

**Statistics Applied to Experimental Design in  
Biosciences**

Code: 107547  
ECTS Credits: 6

**2025/2026**

Degree	Type	Year
Microbiology	OP	4

## Contact

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## Teachers

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## Teaching groups languages

You can view this information at the [end](#) of this document.

## Prerequisites

A sufficient level of English reading comprehension to understand scientific articles and published examples is a prerequisite.

Prior attainment of basic and conceptual-level theoretical statistics knowledge is assumed. These concepts will be reviewed, expanded upon, and applied in examples related to the degree program. The practices can be followed using the free software JAMOVI, and students will be trained in its use.

## Objectives and Contextualisation

### Course Objectives

#### General Objective

The objective is for students to acquire the basic competencies to correctly design the most common study types in Biosciences, apply the appropriate statistical techniques to the design, interpret the results appropriately, and ultimately be able to reach reasoned conclusions in accordance with the data.

#### Specific Objectives

1. Learn and apply the basic statistical techniques necessary for the design and analysis of data from related processes and experiments.
2. Properly understand and interpret the results obtained in a statistical analysis.
3. Use and practice the basic elements of free-use statistical software programs.

## Learning Outcomes

1. CM21 (Competence) Plan research in the field of microbiology with ethical responsibility, gender perspective and respect for fundamental rights and duties and animal welfare.
2. CM22 (Competence) Evaluate processes where microorganisms intervene, taking into account an adequate experimental design and the principles on biosafety and quality.
3. KM31 (Knowledge) Indicate the basic statistical concepts and techniques to analyse biological data and apply the fundamentals of experimental design.
4. SM31 (Skill) Manage computer tools, bibliography and internet resources for experimental design, as well as the search for information, regulations and guides on good practices in the field of microbiology.

## Content

- Introduction. What statistics is and is not useful for.
- Population and sample, sampling. Scientific method, formulation of the working hypothesis.
- Measurement of effect. Types of variables.
- Data analysis: descriptive statistics.
- Probability, random variables. Diagnostic tests.
- Application of bivariate statistical significance tests. Multiplicity.
- Estimation of effects and confidence intervals.
- Concordance, correlation and regression. ANOVA.
- Introduction to the interpretation of the most frequent multivariate analyses. Explanatory models and predictive models.
- Most common types of design. Sample size calculation.
- Importance of pre-definition and planning. Elaboration of the protocol and the data collection notebook.
- Interpretation of results. Statistically significant differences versus relevant differences.
- Evaluation of gender perspective and vulnerable groups.

## Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory Practices (PLAB)	24	0.96	CM21, CM22, KM31, SM31, CM21
Theory (TE)	24	0.96	CM21, CM22, KM31, CM21
Type: Supervised			
Tutorials	4	0.16	CM21, CM22, KM31, SM31, CM21
Type: Autonomous			
Consolidation practices	6	0.24	CM21, CM22, KM31, SM31, CM21
Exercises	18	0.72	CM21, CM22, KM31, SM31, CM21
Individual self-learning tests	6	0.24	KM31, SM31, KM31
Personal Study	36	1.44	CM21, CM22, KM31, SM31, CM21

Practices	24	0.96	CM21, CM22, KM31, SM31, CM21
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#### Supervised activities:

- Theoretical classes (TE) . Each thematic block will begin with one or more face-to-face theory classes where the teacher will explain the key concepts, encourage interaction and discussion of doubts, and give guidelines for monitoring and preparation of complementary autonomous activities..

The support teaching material will contain the essential contents of the theoretical classes, will be available in advance on the Virtual Campus of the subject, and it is recommended that students have it available during the class (computer, tablet or paper format) to facilitate its monitoring.

- Laboratory Practices (PLAB) . Practices related to the theoretical concepts will be carried out. Work will be done to expand and consolidate previous scientific and technical knowledge, and scientific articles will be used to encourage discussion.

#### Autonomous activities

- Self-study tests with feedback will be provided, using the questionnaire utilities of the Moodle classroom of the virtual campus of the subject, to facilitate the review of the subject synchronized with the teaching of the syllabus.
- Group work. There will be several teams works in which students will try to apply their knowledge to a real situation under the supervision of the teacher. Problems will be solved by consulting different sources and using statistical software. The student's capacity for analysis, reasoning and expertise in solving problems related to the professional field will be promoted.
- Personal study . Although the subject is eminently focused on the practical implementation of knowledge in advanced modelling, there will be a minimum individual effort in order to assimilate the theoretical classes.

#### Tutorials and personal attention to students

Students are expected to attend classes and consult doubts by actively participating in them. However, you can consult with the professors using the virtual campus and the e-mails indicated in the teaching staff.

Note: Finally, 15 minutes of class time will be reserved for the completion of surveys evaluating the course and the faculty.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Assessment

### Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Continuous in-class assessment	15%	4	0.16	CM21, CM22, KM31, SM31
Practical work	40%	0	0	CM21, CM22, KM31, SM31
Self-learning tests	15%	0	0	CM21, CM22, KM31, SM31
1st parcial exam	15%	2	0.08	CM21, CM22, KM31, SM31

## Evaluation

This subject does not offer a single assessment system

If the criteria for averaging are met, then the final mark for the course will be calculated using the weightings described in this section. Otherwise, it will be necessary to recover the affected activities in order to make up the average. A minimum of 5 out of 10 points is required to pass the course.

