo, Gauvreau, Kimberlee. Fundamentos de bioestadística. Editorial Thomson Editores, S.A. De C.V. México, 2000
- García Pérez, Alfonso. Estadística aplicada: conceptos básicos. Editorial UNED. Madrid, 2005
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- Shahbaba, B. (2012). Biostatistics with R: An Introduction to Statistics Through Biological Data. Springer. <https://doi.org/10.1007/978-1-4614-1302-8>
- Dalgaard, P. (2008). Introductory Statistics with R (2nd ed.). Springer. <https://doi.org/10.1007/978-0-387-79054-1>
- Crawley, M. J. (2013). The R Book (2nd ed.). Wiley. <https://doi.org/10.1002/9781118448908>