

## 27134 - Food Biotechnology

### Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	446 - Degree in Biotechnology
ECTS	6.0
Year	4
Semester	Second semester
Subject Type	Optional
Module	---

### 1.General information

#### 1.1.Introduction

The food sector is very important from the economical point of view, and is one of the industrial areas where Biotechnology has played and still plays a pivotal role.

In this course, firstly, a general view of the basic aspects (physical-chemical aspects, structure, spoilage), of foods and their processing will be offered. Then, the most relevant aspects for a future Biotechnologist in the food industry will be studied: past and current role of microorganisms and enzymes for the production and transformation of foods and recent advances in foods made of/with genetically modified organisms.

#### 1.2.Recommendations to take this course

Attendance to lectures and practical activities is highly recommended.

A basic background on Biochemistry and Microbiology is required to follow this subject. Also, it would be advisable to study Animal Biotechnology, Vegetal Biotechnology and Microbial Biotechnology, which are fourth-year modules.

#### 1.3.Context and importance of this course in the degree

The subject Food Biotechnology is a 6-ECTS optional module. The contents are related with more basic subjects such as Microbiology, Biochemistry, Molecular Biology and Genetic Engineering. The student will have to connect applicative concepts from this subject with previously acquired fundamental knowledge already acquired along the degree. The visits and seminars will approach the student to actual industrial activity.

#### 1.4.Activities and key dates

For students enrolled in the subject, places, times and dates of lectures and practical sessions will be public via Bulletin Board advertisements of the grade on the platform Moodle at the University of Zaragoza, <https://moodle2.unizar.es/add/>, and in the moodle page for the course. These routes will be also used to communicate enrolled students their distribution by groups of practical sessions, which will be organized by the coordinator of the degree. Provisional dates will be available on the website of the Faculty of Sciences in the corresponding section of the Degree in Biotechnology: <https://ciencias.unizar.es/grado-en-biotecnologia>.

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In this web there will be also available the dates of exams.

### **2.Learning goals**

#### **2.1.Learning goals**

**After studying this course the student will**

1. Describe the applications and current situation of Biotechnology in relation to foods, and will be aware of the advantages and limitations of novel food products obtained through biotechnological approaches.
2. Identify the most important quality parameters and spoilage agents in foods.
3. Know the fundamentals of microbial and enzymatic control in foods.
4. Know the characteristics of raw material and industrial processes applied to obtain the most relevant fermented foods.
5. Describe the role of enzymes in foods, and the most important enzymatic transformations in the food industry.
6. Be able to choose starter cultures and enzymes for producing foods.
7. Deduce the improvement objectives of starter cultures and enzymes to be used in the food industry.
8. Analyze the characteristics of foods made of genetically modified organisms and explain the most relevant scientific advances in this field.
9. Be able to consult the relevant sources of information in Food Biotechnology and analyze the content.

#### **2.2.Importance of learning goals**

The learning outcomes will contribute to train the students for their future professional activities in the industrial sector, and also in research and education.

### **3.Aims of the course and competences**

#### **3.1.Aims of the course**

Given the fact that one of the main career opportunities of graduates in Biotechnology is within the industrial sector, the aim of this course is providing the students with basic knowledge about the applications of Biotechnology in the food industry, and in food-related sectors, the fundamentals of the production of fermented foods, and the new biotechnological strategies for obtaining and transforming food products. Besides, this course also offers contents and activities that will help the students to acquire skills needed for professional opportunities in research and education.

#### **3.2.Competences**

The student will be able to

1. Understand food nature and distinctive features of food industry.
2. Know current applications and foresee future fields of action of Biotechnology in foods.
3. Apply basic knowledge in Microbiology, Biochemistry and Genetic Engineering to obtain fermented foods, foods based on genetically modified organisms, starter cultures, enzymes with appropriate characteristics and analytical methods for quality control in the food industry.
4. Interpret and critically analyze scientific literature related to Food Biotechnology.

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5. Communicate work results through the use of the adequate scientific and technical language.

### **4.Assessment (1st and 2nd call)**

#### **4.1.Assessment tasks (description of tasks, marking system and assessment criteria)**

1.- Exam: written exam with 10 theoretical-practical questions that will account for 80% of the final qualification. Grades will be between 0 and 10, and minimum grade to pass the exam will be 5. This evaluation activity requires the acquisition of learning goals 1-8.

2.- Individual assignment, consisting of a brief written presentation, that will account for 20% of the final qualification. Grades will be between 0 and 10, and minimum grade to pass will be 5. This evaluation activity requires the acquisition of learning goals 1, 2 and 9, and additionally some others, depending on the topic of the assignment chosen by the student. The content will be the design of a novel food through biotechnological approaches, however other possibilities might be offered by the professors along the course.

