



Universitat de Lleida

DEGREE CURRICULUM
AGRI-FOOD BIOTECHNOLOGY

Coordination: RAMOS GIRONA, ANTONIO JAVIER

Academic year 2019-20

Subject's general information

Subject name	AGRI-FOOD BIOTECHNOLOGY			
Code	102251			
Semester	1st Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Character	Modality
	Bachelor's Degree in Food Science and Technology	4	OPTIONAL	Attendance-based
Course number of credits (ECTS)	6			
Type of activity, credits, and groups	Activity type	PRALAB	PRAULA	TEORIA
	Number of credits	0.9	0.8	4.3
	Number of groups	1	1	1
Coordination	RAMOS GIRONA, ANTONIO JAVIER			
Department	FOOD TECHNOLOGY			
Teaching load distribution between lectures and independent student work	Attendance hours: 60h Non contact hours: 90h			
Important information on data processing	Consult this link for more information.			
Language	Catalan: 50% Spanish: 50%			
	English: Part of the teaching material is given in English			
Distribution of credits	25% Isabel Lara 25% Ana Pelacho 25% Roger Ros 25% Antonio J. Ramos			

Office and hour of attention

Antonio Javier RAMOS GIRONA (coordinator)

Center: ETSEA

Departament: Food Technology

Office: 3.17 Consultation hours: by appointment

Phone: 973-702811

Isabel LARA AYALA

Center: ETSEA

Departament: Chemistry

Office: Main building, 0.08 Consultation hours: by appointment

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Ana María PELACHO AJA

Center: ETSEA

Departament: HBJ

Office: Ed. 2, 2.05 Consultation hours: by appointment

Phone: 973-70.25.51

Romi PENA i SUBIRÀ

Center: ETSEA

Departament: Animal Production

Office: 5.01.03 Consultation hours: by appointment

Phone: 973-702918

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
LARA AYALA, ISABEL	isabel.lara@udl.cat	1,5	
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RAMOS GIRONA, ANTONIO JAVIER	antonio.ramos@udl.cat	1,5	
ROS FREIXEDES, ROGER	roger.ros@udl.cat	1,5	

Subject's extra information

The course aims to provide students with the knowledge and skills necessary to understand the basics of the techniques of genetic manipulation of plants and animals, the application of biotechnology in foods, and to form an opinion on the ethical, legal and socio-economic development of biotechnology.

Learning objectives

The students that pass this course must:

- Learn the basic tools for manipulating proteins and nucleic acids.
- Know the applications of biotechnology in plants.
- Understand the fundamentals and the methodology used in the production of plants and genetically modified plants and their products.
- Know the applications of biotechnology in animal production.
- Understand the bases and methodology used in the genetic modification of livestock species.
- Understand the applications of biotechnology in the food industry and in quality control.
- Achieve a critical position on the ethical, legal and social research in biotechnology.

Competences

General skills

We guarantee at least the following basic skills:

CG1: Students should demonstrate knowledge and understanding of the basis of general secondary education at a level that, although supported by advanced textbooks, includes some aspects that involve knowledge from the forefront of this area.

CG2: Students can apply their knowledge to their work or vocation in a professional manner and have

competences typically demonstrated through the preparation and defense of arguments and solving problems within their area of study.

CG3: Students have the ability to gather and interpret relevant data to make judgments that include reflection on relevant issues of social, scientific or ethical.

CG4: Students can communicate information, ideas, problems and solutions to both specialist and non-specialist.

CG5: Students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

In addition, graduates should be able to:

CG6: Analyze specific situations, define problems, make decisions and implement plans of action in the search for solutions.

CG7: Interpret studies, reports, data and analyze them numerically.

CG8: Select and use the sources of written and computerized information available related to professional activities.

CG9: Use tools and communication as existing support for their professional development

CG10: Work alone and in multidisciplinary team.

CG11: Understand and express themselves in appropriate terminology.

CG12: Correctly present information orally and written.

CG17: Analyze and evaluate the social and ethical implications of professional activity.

CG18: Have a critical and innovative spirit.

CG19: Analyze and assess the environmental implications of their professional activity.

Specific skills

- Understand and apply the fundamentals of biology and human physiology necessary for the development of other disciplines and activities of the profession.
- Understand and use the basic concepts of statistical method, being able to analyze statistically the results of studies and interpret them critically.
- Know the basic processes of how to use laboratory equipment, reagents handle, meet safety and reporting.
- Apply correctly the concepts acquired in specific situations.
- Understand the production systems of raw materials of animal and plant.
- Get the technological aspects of animal production that determine the quality of the raw materials for further processing.
- Analyze and evaluate food risks and manage food safety.
- Use the techniques of microbiological analysis of food.
- Perform chemical, physical, microbiological and sensorial evaluation of food.

- Establish ways to manage quality control of products at different stages of the production process.
- Find and use the laws and sources of information affecting the food industry.

