VNIVERSITAT DE VALÈNCIA

Course Guide
34005 Food Biotechnology

COURSE DATA

Data Subject	
Code	34005
Name	Food Biotechnology
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1103 - Degree in Food Science and Technology	Faculty of Pharmacy and Food Sciences	4	First term

Subject-matter

Degree	Subject-matter	Character
1103 - Degree in Food Science and Technology	17 - Food biotechnology	Obligatory

Coordination

Name	Department
GIL PONCE, JOSE VICENTE	265 - Prev. Medicine, Public Health, Food Sc.,Toxic. and For. Med.

SUMMARY

Food Biotechnology is an obligatory subject in the fourth year of the Degree in Food Science and Technology, at the Faculty of Pharmacy, University of Valencia. This course has a total of 6 ECTS.

Biotechnology is the application of scientific and engineering principles to the processing of materials by biological agents to provide goods and services. Biotechnology applications are as old as mankind, especially with regard to food. More than ten thousand years ago, our ancestors were no longer migrating to engage in agriculture and livestock. The first biotechnologists seek the improvement of animal and plant varieties through genetic even ignoring its laws. The fundamental 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 and nutritional (hybridization and selection).

In the late nineteenth century the theory of heredity was formulated and genetics began to expand. By the mid-twentieth century the molecular basis of heredity was discovered, stating that genes are made of the same molecular material, deoxyribonucleic acid (DNA). In recent years, scientists are able to isolate genes in the lab and build in the test tubes recombinant DNA molecules from different species. This is called genetic engineering which can be applied in food to improve the raw material, the improvement of the microorganisms responsible for fermentation and for the biotechnological production of additives. Therefore, it is a new technique applied to genetic improvement of food.

Food Biotechnology requires prior knowledge about the biochemistry and physiology of the species of animals, plants or microorganisms involved in food production and a good genetic basis. Unfortunately, both situations are rare. Lack of knowledge about the metabolic pathways of interest in food technology as well as genes encoding structural or regulatory proteins, is currently very poor. A clear knowledge about the objectives to improve is needed, ie to know what change is needed at nutritional, organoleptic or textural level in the final food. This implies an intimate relationship of food biotechnology to nutrition and food technology. In short, food biotechnology is a discipline closely related to many others involved in the life sciences.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

To have completed the subjects Biology, Biochemistry and Microbiology and it is recommended to have passed the subjects Transformation and Preservation and Food Industries.

OUTCOMES

1103 - Degree in Food Science and Technology

- Capacidad de interpretar datos relevantes.
- Control and optimise processes and products in the food industry.
- Know food products derived from the application of new technologies or new nutritional knowledge, as well as their legislative framework and social impact.
- Desarrollo de habilidades para emprender estudios posteriores.
- Manufacture and preserve food.
- Saber aplicar esos conocimientos al mundo profesional, contribuyendo al desarrollo de los Derechos Humanos, de los principios democráticos, de los principios de igualdad entre mujeres y hombres, de solidaridad, de protección del medio ambiente y de fomento de la cultura de la paz.

- Develop the capacity to gather and convey information in English at a level equivalent to the B1 level in the Common European Framework of Reference for Languages.
- Poseer y comprender los conocimientos en el área de Ciencia y Tecnología de los Alimentos.
- Know the biotechnological processes applied to the production of food, ingredients and food additives.
- Know the role of the new biotechnological tools for the design and production of new processes and products in the food industry.
- Know about genetically modified food and its health, environmental and economic implications, as well as its social effects and legal framework.
- Know food products derived from the application of new technologies or new nutritional knowledge, as well as their legislative framework and social impact.

LEARNING OUTCOMES

- To understand the meaning of classical and modern biotechnology and the methods used for the genetic improvement of organisms.

- To know and to understand the biotechnological processes for the production of food ingredients and food additives as well as key methodologies for improving raw materials and production processes.

- To know what GM foods are, how they differ from the conventional ones, and the implications arising from these differences.

- Understand the main methods used for the production of genetically modified microorganisms, plants and animals.

