# 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:**

| | | |
|---|---|---|
| 1101 | Jose Vicente Roig Genovés **(Profesor responsable)** | jv.roig@ucv.es |

## 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.

This subject cannot be assessed by means of a single assessment.

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

The use of tools based on artificial intelligence (AI) is subject to the teacher's criteria, 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. |
| 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<br>M1 | R1, R2, R3, R4, R5, R6 | 33,00 | 1,32 |
| PRACTICAL CLASSES<br>M2 | R1, R2, R3, R4, R5, R6 | 15,50 | 0,62 |
| SEMINAR<br>M4 | R1, R2, R3, R4, R5, R6 | 5,00 | 0,20 |
| TUTORIAL<br>M6 | R1, R2, R3, R4, R5, R6 | 3,00 | 0,12 |
| ASSESSMENT<br>M7 | R1, R2, R3, R4, R5, R6 | 3,50 | 0,14 |
| **TOTAL** | | **60,00** | **2,40** |

**LEARNING ACTIVITIES OF AUTONOMOUS WORK**

| | LEARNING OUTCOMES | HOURS | ECTS |
|---|---|---|---|
| AUTONOMOUS GROUP WORK<br>M8 | R1, R2, R3, R4, R5, R6 | 18,00 | 0,72 |
| AUTONOMOUS INDIVIDUAL WORK<br>M9 | R1, R2, R3, R4, R5, R6 | 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 |
|---|---|
| DESCRIPTIVE STATISTICS | Description of samples and populationsTypes of variablesFrequency distributionLocation and dispersion measurementsRepresentation of experimental data using statistical graphsDescription of a population: population parameters |
| PROBABILITY | Introduction to probability.<br>Dependent and independent events: Bayes formula<br>Random sampling: types and characteristics<br>Discrete and continuous probability distributions |
| DISTRIBUTION IN SAMPLING | Sample distribution: mean, variance, proportion<br>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<br>Determination of the sample size |
| HYPOTHESIS CONTRASTS | Hypothesis contrasts: stages.<br>Types of errors in contrast<br>Test t, test Z, and test chi2.<br>Prerequisites for these tests<br>Concept of p-value: meaning and calculation |
| ANOVA | Analysis of the variance of a factor<br>ANOVA's fundamental relationships: the F test<br>Assumption to apply ANOVA<br>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, Kimberllee. Fundamentos de bioestadística. Editorial Thomson Editores, S.A. De C.V. México, 2000

·García Pérez, Alfonso. Estadística aplicada: conceptos básicos. Editorial UNED. Madrid, 2005

·Martín González, Germán. Estadística básica con R. Editorial Universidad Católica de Valencia. Valencia 2021

·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