

**COURSE DATA****DATA SUBJECT****Code:** 33193**Name:** Foodstuff biotechnology**Cycle:** Undergraduate Studies**ECTS Credits:** 6**Academic year:** 2026-27**STUDY (S)**

Degree	Center	Acad. year	Period
1111 - Grado en Biotecnología	Facultat de Ciències Biològiques	4	First quarter

**SUBJECT-MATTER**

Degree	Subject-matter	Character
1111 - Grado en Biotecnología	Optability	ELECTIVES

**COORDINATION**

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**SUMMARY**

The subject Food Biotechnology is part of the Degree in Biotechnology at the University of Valencia (Plan 2009). It is a 6-credit ECTS subject included in the optional module that is taught during the first quarter of the fourth and final year of the degree. The objective of this course is to introduce students to the applications of biotechnology in food production, including both traditional fermentation processes such as obtaining genetically modified organisms and the impact that these "new foods" have in different sectors of the food industry.

Biotechnology means the application of scientific principles and engineering to the processing of materials by biological agents to provide goods and services. Biotechnology applications are as old as mankind, especially in relation to food. More than ten thousand years ago, our ancestors were no longer migrating to engage in agriculture and livestock. They sought the improvement of animal and plant varieties through genetic even ignoring its laws. The basic tools of food biotechnology were the occurrence of spontaneous mutants (variability) and the crossing of varieties followed by the search for offspring with better organoleptic or nutritional characteristics (hybridization and selection).

In the late nineteenth century the theory of inheritance was formulated, the term gene was coined and



genetics began to expand. By the mid-twentieth century it was discovered the molecular basis of heredity consisting of all genes are made of the same material molecular, deoxyribonucleic acid (DNA for short). In recent years, scientists are able to isolate genes in the laboratory and build in test tubes recombinant DNA molecules from different species. It is called \"genetic engineering\" and it can be applied in food to improve the raw material, the microorganisms responsible for the fermentations or the biotechnological production of additives. Therefore it is a new genetic technique to apply in the improvement of food.

Food Biotechnology requires prior knowledge about the biochemistry and physiology of the animal, plant or microorganism species involved in food production. It requires knowledge on genetics as well. Unfortunately both situations are rare. Knowledge about metabolic pathways of interest in food technology as well as genes encoding structural or regulatory proteins of the same, are currently very poor. Therefore, it is necessary to have clear objectives about what we want to improve, i.e. what nutritional changes, sensory or textural characteristics are of interest in the final food. This implies a close relationship between food biotechnology and other disciplines in the life sciences and food technology.

## PREVIOUS KNOWLEDGE

### RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

### OTHER REQUIREMENTS

The student has previously acquired knowledge on Microbiology, Genetic Engineering, Molecular and Cellular Biology, and may supplement that training with other optional subjects that are taught simultaneously as Industrial Bioprocesses, Biotechnology Getting Interesting Products Industrial and Sanitary and Microbiological Control process to get an orientation on \"Industrial Food Biotechnology\"

## COMPETENCES / LEARNING OUTCOMES

### 1102 -

Analizar a nivel molecular el resultado de la manipulación de un organismo.

Assimilate the ethical and legal principles of scientific research in biotechnology.

Be able to convey ideas, problems and solutions in the field of biotechnology.

Be able to use English to write reports and to interpret information from protocols, manuals and databases.

Capacidad de interpretar datos relevantes.

Conocer las estrategias de producción y mejora de alimentos por métodos biotecnológicos.

Determinar los marcadores moleculares apropiados en procesos de mejora con fines biotecnológicos.

Develop skills to undertake further study.

Diseñar procesos de manipulación y obtención de productos biotecnológicos.



Have abilities for teamwork and cooperation in multidisciplinary teams.

Have abilities to disseminate and participate in the social debate on aspects related to biotechnology and its use.

Have an integrated view of the R&D&I process from the discovery of new basic knowledge to the development of particular applications of that knowledge and the introduction of new biotechnological products into the market.

Know and know how to apply the criteria of biotechnological risk assessment.

Know the fundamental elements of communication and public perception of biotechnological innovations and the risks associated with them.

Poseer y comprender los conocimientos en Biotecnología.

Ser capaz de evaluar las aplicaciones biotecnológicas de los microorganismos.

The ability to apply this knowledge in the professional world.

### **1111 - Grado en Biotecnología**

Actuar con autonomía en el aprendizaje, tomando decisiones fundamentadas en diferentes contextos, emitiendo juicios en base a la experimentación y el análisis y transfiriendo el conocimiento a nuevas situaciones

Colaborar eficazmente en equipos de trabajo, asumiendo responsabilidades y funciones de liderazgo y contribuyendo a la mejora y desarrollo colectivo

Contribuir en el diseño, desarrollo y ejecución de soluciones que den respuesta a demandas sociales, teniendo en cuenta como referente los Objetivos de Desarrollo Sostenible

Demostrar razonamiento crítico y autocrítico en el ámbito de la titulación, considerando aspectos tales como la ética profesional, los valores morales y las implicaciones sociales de las diferentes actividades realizadas

Propose creative and innovative solutions to complex situations or problems, typical of the area of connection, to donate responses to the various professional and social needs

Saber comunicarse de manera efectiva, tanto de forma oral como escrita, adaptándose a las características de la situación y de la audiencia

## **DESCRIPTION OF CONTENTS**



## **1. Introduction to food biotechnology**

TOPIC 1. Introduction to food biotechnology. Concept and historic review of food biotechnology. Applications of biotechnology in food production. Genetically modified foods.