- To know and apply the regulations governing GM food in Europe concerning research, releasing and marketing.

-Taking sides in the social debate about the marketing of transgenic foods using arguments based on evidence and scientific rigor.

DESCRIPTION OF CONTENTS

1. Introduction to food biotechnology

TOPIC 1. Introduction to food biotechnology.
What is food biotechnology? Historic review of food biotechnology. Genetically modified foods. Relationships of food biotechnology with other scientific subjects. Transgenic crops in the world.

2. Genetic plant breeding

TOPIC 2. Biotechnology of edible plants: improvement by conventional techniques.
Biotechnology and agriculture. Food availability. Green revolutions. Classical breeding techniques. Domestication. Hybridization. Mutagenesis. In vitro culture and somaclonal variety. Cisgenesis and intragénesis.
TOPIC 3. Production of genetically modified plants.
Genetic engineering. How to make a transgenic plant. Genetic transformation systems in plants. Promoters of genes with biotechnological interest.
TOPIC 4. Transgenic plants with biotioc stress tolerance.
Agricultural relevance of plant stresses. Transgenic plants resistant to herbicides. Transgenic plants resistant to plant pathogens.
TOPIC 5. Transgenic plants with abiotic stress tolerance.
Strategies for increased resistance to abiotic stresses. Resistance to drought, salinity and cold.
TOPIC 6. Biotechnological improvement of physico-chemical, organoleptic and nutritional properties.
The importance of the physico-chemical, organoleptic and nutritional properties of plant foods. Biotechnological improvement of physical and chemical properties. Biotechnological improvement of organoleptic properties. Transgenic plants with improved nutritional properties

3. Genetic animal breeding

TOPIC 7. Genetic improvement of farm animals by classical breeding practices.
Classical breeding techniques. Domestication. Artificial insemination and in vitro fertilization techniques. Cloned farm animals. Androgenesis.
TOPIC 8. Transgenic farm animals.
Applications of transgenic farm animals.The techniques of genetic modification in farm animals. Promoters of animal genes with biotechnological interest. Improved productivity. The mammary gland: a fermenter with high added value.

4. Genetic improvement of microbial starters

TOPIC 9. Classical biotechnology of fermented foods
Fermented foods. Yeasts in food: bread, beer and wine. Bacteria in food. Lactic acid bacteria. Filamentous fungi in food.
TOPIC 10. Genetic modified industrial yeasts.
Improving industrial production of baker's yeast. Breadmaking process improvement. Improved brewers yeast. Improvement of wine yeasts. Improvement of brewer's yeast. Improvement of baker's yeast. Improvement of wine yeasts.
TOPIC 11. Genetic engineering of lactic acid bacteria.
Genetic stabilization. Improved resistance to bacteriophages. Improvement of organoleptic and nutritional characteristics. Food health claims.
TOPIC 12. Biotechnological production of food additives.
Historical review. Fermentations. Biotechnological production of amino acids. Biotechnological production of proteins. Directed evolution of enzymes.

5. Benefits and risks of food biotechnology

TOPIC 13. Health assessment of foods produced by biotechnology.
Food safety evaluation. Studies on nutritional composition. Studies on allergenicity. Toxicity studies.
TOPIC 14. Environmental assessment of foods produced by biotechnology.
Controlled release and environmental assessment of transgenic plant varieties. The problem of gene transfer. The possible decline of biodiversity. Lateral damage to species.
TOPIC 15. Economic risks and benefits of food biotechnology.
Companies around the biotech food. Biotechnology patents. Food Biotechnology and the Third World. The risk of not doing.

6. Social, ethical and legal concerns

TOPIC 16.Regulation of food biotechnology.
Legal regulations of food biotechnology. Research and protection of the results. Marketing and labeling.
TOPIC 17. Public perception of food biotechnology.
The views of the groups against biotechnology. The role of the media. The consumer opinion.

