1. OVERVIEW

Subject Area	Food Biotechnology
Degree	Bachelor's Degree in Biotechnology
School/Faculty	School of Biomedical and Health Sciences
Year	Fourth
ECTS	6
Type	Optional
Language(s)	Spanish
Delivery Mode	On campus
Semester	S1
Academic Year	24-25
Coordinating professor	Mónica Martínez Martínez

2. INTRODUCTION

Food Biotechnology is a compulsory subject (worth 6 ECTS) taught each semester during the fourth year of the Degree in Biotechnology. This subject belongs to the BIOTECHNOLOGICAL PROCESSES AND INDUSTRIAL APPLICATIONS module worth a total of 39 ECTS. The latest developments in biotechnology have led to substantial change in the food sector, both regarding how we obtain new products and the production of products with better characteristics. Modern biotechnology has had a huge impact on the production of food in the 21st century and is a field generating significant amounts of research. As with many other great scientific and industrial developments, food biotechnology poses a series of questions regarding issues such as food safety, ethics and the possible environmental and social impact of food obtained through the use of biotechnology. This could be in its more traditional form or as a more modern process where genetic engineering tools are used such as gene delivery or genomic editing.

Therefore, the aim of this subject area is for students to learn how different types of food, ingredients and food additives are produced using biotechnology. They will learn about biotechnological food, new food, functional food, genetically-modified food and the implications of all of them on a social and environmental level. We will also cover the main regulations in force regarding production and labelling.

3. LEARNING OUTCOMES (RA, by the acronym in Spanish)

Knowledge (CON, by the acronym in Spanish)

CON07. Describe the biotechnological production procedures of biological drugs, food and plants, together with their applications.

- Understand the process of biocatalysis in the food industry.
- Understand the production of sweeteners.
- Understand the use of enzymes in the production of fruit juice and other drinks, processed meats and fish, and the dairy industry.

- Understand the production of food additives.
- Understand the biotechnology of new food.
- Understand the biotechnological techniques used in food analysis.
- Be aware of the future outlook of genetic engineering and the food industry.

Skills

COMP06. Develop the skills needed to use the most common equipment, instruments and basic techniques in biotechnology, following quality standards and current biosecurity regulations.

COMP24. Analyse and apply production methods and food improvement through biotechnological procedures according to current legislation.

4. CONTENTS

The contents of the Food Biotechnology subject area are as follows:

• Biocatalysers in the food industry. Immobilisation of biocatalysers.

• Biotechnological production of sweeteners.

• Uses of enzymes in the production of fruit juice and other drinks.

• Uses of enzymes in processed meat and fish.

• Uses of enzymes in the dairy industry.

• Production of food additives. Flavourings, flavour enhancers and acidifiers.

• Biotechnology of new food and food components. Fat substitutes. Food analysis. Enzymatic and microbial biosensors, and those based on antibodies.

• Genetic engineering in the food industry. Future perspectives.

The subject area is organised into 6 topics which are detailed below:

Topic 1. INTRODUCTION TO FOOD BIOTECHNOLOGY. FOOD AND NUTRITION. TECHNOLOGICAL PROPERTIES OF NUTRIENTS.

1.1. Food and Nutrition. Classification of food and nutrients.

1.2. History of food and food biotechnology.

1.3. Macronutrients and their technological functions.

1.4. Micronutrients.

Topic 2. FOOD ADDITIVES.

2.1. What are the additives? Assessing the safety of additives. Classification and types of additives.

2.2. Colourings.

2.3. Preservatives.

2.4. Acidifiers and pH regulators.

2.5. Additives which affect texture.

2.6. Additives which affect flavour and aroma: flavour enhancers, sweeteners and aromas.

Topic 3. BIOTECHNOLOGY OF NEW FOOD. NUTRIGENETICS AND NUTRIGENOMICS. BIOTECHNOLOGICAL FOOD.

3.1. New food and functional food.

3.2. Nutrigenomics and nutrigenetics.

3.3. Biotechnological food.

Topic 4. GENETICALLY MODIFIED FOOD AND OTHER GENETIC MODIFICATIONS.

4.1. Food chosen for genetic improvement. New techniques in phytoimprovement.

4.2. Modern biotechnology.

4.3. Use of genetically modified organisms in food.

4.4. Risks of genetically modified food.

4.5. Genetically modified food and labelling.

Topic 5. FOOD OBTAINED WITH BIOCATALYSERS “FERMENTED”.

