

Degree programme	Type	Course
Biology	OB	2

Contact lecturer

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Teaching staff

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Group languages

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

Prerequisites

It is recommended to have reviewed the concepts developed in Biostatistics in the first year. It is based on the previous achievement of knowledge of theoretical statistics at a basic and conceptual level. These concepts will be reviewed, expanded and applied in examples related to the degree.

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

Objectives

General objective:

The objective is for students to acquire the basic skills to be able to correctly design the most frequent types of study in Biosciences, apply the appropriate statistical techniques to the design, interpret the results appropriately and, finally, be able to obtain reasoned conclusions in accordance with the data.

This is an instrumental subject, which introduces statistical tools into Biology studies in order to analyze biological data from the description of natural phenomena or experiments, emphasizing their correct use and the interpretation of results.

Course objectives:

1. Learn and apply the basic statistical techniques necessary for the design and analysis of data from related processes and experiments.
2. Learn to explore with descriptive methods various sets of data, resulting from the observation of biological phenomena or experimentation.
3. To understand and interpret appropriately the results obtained in a statistical analysis and to know how to communicate them effectively.
4. To use and practice the basic elements of free statistical software. To learn about computer tools (R software and RStudio graphical user interfaces) for statistical data processing.

Learning outcomes

- CM06 (Work in experimental design and data analysis in compliance with the ethical aspects inherent to biological studies of different types.) Work in experimental design and data analysis in compliance with the ethical aspects inherent to biological studies of different types.
- CM07 (Integrate the gender perspective, whether in the design of studies or in the analysis of biological data, knowing how to distinguish the effects of sex and gender variables.) Integrate the gender perspective, whether in the design of studies or in the analysis of biological data, knowing how to distinguish the effects of sex and gender variables.
- CM08 (Plan projects and data analysis using biostatistics, genomics, transcriptomics and proteomics tools, with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values, and in accordance with the Sustainable Development Goals.) Plan projects and data analysis using biostatistics, genomics, transcriptomics and proteomics tools, with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values, and in accordance with the Sustainable Development Goals.
- KM11 (Describe the different types of statistical and epidemiological analysis applied to the resolution of biological problems in different fields.) Describe the different types of statistical and epidemiological analysis applied to the resolution of biological problems in different fields.
- KM12 (Describe the content of databases of interest for biosciences and the methodologies for extracting relevant information in the field of biology.) Describe the content of databases of interest for biosciences and the methodologies for extracting relevant information in the field of biology.
- SM07 (Select the statistical tests and computer resources appropriate to each situation and set of biological data.) Select the statistical tests and computer resources appropriate to each situation and set of biological data.
- SM09 (Interpret the results of statistical tests applied to the resolution of biological problems in different fields, expressing them appropriately.) Interpret the results of statistical tests applied to the resolution of biological problems in different fields, expressing them appropriately.

Contents

- Introduction to Experimental Design: randomization, replication and blocks; general indications.
- Introduction to designs in epidemiology.
- Introduction to R. Data assessment and visualization: outliers, deviations from normality and transformation of variables.
- Remember t-test, independent and paired samples.

- Analysis of variance (ANOVA)
- Correlation and regression analysis
- Descriptive multivariate analysis: principal component analysis / canonical
- Sample size calculation and type II error estimation.
- Interpretation of results. Statistically significant differences versus relevant differences.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Theory classes	20	0.8	CM06, CM07, CM08, KM11, KM12, SM07, SM09
Practical classes	30	1.2	CM06, CM07, CM08, KM11, KM12, SM07, SM09
Study	34	1.36	CM06, CM07, CM08, KM11, KM12, SM07, SM09
Practical projects work	57	2.28	CM06, CM07, CM08, KM11, KM12, SM07, SM09
Individual Tutorials	3	0.12	CM07, SM07, SM09

The core of the learning process is the students' work. Students learn by working, being the mission of the teaching staff help him/her in this task by providing information or showing him/her the sources where one can be obtained and guiding your steps in a way that the learning process can be carried out effectively. In line with these ideas, and in accordance with the objectives of the subject, the course development is based on the following activities:

Theory classes:

Student acquire the scientific and technical knowledge specific to the subject by attending theory classes, complementing them with self-study of the subjects explained in order to assimilate the concepts and the procedures, to detect doubts and to realize summaries and schematics of the subject. In the theory classes, the professor introduces the basic concepts of the subject, showing their application. Theory classes are theoretical-practical classes in which the teacher introduces the basic concepts corresponding to the subject matter, demonstrating their application.

Practical classes:

The practical classes will consist of three practical blocks at the computer class. These sessions are held with a smaller group of students, in which the scientific and technical knowledge presented in the theoretical classes is developed to complete their understanding and deepen their knowledge through the development of three practical projects using appropriate software. This will be done both in class and independently by the students.

