



## INTRODUCTION

### Course overview

Microbial Biotechnology studies the use of microorganisms (genetically modified or not) or their cellular fractions to perform biochemical processes in the biomedical, agricultural, food and environment-related industries. This course examines both the genetic modification of the microorganisms used as producers, and how to employ microbial cultures grown in large-scale to catalyze major biotechnological processes, including the production of drugs, hormones, enzymes, vaccines, food additives, industrial chemicals, functional foods, beverages, waste treatment, etc...

### General information

- **Professor:** Guillermo Martínez de Tejada
- **Degree:** Mandatory for Biology degree and Elective for Biochemistry/Environmental Sciences degrees
- **ECTS (credits):** 3
- **Semester:** 2nd
- **Requirements:** good knowledge of English, as all theoretical sessions will be given in this language
- **Language:** English

## LEARNING OUTCOMES (Competencies)

|                   |                                                                                                                                                                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GRADO EN BIOLOGÍA | Módulo II. Desarrollo, estructura y función de los seres vivos.<br><br>Materia V. Biotecnología (3 ECTS OB)                                                                                                                                                         |
| CB2               | Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio |
| CB3               | Que los estudiantes tengan la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética                              |
| CB4               | Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado                                                                                                                             |



|      |                                                                                                                                                                                                                                                                                                                                                                            |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CB5  | Que los estudiantes hayan desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía                                                                                                                                                                                                                   |
| CG3  | Trabajar en equipo, seleccionar y elegir la metodología de trabajo y distribución de funciones. Saber escuchar y hacer uso de la palabra con intervenciones positivas y constructivas.                                                                                                                                                                                     |
| CG5  | Comunicar de forma escrita y oral sobre temas relacionados con la profesión, con un estilo y lenguaje adecuado a la situación y al interlocutor.                                                                                                                                                                                                                           |
| CE2  | Planificar, desarrollar y evaluar experimentos y utilizar en el laboratorio las técnicas e instrumentos propios de la experimentación en biología.                                                                                                                                                                                                                         |
| CE3  | Desenvolverse de forma adecuada y con seguridad en un laboratorio, incluyendo la manipulación y eliminación correcta de residuos.                                                                                                                                                                                                                                          |
| CE5  | Aplicar los conocimientos, conceptos y teorías biológicos a la práctica.                                                                                                                                                                                                                                                                                                   |
| CE6  | Actualizar autónoma y permanentemente los conocimientos e integrar los nuevos descubrimientos en su contexto adecuado.                                                                                                                                                                                                                                                     |
| CE7  | Comprender, analizar críticamente, discutir, escribir y presentar argumentos científicos, tanto en castellano como en inglés, como lengua de referencia en el ámbito científico.                                                                                                                                                                                           |
| CE12 | Comprender la estructura y función de las biomoléculas, en particular de las macromoléculas complejas, las principales rutas metabólicas y su regulación y los principios que rigen los intercambios de materia y energía con el medio. Comprender la organización, dinámica y expresión de genes y genomas, las leyes de la herencia y las fuentes de variación genética. |



|                     |                                                                                                                                                                                                                                                                     |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GRADO EN BIOQUÍMICA | Módulo IX. Optatividad                                                                                                                                                                                                                                              |
| CB2                 | Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio |
| CB4                 | Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado                                                                                                                             |
| CB5                 | Que los estudiantes hayan desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía                                                                                                            |
| CG2                 | Pensar de forma integrada y abordar los problemas desde diferentes perspectivas. Tener razonamiento crítico. Aportar soluciones a problemas en el ámbito científico                                                                                                 |
| CE5                 | Comprender, analizar críticamente, discutir, escribir y presentar argumentos científicos, tanto en castellano como en inglés, como lengua de referencia en el ámbito científico                                                                                     |
| CE11                | Conocer los principales temas de debate y retos futuros de la Bioquímica y de la Biología Molecular, su dimensión social y económica así como sus aplicaciones prácticas                                                                                            |
| CE13                | Aplicar los conocimientos, conceptos y teorías de las Biociencias moleculares y de la Biomedicina a la práctica                                                                                                                                                     |

## SYLLABUS

### Theoretical lectures

1. Introduction to Microbial Biotechnology. Major groups of microorganisms for biotechnological applications. (1 h)
2. Genetic modification of microorganisms for biotechnological purposes. (2 h)



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3. Growth of microorganisms in biotechnological processes. Starter cultures. Conservation. Production at industrial scale. Fermenters. (1,5 h)