5.1. Enzymes and biocatalysers.

5.2. Production of enzymes.

5.3. Fermented food: cheese and dairy, fruits and vegetables, meat and fish, and alcoholic beverages (wine and beer).

5.4. Fat and oil industry.

5.5. Production of food additives and ingredients. 5.6. Other uses of yeast and bacteria.

Topic 6. BIOTECHNOLOGICAL FACTORS IN FOOD ANALYSIS. BIOSENSORS. FOOD BIOSAFETY AND LEGISLATION.

6.1. Food analysis: physicochemical, sensorial and microbiological.

6.2. Biotechnological techniques in food analysis.

6.3. Biosensors and smart packaging.

6.4. Food safety: biological, chemical and radioactive agents.

6.5. Biosafety and GMOs.

6.6. Legislation on biotechnological food.

6.7. Concept of foodomics.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Lecture.
- Project-based learning.
- Learning based on workshop teaching

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity	Number of hours
Lectures	30
Asynchronous master lectures	10
Debates and discussions	3
Case Studies	8
Tutorials	15
Independent working	50
Workshops and/or lab work	9
Research (scientific/case studies) and projects	20
On-campus knowledge tests	5
TOTAL	**150**

7. ASSESSMENT

The assessment methods, together with how much they each count towards the final grade for the subject area, are as follows:

On campus:

Assessment system	Weighting
On-campus knowledge tests	60%
Projects	20%

Case study/problem scenario	5%
Laboratory work	15%

On the Virtual Campus, when you open the subject area, you can see all the details of your assessment activities and the deadlines and assessment procedures for each activity.

7.1. Ordinary exam period

To pass the subject area in the ordinary exam period you must obtain a mark of 5.0 or more out of 10.0 in all assessed parts of the subject. Any part you do not pass in the ordinary exam period will need to be recovered in the extraordinary exam period (resits).

Your final grade will be the average of the partial marks in each of the learning activities you have passed. The continuous assessment system for the learning activities requires attendance to at least 50% of the classes.

It is compulsory for students to accredit attendance to at least 50% of classes. This requirement is essential to the assessment process and qualifies students for the right to obtain academic counselling, support and monitoring from the professor. To this end, students must use the technological means made available by the University to accredit their daily attendance to each of their classes. This system will also serve to guarantee an objective record of the active role of the students in the classroom. Failure to accredit attendance to at least 50% of the classes by any of the means proposed by the University will mean that the professor awarding a fail to the student for that subject area in the ordinary exam period in accordance with the grading system outlined in these regulations. All of the above, without prejudice to the other requirements or higher attendance percentages that other faculties may stipulate in their learning guides or internal regulations. Regulations for the assessment of official degree programmes, Art. 1 point 4. (http://www.uem.es/myfiles/pageposts/reglamento_evaluacion_titulaciones_oficiales_grado.pdf).

7.2. Extraordinary exam period (resits)

To pass the subject area in the extraordinary exam period (resits), the students must obtain a mark equal to or above 5.0 out of 10.0 in all parts of the subject assessment they did not pass during the ordinary exam period.

The student must submit the activities not passed in the ordinary exam period taking into account the corrections or comments made by the teacher. The student must also submit any activities which were not submitted.

The final grade will be the average of the partial marks in each of the activities passed (with a mark equal to or higher than 5 out of 10). The marks for the assessable activities the student passed in the ordinary exam period will be maintained for calculating this grade.

8. TIMELINE

The timeline with delivery dates of assessable activities in the subject area is indicated in this section:

Assessable activities	Date
Food labelling problem	Week 3
Delivery of project on cheese production	Week 5
Laboratory work	Week 5 to 7
First objective knowledge test	Week 9
Functional food problem	Week 10
Biosensor project	Week 15
Objective knowledge tests (ordinary exam period)	Week 19-20

The timeline may be subject to modifications for logistical reasons of the activities. Students will be informed of any changes in due time and course.

9. BIBLIOGRAPHY

The reference work for following this subject area is:

BASIC BIBLIOGRAPHY:

• Ascencio Peralta, C. (2012) Fisiología de la nutrición. McGraw-Hill Interamericana.