### **5.Methodology, learning tasks, syllabus and resources**

#### **5.1.Methodological overview**

The course is divided into 5 parts, with a total of 42 lectures, 2 hours of seminars, 6 hours of practical sessions, and 10 hours of visits to food-related industries. The seminars will deal with specific biotechnological applications and will be given by invited professionals.

#### **5.2.Learning tasks**

**I: Introduction.** 1.6 ECTS.

Lectures: 10 h.

Practical activities: 6 h. Visit to Food Science Pilot Plant in the Faculty of Veterinary. Fundamentals of sensory analysis. Supermarket.

**II: Food fermentations.** 2.0 ECTS

Lectures: 14 h.

Practical activities: 6 h. Visit to related industries.

**III: Enzymes of relevance in the food industry.** 1.0 ECTS.

Lectures: 6 h.

Practical activities: 4 h. Visit to a related industry.

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### **IV: Genetically modified organisms for the production of foods with improved properties. 1.0 ECTS.**

Lectures: 10 h.

### **V: Other applications. 0.5 ECTS.**

Lectures: 1 h.

Practical activities 2 h. Seminars: Use of by-products of the food industry. Development of kits for pathogen detection in foods.

## **5.3.Syllabus**

### **CHAPTER I: INTRODUCTION**

Food biotechnology: definition, history, current situation, social perception. General aspects of food technology and food industry. Quality attributes in food: sensory, nutritional and safety properties. Food spoilage: physical, chemical and microbiological agents. Strategies for the control of spoilage agents.

### **CHAPTER II: FOOD FERMENTATIONS**

Starter cultures: classification, applications, market trends, legal aspects. Fermented dairy products: classification, characteristics, industrial production, microorganisms involved and targets for starter improvement. Cheese: types, improvement of starters. Products obtained by alcoholic fermentation: alcoholic drinks, bread, doughs. Other foods obtained by fermentation: vinegar, foods from soy fermentation, meat substitutes. Production of ingredients and additives.

### **CHAPTER III: ENZYMES OF INTEREST IN FOOD INDUSTRY**

Enzymes in food science: friend and/or enemy. Properties of enzymes of special interest for food technologists. Use of enzymes in food processing: filtration aids, meat tenderization, protein texturization, production of sweeteners, fat interesterification, milk curdling. Biotechnological modification of enzymes involved in food processing: general strategies and examples.

### **CHAPTER IV: GENETICALLY MODIFIED ORGANISMS FOR THE OBTENTION OF FOODS WITH IMPROVED PROPERTIES**

Biotechnological modification of nutritional value of foods. Fundamentals of food flavour and its biotechnological modification. Food texture and structure and its biotechnological modification. Chemical basis of food colour: modification through biotechnological strategies. Modification of starches for their use in food industry. Modification of proteins for the food scientist. Genetically modified animals and their potential use by the food industry.

### **CHAPTER V: OTHER APPLICATIONS**

Applications of biotechnology in quality assurance in the food industry. Use and exploitation of residues and byproducts.

## **5.4.Course planning and calendar**

Schedules of lectures will coincide with the officially established and will be available at:  
<https://ciencias.unizar.es/grado-en-biotecnologia>.

The places, calendar and groups for training and practical sessions will be established in coordination with the rest of modules at beginning of the term. The Coordinator will create the groups of students for these activities to avoid overlaps with other subjects.

## **5.5.Bibliography and recommended resources**

- Doyle, M.P., Beuchat, L.R., Montville, T.J. 2001. Microbiología de los Alimentos, fundamentos y fronteras. 1ª ed., Acribia, Zaragoza.
- EFSA, European Food Safety Authority, <http://www.efsa.europa.eu/>
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- Jeantet, R., Croguennec, T., Brulé, G. 2010. Ciencia de los Alimentos, vol 1. Acribia, Zaragoza.
- Johnson-Green P. 2002. Introduction to Food Biotechnology. CRC Press, Boca-Ratón.
- Lee B.H. 2000. Fundamentos de Biotecnología de los Alimentos. Ed. Acribia, Zaragoza.
- Madigan, M.T., Martinko, J.M., Dunlap, P.V., Clark, D.P. 2009. Brock Biología de los Microorganismos. 12ª ed., Pearson Addison Wesley, Madrid.
- Mozzi F., Raya R., Vignolo G. (eds.) 2010. Biotechnology of lactic acid bacteria. Novel applications. Wiley-Blackwell, Ames, EEUU.