4. Fermentation processes. Control of raw materials and fermentation process. Upstream and Downstream processing. Product recovery. (1 h)

Biotechnological production of:

5. Microbial biomass: single cell protein, starters and applications of microbial biomass (probiotics, bioconversion, bio-insecticides, bio-fertilizers) (1,5 h)

6. Microbial enzymes: industrial and biomedical applications. Enzyme engineering. Immobilized enzymes (2 h)

7. Ethanol and other chemical compounds: organic acids, alcohols, biopolymers (2 h)

8. Food additives: amino acids, nucleotides, vitamins (1 h)

9. Compounds for medical use: antibiotics, steroids, hormones, vaccines (2 h)

10. Production of fermented foods and beverages (2 h)

11. Biomethanation and composting: application to solid and liquid waste treatment (2 h)

Practical sessions

The practical sessions will consist of four visits to companies that make or analyze biotechnological products

## LEARNING ACTIVITIES

**Class work:** 0,72 ECTS (18 h)

The most relevant contents will be reviewed in these sessions. The slides used in the presentations will be made available to the students through the ADI system before the lectures. To promote interactive learning, students will discuss, individually or in groups, questions that the Professor will ask during the sessions using the *Wooclap* online platform. Therefore, students will need to use their electronic devices (smartphones, tablets or laptops) in the classroom to log into the *Wooclap* website (<https://www.wooclap.com/>).

Detailed information about the timetable of lectures is available in the Syllabus section.

**Practical sessions:** 0,6 ECTS (15 h)

Before each practical session, students will receive scientific information on the biotechnological process that will be the focus of the visit. To evaluate learning of the process students will have to answer one or several questionnaires during the visit and turn them to the professor before the end of the visit. Finally, the knowledge gained by the students throughout the practical sessions will be evaluated in a final exam.

**Study:** 1,6 ECTS (40 h)

**Exams:** 0,08 ECTS (2 h)



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## ASSESSMENT

**Continuous evaluation/assessment of practical sessions:** percentage of the final grade: 40%

Participation in lectures and in practical sessions will account for 10% and 15% of the final grade, respectively. Whereas the former activity will be evaluated via the *Wooclap* online platform, the latter will correspond to the average mark obtained in the questionnaires filled out during the visits. The remaining 15% corresponds to the practical session exam, which will assess the knowledge gained during the visits, including bibliography provided for those sessions. This multiple choice test will be given to the students on the same day as the theoretical exam (see below).

**Final exam (May call):** percentage of the final grade 60%

This exam will assess the knowledge acquired by the students during the lectures and will consist of a 50-question-multiple-choice test which will penalize wrong answers (4 wrong answers will subtract a correctly answered question). A minimum score of 3,5 out of 10 in the test will be strictly required to take into account the continuous evaluation score. If that minimum is not reached, the final grade will be that of the theoretical test. Therefore, students scoring below 3,5 out of 10 in this test will not pass the course.

### Evaluation in June

Students who do not pass the course in May will have to take a new exam in June with the same features mentioned above. The marks of the continuous evaluation will be retained for the June exams and the grading system will be identical to that described for the May exam. The final exam of June will have the same features as that explained above for the May call.

### Students who have to repeat the course

Students who fail to pass the final exam in June will have to re-examine of the entire theoretical contents of the course. These students will NOT have to take the practical exam again if they passed it in their previous academic course. Attendance to practical sessions is not mandatory for these students.

### Students with special educational needs

Students with special educational needs must contact the Academic Coordination Office of their Faculty beforehand to obtain authorization for any necessary accommodations (e.g., extra time on exams). This authorization must then be sent by the student to the professor. It is recommended that this process be completed at the beginning of the semester.

In those justified cases where exams have to be held outside of the official dates, the type and structure of the exam may vary.

### Plagiarism/Cheating

Any attempt at fraud, copying, plagiarism or other irregular behavior constitutes a serious infraction as contemplated in Title IV of the document "Normas de disciplina académica de los estudiantes" dentro del Sistema de normas sobre la convivencia en la Universidad de Navarra".

## OFFICE HOURS

Please, schedule appointments by e-mail. **E-mail:** [gmartinez@unav.es](mailto:gmartinez@unav.es)

**Office number:** 3301 located inside of the laboratory 3260 (third floor of Edificio de Investigación)



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**Phone:** 948-425600 extension 806522 or 806205

## BIBLIOGRAPHY

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