In the computer practice sessions, the student will learn to use computer tools for descriptive analysis of data sets and statistical inference.

Note: 15 minutes of a class will be reserved, within the calendar established by the centre/degree, for the complementation by the students of the questions of evaluation of the performance of the professor and of evaluation of the subject/module.

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

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Theory exam	35%	3	0.12	CM06, CM07, CM08, KM11, KM12, SM07, SM09
Practical exam	20%	3	0.12	CM06, CM07, CM08, KM11, KM12, SM07, SM09
Practical projects work	45%	0	0	CM06, CM07, CM08, KM11, KM12, SM07, SM09

Continuous evaluation.

The evaluation of the subject consists of a continuous assessment part of the acquired skills: there will be a theoretical exam with a weight of 35%. A practical exam with a computer that will have a weight of 20% in the final assessment of the subject. These two exams will be the recoverable part of the subject. The remaining 45% of the grade will be obtained from the submission of three assignments (each one counts for 15%). These assignments are not recoverable.

Attendance at practical sessions (informatics and Q&A sessions) is mandatory. Practical sessions cannot be recoverable. If a student is unable to attend a session, they may arrange with the professor to attend with another group, provided there are computers available. Students will receive a grade of "Non-evaluable" if their absence exceeds 20% of the scheduled sessions.

Students who pass the theory exam will be permitted to improve their grade, however, the final grade considered will be the last grade, regardless of whether it is higher or lower than the previous one.

To participate in the recovery examination, students must have previously been assessed in a set of activities whose weight is equivalent to a minimum of two thirds of the total grade of the subject. Therefore, the students will obtain the "Non-evaluable" qualification when the evaluation activities carried out have a weighting of less than 67% in the final grade.

Unique evaluation.

The unique evaluation consists of the theory exam, the practical exam and, regarding the submissions of the three practical assignments, a single submission can be made on the same day as the practical exam and they are not recoverable.

Minimum grades.

A minimum mark of 4.5 out of 10 is required for each exam (theoretical or practical). If these minimum marks are achieved, the final mark is the weighted average of the different assessable parts and to pass must be equal to or greater than 5. Otherwise, the maximum grade that can be entered in the official record will be 4.5.

Use of AI

For this subject, the use of Artificial Intelligence (AI) technologies is permitted exclusively in support tasks, such as bibliographic or information searches, text correction, translations, for code creation or other activities at the discretion of the teaching staff. The student must clearly identify which parts have been generated with this technology, specify the tools used and include a critical reflection on how these have influenced the process and the final result of the activity. Lack of transparency in the use of AI in this assessable activity will be considered a lack of academic honesty and may lead to a partial or total penalty in the grade of the activity, or greater sanctions in serious cases.

The commission of any irregularity in an assessment act (academic fraud, plagiarism or improper use of AI, unless such use is expressly authorised in the course guide), which may lead to a significant change in the grade, will result in that attempt being marked with a 0. If the course guide stipulates that obtaining a minimum mark in this assessment is a prerequisite for passing the module, or if multiple irregularities occur in the assessments for the same module, the final mark for that module will be 0. In addition, disciplinary proceedings may be initiated against any student who commits any of these irregularities.

Bibliography

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Bardina, X. Farré, M. *Estadística descriptiva*. Manuals UAB, 2009.

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Delgado, R. *Probabilidad y Estadística para ciencias e ingenierías*. Delta, Publicaciones Universitarias. 2008.

Devore, Jay L. *Probabilidad y Estadística para ingeniería y ciencias*. International Thomson Editores. 1998.

Legendre, P., & Legendre, L. *Numerical Ecology* (3rd English ed.). Amsterdam: Elsevier. 2012.

Milton, J. S. *Estadística para Biología y Ciencias de la Salud*. Interamericana de España, McGraw-Hill, 2007 (3a ed. ampliada).

Pagano, M., Gauvreau, K., & Mattie, H. (2022). *Principles of Biostatistics* (3rd ed.). Chapman and Hall/CRC. <https://doi.org/10.1201/9780429340512>

Remington, R. D. Schork, M. A. *Estadística Biométrica y Sanitaria*. Prentice/Hall Internacional, 1974.

Robert R. Sokal, F. James Rohlf. *Biometry: The principles and practice of statistics in biological research*. W.H. Freeman and Company, New York. 2013.

StatSoft Electronic Statistics Textbook (<http://www.statsoft.com/Textbook>)

Software

In the computer practice sessions, the student will learn to use the free software R with the graphical user interface RStudio, in order to apply the statistical tools for the descriptive analysis of data sets and statistical inference.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	12	Catalan/Spanish	second semester	afternoon
(PLAB) Practical laboratories	121	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	122	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	123	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	124	Catalan/Spanish	second semester	morning-mixed