To assess the degree of achievement of the competences, the following instruments and weightings will be used:

### Exams

There will be two partial exams with a weighting of 15% each, in which students will have to answer questions on theoretical and applied concepts. The minimum mark for weighting is 3.5 out of 10.

These activities are compulsory. In order to have access to the recovery it is necessary to have done 80% of the evaluable activities and to have taken the 2 mid-term exams.

### Practical work

These activities are compulsory and it is necessary to have at least a mark of 3.5 out of 10 in each of them, otherwise it will be necessary to recover the affected activities. Practical work is worth 40% of the overall mark for the course.

Deliveries after the deadline:

- The late delivery of the practices will imply a penalty of 20% of the obtained mark.

These activities are compulsory and recoverable.

### Self-study activities

They will have a weight of 15% provided that at least 80% of the activities have been carried out, otherwise the mark for this part will be a zero. There is no minimum grade for these activities.

Deliveries after the deadline:

- The delivery of these activities late and up to 48 hours after the deadline, will imply a penalty of 20% on the grade obtained.
- The late delivery of activities after this 48-hour margin will mean that they will be counted as not having been completed for the evaluation.

These activities are not mandatory, but they are not recoverable either.

### Continuous training and evaluation

It is reminded that the evaluation will be made according to the contents commented by the teacher in class, and that, therefore, attendance in person is highly recommended since not all the information will be accessible on the virtual campus.

In addition, during the course there will be a continuous assessment and it will be necessary to have participated in 80% of the assessment activities for them to be weighted at 15%, otherwise the mark for this part will be a zero. Standard teaching innovation tools will be used to control class participation. There is no minimum mark for these activities.

These activities are not mandatory, but they are not recoverable either.

## Summary of criteria and weights for the evaluation of the subject

	Participacion <sup>1</sup>	Minimum participation <sup>2</sup>	Minimum mark <sup>3</sup>	Exercise recoverable <sup>4</sup>	Weighting <sup>5</sup>
			30%		
1st partial	Compulsory	100%	3.5	Compulsory	15%
2 <sup>nd</sup> partial	Compulsory	100%	3.5	Compulsory	15%
Practical work					
Completion	Compulsory	100%	3.5	Compulsory	40%
Attendance	Compulsory	≥75%	NA	Unrecoverable	*
Continued appraisal	Volunteer	≥80%	NA	Unrecoverable	15%
Self-study	Volunteer	≥80%	NA	Unrecoverable	15%

NA: Not applicable

1: Compulsory participation implies that non-participation will have to be recovered in order to be weighted, and if it is not done, it will not be possible to average, and therefore the subject will not be approved either. Voluntary participation implies that it is not compulsory but that it cannot be recovered later.

2: Value of minimum participation to weight, otherwise the activities will count as 0.

3: Minimum mark of 10 points to be weighted with the rest, if the minimum is not reached, the specific activity will have to be recovered, regardless of the rest of the marks of the same type

4: When the activity is recoverable, it must be recovered if the minimum mark is not obtained. In case of non-recoverable activity, the mark cannot be recovered, and therefore it will be weighted to the final mark, even if it is 0 or less than any threshold.

5: Weight value if the previous criteria are met

\*: For participations of less than 75%, the practical activities may be penalized proportionally to the lack of attendance

## Bibliography

Bibliography

### Reference bibliography:

Due to its content and length, the subject does not have a textbook. The following are useful books to consult to deepen or review a point.

- Milton JS. *Estadística para biología y ciencias de la salud*. 3a. Edición. Madrid: Interamericana. McGraw-Hill, 2001.
- Daniel WW. *Bioestadística. Base para el análisis de las ciencias de la salud*. 4a Edición. Limusa Wiley, 2002.
- Cuadras CM. *Fundamentos de estadística: aplicación a las ciencias humanas*. Barcelona: EUB, 1996.
- Sentís J, Pardell H, Cobo E, Canela J. *Manual de Bioestadística*. 3a. Edición. Barcelona: Masson, 2003.

- Armitage PG, Berry G, Matthews JNS. 2002. *Statistical methods in medical research*. Oxford: Blackwell Science Limited.

#### Web links:

- <http://www.bioestadistica.uma.es/libro/>
- [http://www.hrc.es/bioest/M\\_docente.html](http://www.hrc.es/bioest/M_docente.html)
- <http://davidmlane.com/hyperstat/index.html>
- <https://www.equator-network.org>

#### Simulators:

- <http://web.udl.es/usuaris/q3695988/wenessim/Pagines/index.htm>
- [http://www.uco.es/simulaciones\\_estadisticas/index.php?menu=simula](http://www.uco.es/simulaciones_estadisticas/index.php?menu=simula)

## Software

### JAMOVI

- The jamovi project (2023). jamovi (Version 2.3) [Computer Software]. Retrieved from <https://www.jamovi.org> , accessed 2024-07-04

### GranMo

- Program of the Girona Heart Registry (REGICOR), IMIM, Barcelona. GranMo. <https://www.datarus.eu/en/applications/granmo/> , accessed 2024-07-04

### pwrss

- Bulus, M. (2023). pwrss: Statistical Power and Sample Size Calculation Tools. R package version 0.3.1. <https://CRAN.R-project.org/package=pwrss>
- Bulus, M., & Polat, C. (2023). pwrss R paketi ile istatistiksel güç analizi [Statistical power analysis with pwrss R package]. Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi, 24(3), 2207-2328. <https://doi.org/10.29299/kefad.1209913> , accessed 2024-07-04

## Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	741	Catalan	first semester	morning-mixed
(TE) Theory	74	Catalan	first semester	morning-mixed