Subject contents

SECTION A. BASIC TECHNIQUES OF BIOTECHNOLOGY

Unit 1. General methods and techniques in molecular biology. Cell lysis and extraction solutions. Preparative separation techniques. Separation techniques: chromatography, electrophoresis, blotting. (2 hours)

Unit 2. Extraction, purification and characterization of proteins. Fractionation and purification of extracts. Quantification. Enzyme assays. Immunological methods. (3 h)

Unit 3. Extraction and purification of nucleic acids. Extraction of genomic DNA, plasmid and organelles. RNA extraction. Quantification. Southern and Northern blot. DNA sequencing. Obtaining cDNA. (3 h)

Unit 4. Fundamentals of recombinant DNA technology. Digestion and linkage of nucleic acids. Amplification of DNA in vivo: cloning vectors, transformation of competent cells and selection of recombinants. Amplification of DNA in vitro: the polymerase chain reaction (PCR). Gene libraries of genomic and cDNA gene libraries: building and tracking. Production of recombinant protein. (3 h)

SECTION B. PLANT BIOTECHNOLOGY PRODUCTS

Unit 5. Basic methods for the production of genetically modified plants and plant products. In vitro cultivation of plant tissues. Regeneration. Technical transformation: biolistic and *Agrobacterium tumefaciens*. Transformation vectors, promoters and markers. (4 h)

Unit 6. Transgenic plants: first generation. Herbicide resistance. Resistance to diseases and plagues. Improving mineral absorption. Resistance to the physical environment. Current status and global impact of first generation of GM crops. (2 hours)

Unit 7. Second generation of transgenic plants. Plants controlling the maturation: softening, ethylene synthesis, color. Improving the organoleptic properties. Handling crop yields. (2 hours)

Unit 8. Third-generation of transgenic plants. General strategies in manipulating metabolic pathways. Improving the nutritional quality of food: "golden rice". Increased lycopene in tomatoes. Production of other industrial compounds and medicinal plants and plant cell cultures. (3h)

SECTION C. ANIMAL BIOTECHNOLOGY PRODUCTS

Unit 9. Applications of biotechnology in improving milk. The composition of milk. Improvement objectives. Major genes and genetic markers. The genomic selection. (2h)

Unit 10. Applications of biotechnology in improving the quality of the meat. Objective selection. The concept of quality meat. Genes and physiological factors related to the quality of pork and beef. Major genes related to growth and meat production. (3h)

Unit 11. Manipulation of gene expression in transgenic animals. Obtaining transgenic animals: basic concepts and general strategies. Methods: (i) pronuclear microinjection of DNA into fertilized oocytes; (ii) viral vectors; (iii) mediated gene transfer • stem cells (ES cells); (iv) nuclear transfer; (v) the sperm-mediated transgenesis. Variables and problems of each method. (3h)

Unit 12. The transgenic animal production and animal health. Value added new characters farmer interest. Changing the composition of milk and other characters of productive interest. GMOs as bioreactors. Obtaining recombinant proteins in milk, eggs and other products. Transgenesis and genetic resistance to disease. (2h)

SECTION D. BIOTECHNOLOGY IN THE FOOD INDUSTRY

Unit 13. Biotechnological production of enzymes. Potential enzymes in biotechnology. Stages in the production of enzymes, and regulatory enzymes. Key enzymes: amylase, protease, renin, pectinase, lipase and lactase. (2h)

Unit 14. Production of raw materials for food processing. Biotechnological production of amino acids, organic acids, biopolymers, vitamins, colorants, flavorings, sweeteners and flavor enhancers. Mycoprotein. (4h)

Unit 15. Application of Biotechnology in Food Quality Control. Detection of pathogens in food. Food fraud detection. Detection of GMOs. (2h)

Unit 16. Socio-economic, ethical and legal GM foods. Patents. Genetic contamination. Labelling and substantial equivalence. Bioethics. Biotechnology and religion. (3h)

Practical activities

Attendance at practices is mandatory and its absence represents the fail of the subject.

It is MANDATORY that students have the following individual protection teams (EPI) in the course of teaching practices.

- White lab coat
- Safety glasses
- Gloves for chemical / biological protection

The EPI can be purchased at UdL's ÚDELS store

Center for Cultures and Cross-Border Cooperation - Cappont Campus

Carrer de Jaume II, 67 low. 25001 Lleida

Block A

1. Extraction of total soluble protein (2h)
2. Polyacrylamide gel electrophoresis and SDS (SDS-PAGE) of proteins (2h)

Block B

3. Laboratory Practice in vitro plant tissue. Instruments, equipment for handling and processing plants. (1h)
4. Production of a transgenic plant: Gathering information. Selection of the plasmid. Promoters. Bookmarking transformation. Species and method of processing. Regeneration. Determination of the expression of the transformation. Preparation and presentation of results (3h)

Block C

5. Application of molecular markers in product certification and food fraud detection. (2h)
6. Identification of genetic polymorphisms associated with food quality. (3h)