7. Laboratory work

1. Detection of a microorganism genetically modified with a gene of interest in food and agriculture through PCR.
2. Detection of transgenic protein in food by immunoassay (ELISA sandwich).
3. Production in fermentation of a food additive derived from a genetically modified wine yeast.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Laboratory practices	15,00	100
Seminars	2,00	100
Tutorials	2,00	100
Development of group work	5,00	0
Development of individual work	5,00	0
Study and independent work	10,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	30,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	10,00	0
Resolution of case studies	10,00	0
TOTAL	**147,00**	

TEACHING METHODOLOGY

Method	Hours
Seminars	2
Theory	38
Practice	15
Tutoring	2

Teaching is based on the individual study of the topics that will be reinforced with the organization of **tutoring**. Prior to the date of tutoring, the student must have prepared the proposed activities to reinforce the learning of specific aspects of the program. **Classes** are taught using audio-visual equipment. The student will have this material available in the virtual classroom.

The **laboratory work** will favor the relationship between knowledge and its application to practice. Prior to visit the lab, be provided a booklet with the procedures, as well as a number of issues and problems that students must solved and return the teacher within a certain time.

Will be conducted **seminars** on topics suggested by the teacher and related to the subject. The preparation of the seminar will be supervised by the teacher. The work shall be in writing and will be presented by students.

EVALUATION

a) (10%) Producing, presentation and defense of works related to the contents explained and discussed in the classroom related to one of the subjects studied during the semester (coordinated seminars). Written work and understanding of the content and skills to their exposure, advocacy and discussion will be evaluated.

b) (60%) Evaluation of theoretical content established for the subject through a written test. A minimum of 4 points out of 10 in this test is needed to pass the subject.

c) (20%) Evaluation of laboratory work through a written test that will reflect the work done and the ability to solve the experimental problems raised, and, optionally, assess the ability to make well-detailed and organized reports of experimental results. A minimum of 4 points out of 10 in this test is needed to pass the subject

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d) Evaluation of the work during the tutorials and the ability to solve the proposed activities (10%).

To pass the subject, you must obtain 4.5 or more points out of 10 in the weighted sum of sections b) and c), and 5 or more points out of 10 in the final grade, considering all evaluable activities.
To obtain “with honors” mention (matrícula de honor), it is a preferred criterion to pass the subject in the first convocation.

Attendance at practices is obligatory for passing the subject except for those students that have undertaken these classes previously. Unjustified non-attendance to tutorials and coordinated seminars imply zero points in the corresponding evaluation section except for those students that have undertaken these classes in previous years.

REFERENCES

Basic

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- Marín, I., Sanz, J.L., Amils, R. (2005). Biotecnología y medioambiente. Ed. Ephemera. Madrid.
- 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.
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- Lee Byong H. (2000). Fundamentos de biotecnología de alimentos. Ed. Acribia. Zaragoza.

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/

- García-Olmedo, F. (1998). La tercera revolución verde. Plantas con luz propia. Ed. Debate. Madrid
- Sociedad Española de Biotecnología (2000). La Biotecnología aplicada a la agricultura. Ed. Eumedia. 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.
- 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.
- Ramón, D. 1999. La biotecnología y la agroalimentación. En Promoción y difusión de la biotecnología en España (pp. 79-81). GABIOTEC, Madrid.

ADDENDUM COVID-19

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

3. Teaching methodology

Theory classes: 100% of the planned theory classes will be taught. If they could not be face-to-face in the classroom, they will be held by synchronous videoconference through the Blackboard Collaborate application, respecting the schedule programmed.

Practical classes: If due to limitations in capacity, 100% of the practical contents cannot be taught in the laboratory, complementary non-contact activities will be carried out using audio-visual material and the discussion of practical cases.

4. Evaluation

Continuous assessment: There will be a test to evaluate topics 1, 2 and 3 before the first classroom tutorial session and another of topics 4, 5, and 6 before the second classroom tutorial session. The marks obtained will count 20%, respectively, of the grade for the theoretical final exam only if they are higher than that of the final exam (so they are only used if they lead to raise the grade, but not to lower it).