## **2. Transgenic edible plants**

TOPIC 2. Transgenic edible plants. Classical breeding. Field evaluation of transgenic crops. Genetic characteristics can be improved: herbicide resistance, pest resistance, abiotic stress resistance, nutritional, physicochemical properties.

## **3. Food fermentations**

TOPIC 3. Microbial fermentations applied in food. Microorganisms and metabolic pathways involved. Lactic fermentation. Alcoholic fermentation. Malolactic fermentation. Other metabolic pathways of food interest.

TOPIC 4. Foods derived from lactic fermentation. Dairy. Cured meat products. Fermented vegetable products.

TOPIC 5. Foods derived from alcoholic fermentation or mixed. Traditional fermented products. Alcoholic beverages. Baking process.

## **4. Genetic improvement of lactic acid bacteria**

TOPIC 6. Genetic improvement of lactic acid bacteria. Improvement by classical techniques. Increased proteolysis. Production of diacetyl. Resistance to bacteriophages. Production of bacteriocins. Vehicles for oral vaccination.

## **5. Genetic improvement of industrial yeasts**

TOPIC 7. Genetic improvement of industrial yeasts. Improvement by classical techniques. Transgenic yeast brewers. Transgenic baker yeast. Transgenic wine yeasts.

## **6. Biotechnological improvement of farm animals**

TOPIC 8. Biotechnological improvement of farm animals. Classical breeding. Examples of improvement through genetic manipulation: Increased productivity. Transgenic animals as cell factories. Improved utilization of feed. Changes in nutritional composition. Resistance to abiotic stresses.



## 7. Novel foods

TOPIC 9. Novel foods. Regulation and labeling of novel foods and food ingredients. Concept of functional foods. Probiotics, prebiotics and synbiotics. Functional ingredients, nutraceuticals and nutrigenomics.

## 8. Molecular methods for quality control and food safety

TOPIC 10. Molecular methods for quality control and food safety. Identification of organisms of interest: traceability. Detection of pathogens or spoilage organisms, food fraud, and foods.

## 9. Health assessment of GM foods

TOPIC 11. Health assessment of GM foods. Nutritional composition. Evaluation of allergenicity, toxicity.

## 10. Lab

Practice 1. - Detection of GMOs. It consists in extracting DNA from samples of corn flour and its analysis by PCR using the kits commercialized by Genome Systems and commonly used in the food industry and Autentigen-GMOscreen ExtraGenAlimentos, respectively.

Practice 2. - Development of a bio-yoghurt. It will be an example of developing a functional food, "probiotic". It consists in the manufacture of a conventional yoghurt, using a commercial starter culture YoMix ® and, in parallel, a bio-yoghurt which, in addition, includes a lactic acid bacterium with probiotic properties.

## 11. Visit a Biotech Company

### WORKLOAD

#### PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	2,00
Theory	37,00
Laboratory	21,00
<b>Total hours</b>	<b>60,00</b>

#### NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	20,00
Independent study and work	50,00



Preparation of lessons	15,00
Preparation for assessment activities	5,00
Resolution of case studies	0,00
<b>Total hours</b>	<b>90,00</b>

## TEACHING METHODOLOGY

### THEORETICAL

The contents of the program will be presented by the teacher in 2-3 hour sessions per week. Attendance at the sessions of theory is optional for the student but regular monitoring is recommended.

### PRACTICAL

The course includes 4 sessions of 4 h to be conducted in the laboratory and allow students to make contact with methodologies related to food biotechnology. Attendance is mandatory and tracked direct and personalized learning will be reflected in the evaluation.

### DEBATES

All students will have to prepare a topic-discussion on current issues in Food Biotechnology for debate and discussion with the class. This task will be carried out in groups of 3 people. General instructions will be available on the document that will be provided through the Aula virtual.

### TUTORIALS

This activity consists on the orientation and monitoring of the learning process.

### COMPANY VISIT

It is planned to visit a biotechnology company located in Valencia. Students may prepare a report on the visit where its activity and impact in the food sector have to be analyzed.

### INDIVIDUAL LEARNING

Each theory session should be previously outlined by students by dedicating about half-hour to know the contents. At least 2 hours of study per week should be required to establish knowledge and prepare for the exam.

### OTHER CONSIDERATIONS

The distribution of teaching and the relationship between face-to-face and non-face-to-face activities may be modified throughout the course if sanitary conditions require it.

## EVALUATION

It is considered essential for learning assessment the direct contact to students through the tutorials held throughout the course, which can provide guidance on the status of acquisition of basic knowledge, through the discussion sessions and through the relationship with the teacher in the laboratory. To pass the subject, it is necessary to obtain a minimal mark of 5 out of 10 with the following distribution:



THEORY: 6 out of 10. Minimum necessary to pass the theory: 3 points, obtained in the final exam.

PRACTICE: 2 out of 10.

- Attendance is mandatory: required for examination (minimum 2 sessions).
- Practice examination: up to 2 points (minimum 1 point: practice examination has to be approved independently of the theory).

DEBATES: 2 out of 10.

- Mandatory task (up 1.5 points)
- Attendance and participation in discussion (up to 0.5)
- No minimum points to pass this part

With the minimum scores in theory and practice (3 + 1) it is not possible to pass the subject. After passing each of the above mentioned parts, the marks obtained will be kept until the second round (July) if any part is not passed in June. There will be, therefore, a second exam of theory and practice in the second call, to whose qualifications, after overcoming both independently, will be added the qualifications previously obtained for the debate/group work and other activities, if any.

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