



Universitat de Lleida

DEGREE CURRICULUM
AGRI-FOOD BIOTECHNOLOGY

Coordination: RAMOS GIRONA, ANTONIO JAVIER

Academic year 2021-22

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 Independent student work: 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			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
LARA AYALA, ISABEL	isabel.lara@udl.cat	1,5	
PELACHO AJA, ANA MARIA	anamaria.pelacho@udl.cat	1,5	
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

Basic skills:

CB2. That students know how to apply their knowledge to their work or vocation in a professional way and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant issues of a social, scientific or ethical nature.

General competences

CB1. Analyze specific situations, define problems, make decisions and implement action plans in search of solutions.

CB2. To be able to develop studies, reports, data and analyze them numerically.

CB3. Select and manage the available written and computerized sources of information related to the professional activity.

CB4. Work alone and in a multidisciplinary team.

CB5. Understand and express themselves with the appropriate terminology.

CG1. Discuss and argue in various forums.

CG2. Recycle in new technological advances through continuous learning.

CG3. Value comprehensive training, personal motivation and mobility.

CT3. Analyze and assess the social and ethical implications of professional activity.

CG4. Have a critical and innovative spirit.

CG5. Analyze and assess the environmental implications in professional activity.

Transversal competences

CT1. Correctly present information orally and in writing.

CT4. Respect the fundamental rights of equality between men and women, the promotion of Human Rights and the values of a culture of peace and democratic values.

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)

Unit2. 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. Introduction to plant biotechnology. In vitro cultivation of plant tissues. Regeneration. Genetic transformation techniques: *Agrobacterium tumefaciens* and biolistics. Transformation vectors, promoters and markers. Plant tissue culture. Regeneration (4 h)

Unit 6. First generation transgenic plants. Transgenic plants relevant as food crops. Herbicide resistance. Resistance to pests and diseases. Plant mineral absorption improving. Resistance to the physical environment. Current status and global impact of first generation of GM crops. (2 h)

Unit 7. Second generation transgenic plants. Plant transformation to control ripening and senescence: softening, ethylene synthesis, color. Improving organoleptic properties of food products. Modification of secondary metabolism pathways of food interest. (2 h)

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

SECTION C. ANIMAL BIOTECHNOLOGY PRODUCTS

Unit 9. Biotechnology applications in milk improvement. What is animal genetic improvement? The composition of milk and improvement objectives in dairy cattle. Genotyping chips. Genomic Association Studies (GWAS). Genomic selection. Major genes and genetic markers. (3h)

Unit 10. Applications of biotechnology in improving the quality of meat and eggs. The concept of meat quality and selection objectives. Major genes related to the quality of the meat. Major genes related to growth and meat production. Sexing genes in laying hens. (3h)

Unit 11. Transgenesis, cloning and genomic editing in animal production. Basic concepts and general strategies. The transgene. Transgene transfer methods. The CRISPR/CAS9 system. (3h)

Unit 12. Applications of transgenesis and genomic editing in animal production. Approved and experimental applications. Added value of the product and new characteristics of livestock interest. Pharming: transgenic animals as bioreactors. Obtaining recombinant proteins in milk, eggs and other products. Livestock species in biomedical research. (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 all 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. Plant tissue culture laboratory. Instruments, equipment and handling for plant tissue culture and genetic transformation. (2h)

4. Production of a transgenic plant: Gathering information. Selection of the plasmid. Selection of the promoter. Transformation markers. Plant species and transformation procedures. Regeneration. Determination of the transformation expression. Preparation and presentation of results (2h)

Block C

5. Identification of genetic polymorphisms associated with food quality. (2h)

6. Application of molecular markers in product certification and food fraud detection. (2h)

Block D

7. Debate on OGM foods. (2h)

8. Cineforum on ethical issues in biotechnology research. (2h).

Methodology

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

ACADEMIC COURSE PLANNING

AGRI-FOOD BIOTECHNOLOGY

COURSE 2021-2022

Week day	Day	Hour	Sum of hours	Type/classroom	Teacher
SEPTEMBER					
Monday	13	12.10-14.00h	2	2.1.03	I. Lara
Tuesday	14	08.00-09.50h	4		I. Lara
Friday	17	08.00-09.50h	6		I. Lara
Monday	20	12.10-14.00h	8		I. Lara
Tuesday	21	08.00-09.50h	10		I. Lara
Friday	24	08.00-09.50h	12		I. Lara
Monday	27	12.10-14.00h	14		I. Lara
OCTOBER					
Monday	4	12.10-14.00h	15+16		I. Lara/ A. Pelacho
Tuesday	5	08.00-09.50h	18		A. Pelacho
Friday	8	08.00-09.50h	20		A. Pelacho
Monday	11	12.10-14.00h	22		A. Pelacho

