

### *Basic laboratory techniques Guía docente 2025-26*

# INTRODUCTION

**Short description:** Basic notions of different analytical methods and interpretation of results. Study of quality parameters of analytical methods. Study of the basis of UV-visible molecular absorption and emission spectroscopic techniques and their application to compounds of biological interest. Introduction to separation methods: chromatography and electrophoresis. Radiochemical techniques applied to biological systems. Laboratory Safety: basic concepts of chemical and biological safety.

- Degree: Biology
- Module in the Degree Program: Module I: Instrumental Methods applied to Biology
- Number of credits: 3 ETCS
- Year: First; Second Semester
- Type of course: Mandatory
- Instructors: Bianca Menchicchi
- Language: English
- Lecture Schedule: Tuesdays (10:00-12:00, Room 13, Edificio Biblioteca) and Thursdays (10:00 -11:00; Room 22, Edificio Biblioteca). Lectures beginn: 18.02.2025

# LEARNING OUTCOMES (Specific Skills)

**CE1**. Pose and solve qualitative and quantitative problems in biology through scientific hypotheses that can be verified empirically and that are based on available knowledge and theories.

**CE2**. Plan, set and evaluate experiments and use the techniques and instruments specific to biology experimentation in the laboratory.

**CE3**. Perform appropriately and safely in a laboratory, including the correct handling and disposal of waste.

**E10**. Understand the basics of Mathematics, Physics, Chemistry, Statistics and Computer Science, relevant to understanding biological processes in living beings, as well as to be able to apply with judgment the techniques of observation, measurement and experimentation specific to Biology.

# LEARNING OUTCOMES (General and basics Skills)

**CB1.** The students have demonstrated that they possess and understand knowledge in an area of study that is based on the foundation of general secondary education, and is usually at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

**CG1.** The students can plan and organize time and manage own's continuous training, updating knowledge of innovations in the scientific field with a look on future trends.



**CG3.** The students can work in a team, can select and choose the work methodology and distribution of functions. Know how to listen and use words with positive and constructive interventions.

### PROGRAM

- 1. **The analytical process.** Introduction. Calibration curves. Interpretation of results and quality parameters of an analytical method.
- 2. Introduction to spectroscopic techniques applied to biological analysis. Basic principles of electromagnetic radiation (EMR) and its interaction with matter: absorption and emission of radiation. The electromagnetic spectrum.
- 3. UV-visible molecular absorption spectroscopy. Theoretical aspects and applications to biological analysis. Beer's and Lambert's law.
- 4. **UV-visible molecular emission spectroscopy.** Luminescence. Fluorescence and phosphorescence. Jablonski diagram. Basis and application to molecules of biological interest.
- 5. **Introduction to chromatographic separations.** Fundamentals of chromatography and types of chromatography: adsorption, partitioning, ion exchange, exclusion and affinity.
- 6. Planar chromatography. paper and thin layer. Applications.
- 7. **Column chromatography.** High-performance liquid chromatography (HPLC). HPLC chromatograph. Chromatographic parameters. Applications in biology.
- 8. **Radioactivity.** Radioactive isotopes. Radiochemical techniques applied to biological analysis.
- 9. **Biological safety in the laboratory.** General safety regulations. Physical risks. Chemical risks. Infectious agents. What to do in case of an accident. Waste regulations at the University of Navarra

# **EDUCATIONAL ACTIVITIES**

Classroom activities

LECTURES: 22 Hours (0.9 ECTS)

- Methodology: Presentation of fundamental theoretical concepts in the classroom.
- Acquired skills: students will learn the fundamentals of laboratory instrumental techniques and their practical application in the biological field.

### PRACTICAL SESSIONS IN THE LAB (MANDATORY): 10 Hours (0.4 ECTS)

- Methodology: practical sessions in the laboratory, which are compulsory. The student will carry out the experimental part using some instrumental techniques and will analyses and evaluate the results obtained
- Acquired skills: the student will learn how to work in a instrumental laboratory and will become familiar with the use of some techniques of interest in biological



analysis. In addition, he or she will learn to carry out an appropriate evaluation of the experimental results and will acquire a critical character regarding the analytical method.

#### PROBLEM SOLVING SEMINARS: 6 Hours (0.24 ECTS)

- Methodology: classroom sessions in which students work individually or in groups solving problems or exercises. Doubts regarding the practical part and applications of the techniques studied are resolved. These classes will have a participatory nature on the part of the student and their objective is to reinforce the content taught in the theoretical classes.
- Acquired skills: This activity provides the student with skills in the practical application of the different techniques and develops the student's critical spirit regarding the results obtained when applying a laboratory technique.

#### Out-of-classroom activities

#### SOLVING PROPOSED EXERCISE: 8 Hours (0.32 ETCS)

- Methodology: After each theoretical topic, students are given practical exercises and problems, which can be evaluated by the teacher.
- Acquired skills: The student acquires the ability to solve practical exercises carried out with the techniques studied and to properly interpret the results. In addition, he or she will learn to analyze possible sources of error in the experimental design and to evaluate the quality of the analytical method.

#### PERSONAL STUDY: 25 Hours (1 ECTS)

- Methodology: the student must study the provided material as well as any additional material that the teacher may suggest (articles, links, etc.). The student will use the recommended texts as support material for the theoretical classes.
- Acquired skills: reinforcement and establishment of the knowledge necessary to achieve the objectives of the subject

# **EVALUATION**

### ORDINARY CALL

The final grade of the subject is the result of:

1. **Theoretical exam grade** (70% of the final grade; maximum grade: 7): it will take place at the end of the course and consists of a theoretical part (multiple choice test and short questions) and problem-solving part. 3 hours (0.12 ECTS).

Important: it is necessary to achieve a minimum grade of 4 in both theoretical and problemsolving parts. If this minimum grade is not achieved, the student will be graded with the score of the part in which a 4 was not achieved (< 4).

1. **Practical exam grade** (30% of the final grade): it will be held at the end of the laboratory practices and consists of multiple-choice questions, theoretical-practical questions and problems. 1.30 hour (0.08 ECTS)



Very important: the laboratory practices and the practical exam are MANDATORY. Any student who has not attended all the practices and/or has not completed the practical exam will not be able to take the theoretical exam for the subject. In this case, the grade for the subject will be NOT PRESENTED.

### EXTRAORDINARY CALL

The same criteria as in the regular call are maintained. Students are not required to repeat the laboratory sessions and they may keep the score they got during the regular call.

#### Additional information:

\* Student with a special educational need, will receive an adaptation of both the training activities and the evaluation while maintaining the quality of teaching.

\* In case of plagiarism, the student runs the risk of failing the subject, and the grades or merits previously obtained will not be taken into consideration.

**OFFICE HOURS** 

#### Dra. Bianca Menchicchi(bmenchicchi@unav.es)

- Office 1232, First floor (Edificio de Investigación)
- Tutoring time: by appointment

### **BIBLIOGRAFÍA Y RECURSOS**

Skoog, D. A., Holler, F. J., & Crouch, S. R. (2007). *Principles of instrumental analysis*. (6th ed.). Thomson Brooks/Cole. <u>Find in the library</u>