Block D

7. Debate on OGM foods. (2h)
8. Cineforum on ethical issues in biotechnology research. (2h).

Methodology

Activity	Classroom activity		Off-side activity		Evaluation	Total time/ECTS
	Objectives	Hours	Student work	Hours	Hours	Hours
Lectures	Explanation of the main concepts	43	Study: know, understand and synthesize knowledge	70	4	117
Problems and cases	Problem solving and cases	4	Learning to solve problems and cases	6		10
Laboratory activities and other practices	Implementation of the practice: understanding phenomena, measuring ..	13	Study and exam	10		23
Total		60		86	4	150/6

Development plan

COURSE PLANNIFICATION

Week day	Day	Hour	Cumulative hours	Classroom	Teacher
SEPTEMBER					
Friday	13	8.00-9.50 h	2	3.1.01	I. Lara
Monday	16	12.10-14.00 h	4	3.1.01	I. Lara
Tuesday	17	8.00-9.50 h	6	3.1.01	I. Lara
Friday	20	8.00-9.50 h	8	Lab. B.0.03	I. Lara
Monday	23	12.10-14.00 h	10	3.1.01	I. Lara
Tuesday	24	8.00-9.50 h	12	3.1.01	I. Lara
OCTOBER					
Tuesday	1	8.00-9.50 h	14	Lab. B.0.03	I. Lara
Monday	7	12.10-14.00 h	16	3.1.01	I. Lara/A. Pelacho
Tuesday	8	8.00-9.50 h	18	3.1.01	A. Pelacho
Monday	14	12.10-14.00 h	20	3.1.01	A. Pelacho
Tuesday	15	8.00-9.50 h	22	Labs. 2.2.07 y 2.2.08	A. Pelacho
Monday	21	12.10-14.00 h	24	Labs. 2.2.07 y 2.2.08	A. Pelacho
Tuesday	22	8.00-9.50 h	26	3.1.01	A. Pelacho
Monday	28	12.10-14.00 h	28	3.1.01	A. Pelacho
Tuesday	29	8.00-9.50 h	30	3.1.01	A. Pelacho

NOVEMBER					
Tuesday	5	8.00-11.00 h	FIRST EXAM	3.1.01	I. Lara/A. Pelacho
Monday	11	12.10-14.00 h	32	3.1.01	R. Ros
Tuesday	12	8.00-9.50 h	34	3.1.01	R. Ros
Monday	18	12.10-14.00 h	36	3.1.01	R. Ros
Tuesday	19	8.00-9.50 h	38	Computer classroom A.1	R. Ros
Monday	25	12.10-14.00 h	40	3.1.01	R. Ros
Tuesday	26	8.00-9.50 h	42	3.1.01	R. Ros
DECEMBER					
Monday	2	12.10-14.00 h	44	Computer classroom A.1	R.Ros
Tuesday	3	8.00-8.50 h	45	Computer classroom A.1	R.Ros
		9.00-9.50	46	3.1.01	A.J. Ramos
Monday	9	12.10-14.00 h	48	3.1.01	A.J. Ramos
Tuesday	10	8.00-9.50 h	50	3.1.01	A.J. Ramos
Monday	16	12.10-14.00 h	52	3.1.01	A.J. Ramos
Tuesday	17	8.00-9.50 h	54	3.1.01	A.J. Ramos
Friday	20	8.00-9.50 h	56	3.1.01	A.J. Ramos
JANUARY					
Tuesday	7	8.00-9.50 h	58	3.1.01 CINEFORUM	A.J. Ramos
Friday	10	8.00-9.50 h	60	3.1.01 DEBATE	A.J. Ramos
Tuesday	14	8.00-11.00 h	SECOND EXAM	3.1.01	R.Ros/A.J. Ramos
Tuesday	28	8.00-11.00 h	FINAL EXAM	3.1.01	All

Evaluation

The evaluation of the course consists of:

- Two written tests about the theoretical content taught in the 4 blocks of the course. The first test includes the contents of the blocks A and B and is 30% of the final mark. The second test includes the contents of the blocks C and D and is 30% of the final mark. In any case, **each of these 4 blocks must be overcome individually with at least 4.0 to be averaged with marks of the rest of blocks** and thus calculate the final mark of the course, together with the rest of activities.
- Two written tests on the acquired knowledge in practical lessons. The first test includes the practices of Block A and is 10% of the final mark. The second test block B includes practices and is 10% of the final mark.
- Report of practices Block C: 10% of the final mark
- Evaluation of participation, attitude and level of preparation of the debate on GM foods: 10% of the final mark.

All practical activities are of compulsory attendance. Failure to attend any of these activities without proper justification involves the suspense of the subject.

Bibliography

BASIC BIBLIOGRAPHY

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Slater, A., Scott, N.W., and Fowler, M.R. (2008). Plant Biotechnology. Oxford Univ Press. New York, EEUU.

Tamames, R. (2003) Los transgénicos. Conózcalos a fondo. Ed. Ariel, Barcelona. Víctor, M. y Villalobos, A. (2008). Los transgénicos. Mundi-Prensa, Barcelona.