Friday	15	08.00-09.50h	24		A. Pelacho
Monday	18	12.10-14.00h	26		A. Pelacho
Tuesday	19	08.00-09.50h	28		A. Pelacho
Monday	25	12.10-14.00h	30		A. Pelacho
Tuesday	26	08.00-09.50h	32		A.J. Ramos
NOVEMBER					
			Exam	2nd-8th of november	Part I.Lara+A.Pelacho
Tuesday	9	08.00-09.50h	34		A.J. Ramos
Monday	15	12.10-14.00h	36		A.J. Ramos
Tuesday	16	08.00-09.50h	38		A.J. Ramos
Monday	22	12.10-14.00h	40		A.J. Ramos
Tuesday	23	08.00-09.50h	42		A.J. Ramos
Tuesday	30	08.00-09.50h	44		A.J. Ramos
DECEMBER					
Wednesday	1	10.10-12.00h	45+46		A.J. Ramos/R. Ros
Friday	10	08.00-09.50h	48		R. Ros
Tuesday	14	08.00-09.50h	50		R. Ros
Wednesday	15	10.10-12.00h	52	Computer room	R. Ros
Monday	20	12.10-14.00h	54		R. Ros
Tuesday	21	08.00-09.50h	56	Computer room	R. Ros
JANUARY					
Monday	10	12.10-14.00h	58		R. Ros
Tuesday	11	08.00-09.50h	60		R. Ros
			Exam	17 to 26 January	Parte R.Ros+A.J.Ramos
FEBRUARY					
			Exam	27 th January to 4 th February	All

Classroom: 2.1.03

Due to the special circumstances derived from the health crisis caused by COVID-19, this subject could have both face-to-face classes and virtual teaching. In principle all classes will be attended in person; in the event that the circumstances evolve towards a change in attendance, it will be reported in due course.

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 40% 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 5% of the final mark. The second test block B includes practices and is 5% 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.

Written tests and practical activities are attendance-based (or in the modality in which they are carried out) of compulsory completion. Failure to attend practical activities without due justification means failure of the subject.

In the event that the circumstances derived from the current coronavirus crisis did not make it possible, classes, written tests and the debate will be carried out on-line (maintaining their value).

Bibliography

BASIC BIBLIOGRAPHY

Ausubel, F.M., Brent, R., Kingston, R.E., Moore, D.D., Seidman, J.G., Smith, J.A., and Struhl, K. (1997). Current protocols in molecular biology. John Wiley & Sons, Inc.

García-Garibay, M., Quintero, R. y Lopez-Munguía, A. (1993). Biotecnología Alimentaria. Limusa Noriega editores. México.

Halford, N. (2006). Plant Biotechnology. John Wiley & Sons, Inc. Chichester, England.

Heldman, D.R., Wheeler, M.B., and Hoover, D.G.. (2011). Encyclopedia of biotechnology in agriculture and food. CRC Press, London.

Heldt, H.W., and Piechulla, B. (2011). Plant Biochemistry. Academic Press. London, UK. Houdebine, L.M. (1997). Transgenic animals: generation and use. Harwood Academic Publishers, Austràlia.

Kapuscinski, A.R., and Schei, P.J. (2004-2008). Environmental risk assessment of genetically modified organisms . Volúmenes 1 a 4. CABI Pub, Cambridge, Reino Unido.

MacKenzie, A.A. (2005). Biotechnology applications in animal health and production. La biotechnologie appliquée à la santé et à la production animales. Aplicaciones de la biotecnología en la sanidad y la producción animal. Office international des epizooties, Paris, França.

Murray, J.D. (1999). Transgenic animals in agriculture. CABI Publishing, Wallingford, EEUU. Neumann, K.-H., Kumar, A., and Imani, J. (2009). Plant cell and tissue culture – A tool in biotechnology. Springer. Heidelberg, Germany.

Nottingham, S. (2004). Come tus genes: cómo los alimentos transgénicos están en nuestra dieta. Paidós, Barcelona.

Parekh, S.R. (2004). The GMO handbook: genetically modified animals, microbes, and plants in biotechnology. Humana Press, Inc., New Jersey, EEUU.

Pedauyé, J., Ferro, A. y Pedauyé, V. (2000). Alimentos transgénicos. La nueva revolución verde. McGraw-Hill, Madrid.

Ramón, D. (1997). El gens que mengem. Ed. Bromera. Alzira, Valencia.

Renaville, R., and Burny, A. (2001). Biotechnology in animal husbandry. Kluwer Academic Publishers, Dordrecht, Països Baixos.

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.