• Azhakanandam, K., Silverstone, A., Daniell, H., Davey, M. R., & SpringerLink. (2015). Recent advancements in gene expression and enabling technologies in crop plants. New York, NY: Springer New York.

• Brown, T.A., (2010), Gene cloning and DNA analysis: an introduction, 6th ed., Wiley-Blackwell.

• Comité asesor de Ética en la Investigación Científica y Técnica (2005): Informe/ organismos modificados genéticamente en la agricultura y la alimentación. Madrid: FECYT, D.L.

• Glick, B.R., Pasternak, J.J. and Patten, C.L., (2010), Molecular biotechnology: principles and applications of recombinant DNA, 4th ed., ASM; Oxford: Blackwell.

• Hernández Rodríguez, M (2008). Tratado de nutrición. Ediciones Díaz de Santos. España.

• Lee BH. (2015) Fundamentals of food biotechnology. ed. Chichester, West Sussex, UK: John Wiley & Sons Inc.

• Liong, M. (2015). Beneficial microorganisms in food and nutraceuticals (2015th ed.). Cham: Springer International Publishing.

• Morcillo Ortega, G et al. (2011) Biotecnología y alimentación. Madrid: Universidad Nacional de Educación a Distancia.

• Oort, M., & Whitehurst, R. J. (2010). Enzymes in Food Technology. Chichester, U.K.: Wiley-Blackwell.

establecer sobre estas bases sus cada vez mayores aplicaciones tecnológicas y la terapéutica del futuro. Muy visual.

• Ortiz R. (2015). Plant breeding in the omics era (2015th ed.). Cham: Springer International Publishing.

• Querol, A., Fleet, G. (2006). Yeasts in food and beverages. Berlin, Heidelberg: Springer Berlin Heidelberg.

• Shetty, K. (2006). Food biotechnology. Taylor & Francis Group.
• Vega, L. (2010). Fundamentos de nutrición y dietética. Pearson Educación.

WEBSITES

• European Food Information Conuncil: https://www.eufic.org/index/es
• Agencia Española de Seguridad Alimentaria y Nutrición: http://www.aecosan.msssi.gob.es/AECOSAN/web/home/index.htm
• European Food Safety Authority: http://www.efsa.europa.eu/
• Comisión Europea, Seguridad alimentaria: http://ec.europa.eu/food/safety/index_en.htm
• World Health Organization (Organización Mundial de la Salud): http://www.who.int/foodsafety/en/
• International Service for the Acquisition of Agri-Biotech Applications: http://www.isaaa.org/
• Codex Alimentarius, FAO y OMS: http://www.fao.org/fao-who-codexalimentarius/es
• Registro de la Comisión Europea de alimentos modificados genéticamente: http://ec.europa.eu/food/dyna/gm_register/index_en.cfm
• Fundación Española para la Ciencia y la Tecnología: http://www.fecyt.es
• Sitio educativo del grupo Nature: http://www.nature.com/scitable
• Servicio de Información de Noticias Científicas, FECYT: http://www.agenciasinc.es/

The recommended bibliography is indicated below:

• Brown, T.A., (2010), Gene cloning and DNA analysis: an introduction, 6th ed., Wiley-Blackwell.
• Codex Alimentarius, FAO y OMS: http://www.fao.org/fao-who-codexalimentarius/es
• Shetty, K. (2006). Food biotechnology. Taylor & Francis Group.

10. EDUCATIONAL GUIDANCE AND DIVERSITY UNIT

The Educational Guidance and Diversity Unit (ODI in Spanish) offers support throughout your time at university to help you with your academic achievement. Other cornerstones of our educational policy are the inclusion of students with special educational needs, universal access in all our university campuses and equal opportunities.

This ODI unit offers students:

1. Support and monitoring through counselling and personalised student plans for those who need to improve their academic performance.
2. Curricular adaptations to uphold diversity, with assistance for those students who require specific educational support, leading to equal opportunities without significant changes to methodology or evaluation.
3. We offer students a range of extracurricular educational resources to reinforce skills which will enhance their personal and professional development.
4. Career guidance by offering tools and advice to students with doubts regarding their professional careers or those who believe they have chosen the wrong line of study.

Students who need educational support can contact us at:
orientacioneducativa@universidadeuropea.es

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Your opinion is essential to improve the quality of the degree.

Many thanks for taking part.