VNIVERSITAT DE VALÈNCIA

Course Guide
33193 Foodstuff biotechnology

COURSE DATA

Data Subject	
Code	33193
Name	Foodstuff biotechnology
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1102 - Degree in Biotechnology	Faculty of Biological Sciences	4	First term

Subject-matter

Degree	Subject-matter	Character
1102 - Degree in Biotechnology	103 - Food biotechnology	Optional

Coordination

Name	Department
AZNAR NOVELLA, ROSA	275 - Microbiology and Ecology
MATALLANA REDONDO, EMILIA	30 - Biochemistry and Molecular Biology

SUMMARY

The subject Food Biotechnoloy 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 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"

OUTCOMES

1102 - Degree in Biotechnology

- Poseer y comprender los conocimientos en Biotecnología.
- The ability to apply this knowledge in the professional world.
- Capacidad de interpretar datos relevantes.
- Be able to convey ideas, problems and solutions in the field of biotechnology.
- Develop skills to undertake further study.
- 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.

- Assimilate the ethical and legal principles of scientific research in biotechnology.
- Conocer las estrategias de producción y mejora de alimentos por métodos biotecnológicos.
- 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.
- Be able to use English to write reports and to interpret information from protocols, manuals and databases.
- 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.
- Ser capaz de evaluar las aplicaciones biotecnológicas de los microorganismos.
- Determinar los marcadores moleculares apropiados en procesos de mejora con fines biotecnológicos.
- Diseñar procesos de manipulación y obtención de productos biotecnológicos.
- Analizar a nivel molecular el resultado de la manipulación de un organismo.

LEARNING OUTCOMES

- Understand what are the classical and the modern food biotechnology and know the most important developments in biotechnology in the food sector.
- Know the characteristics that can be genetically modified in plants, animals and microorganisms, and the different molecular approaches to improve the industrial process and to obtain more nutritious and healthy foods.
- Know what are the new foods, including GM foods, their differences from the conventional ones and the implications arising from these differences.
- To know and apply the regulations governing genetically modified foods in Europe regarding research, release and marketing.
- To be able to take a position in the social debate about the commercialization of GM foods and to use arguments based on evidence and scientific rigor.

DESCRIPTION OF CONTENTS

1. Introduction to food biotechnology

TOPIC 1. Introduction to food biotechnology. Concept and historic review of food biotechnology. Aplications 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

ACTIVITY	Hours	% To be attended
Theory classes	37,00	100
Laboratory practices	21,00	100
Tutorials	2,00	100
Development of group work	15,00	0
Development of individual work	5,00	0
Study and independent work	45,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	5,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	5,00	0
TOTAL	**150,00**	

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

OTHER ACTIVITIES: The report of the visit to the company and other optional activities will be valued up to 1 point maximum. No minimum required. It will be added to the score of 10 obtained from the three previous sections.

With the minimum scores in theory and practice (3 + 1) it is not possible to pass the subject as the 5 points needed are not reached if there is no score for any other section (Debates and other activities). 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.

REFERENCES

Basic

- Renneberg, R. (2008). Biotecnología para principiantes. Ed. Reverté, S.A. Barcelona.
- Ramón, D., Cassiman, B. Gil, J.V., González, R., Palomeras, N. (2006). Biotecnología y alimentación. .Fundación Cotec para la Innovación Tecnológica. Madrid.
- Ratledge, C, Kristiansen, B. (2009). Biotecnología Básica. EU Biotech Consulting. Norway.
- Lee Byong H. (2000). Fundamentos de biotecnología de alimentos. Ed. Acribia. Zaragoza.
- Shetti, K. (2006) Food Biotechnology. Tailor and Francis.
- Glick, B.R., Pasternak, J.J. (2010) Molecular Biotechnology. ASM Press.
- Glazer, A.N., Nikaido, H. (2007) Microbial biotechnology. Fundamentals and applied microbiology. Cambridge University Press.
- Mozzi, F., Raya, R.R., Vignolo, G.M. (2010). Biotechnology of Lactic Acid Bacteria: Novel Applications. Wiley-Blackwell.

Additional

- Ramón, D. (1999). Los genes que comemos. Ed. Algar. Alzira.
- Sociedad Española de Biotecnología (SEBIOT). Cuadernos de preguntas y respuestas sobre biotecnología. Acceso gratuito en formato pdf. http://www.sebiot.org/
- Sociedad Española de Biotecnología (2000). La Biotecnología aplicada a la agricultura. Ed. Eumedia. Madrid.

- García-Olmedo, F. (1998). La tercera revolución verde. Plantas con luz propia. Ed. Debate. Madrid
- Grierson, D., Covey, S.N. (1991). Biología Molecular de las plantas. Ed. Acribia. Zaragoza.
- Smith, J.E. 2006. Biotecnología. Ed. Acribia S.A., Zaragoza.
- Ramón, D. 1999. La biotecnología y la agroalimentación. En Promoción y difusión de la biotecnología en España (pp. 79-81). GABIOTEC, Madrid.
- Ward, O.P. 1991. Biotecnología de la fermentación. Ed. Acribia S.A. Zaragoza.
- Lindsey, K. 1992. Biotecnología vegetal agrícola. Ed. Acribia S.A. Zaragoza.
- Muñoz, E. 2003. Biotecnología y sociedad. Encuentros y desencuentros. Ed. Akal. Madrid.
- Muñoz, E. 2004.Plantas transgénicas: las caras contrapuestas del progreso. Ed. Erein.Donostia.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available