

MODULE	SUBJECT	COURSE	TERM	CREDITS	TYPE
Biotechnology	Molecular biology applied to food	4º	1	6	Optional
PROFESSORS ⁽¹⁾			CONTACT ADDRESS		
Abdelalí Daddaoua, Concepción M Aguilera García Carolina Gómez Llorente			Department of Biochemistry and Molecular Biology II, fourth floor, Pharmacy Faculty A Daddaoua: daddaoua@ugr.es, 958243838, despacho 399. CM Aguilera: caguiler@ugr.es, 958242335, despacho 385. C Gómez Llorente: gomezll@ugr.es, 958242334, despacho 385.		
			TUTORING HOURS ⁽¹⁾		
			A Daddaoua: Tuesday and thursday, de 9:00 – 12:00 h CM Aguilera: Tuesday de 8:30 a 11:30 y de 12:30 a 15:30 h C Gómez Llorente: Tuesday, de 9:30 a 15:30 h (first term). Monday de 9:30 a 15:30 (Second term)		
Degree in which is offered			Others degrees		

¹ Consulte posible actualización en Acceso Identificado > Aplicaciones > Ordenación Docente

(∞) Esta guía docente debe ser cumplimentada siguiendo la "Normativa de Evaluación y de Calificación de los estudiantes de la Universidad de Granada" (<http://secretariageneral.ugr.es/pages/normativa/fichasugr/neg7121/>!)

Biochemistry	Science and Food Technology degree, Human Nutrition and Dietetics degree
PREREQUISITES AND/OR RECOMMENDATIONS (if applicable)	
<p>To have studied the following the subjects: Macromolecular Structure, Biosynthesis of Macromolecules , Regulation of Metabolism , Molecular Plant Physiology , Molecular Genetics and Genetic Engineering.</p> <p>To have sufficient knowledge about:</p> <ul style="list-style-type: none"> • Understand scientific texts in English • Basic computer skills • Search and management of scientific literature 	
A BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO MEMORY VERIFICATION GRADE)	
<ul style="list-style-type: none"> - Gene expression regulation by nutrients and others food bioactive compounds: Gene expression regulation by glucose, aminoacids, nucleotides, lipids, minerals and vitamins. - Molecular biology applied to food industry: Modifications of lactic acid bacteria, yeast and fungus with probiotic characteristic to be produced as food-grade ingredients. - Transgenic Plants and animals with interest in the food industry. - Strategies for the use of microorganisms and genetically engineered ingredients in the food industry: Probiotics, prebiotics and symbiotic. Modified enzymes with food interest: recombinant production and immobilization bioreactors. - Genetically Modified Organisms legislation related to production, marketing and consumption process. 	
General and specific skills	
<p>General competences</p> <ul style="list-style-type: none"> • CG1: Have and understand the fundamental knowledge about the organization and function of biological systems at the cellular and molecular level, being able to discern the different molecular mechanisms and chemical transformations responsible for a biological process. • CG2: Apply the knowledge in Biochemistry and Molecular Biology in the professional world, especially in the life science activities and in the research and teaching áreas, including the ability to solve problems in the Molecular Biosciences field by using the scientific method. • CG3: Develop the ability to gather and interpret relevant data within the Biochemistry and Molecular Biology area, as well as to draw conclusions and critically reflect on them in different relevant topics in the Molecular Bioscience field. • CG4: Transmit information, ideas, problems and solutions in the Biochemistry and Molecular Biology area, including the capacity to communicate key aspects if their work to other professionals in your area, or related areas, an to a non-specialized audience. • CG5: Have developed the needed skills to understand further specialization studies with a high 	



degree of autonomy, including the ability to assimilate the different scientific and technological innovations that are occurring in the Molecular Bioscience field.

Basics competences

- • CB1: That the students have demonstrated to possess knowledge and understanding of a studied area that part of the basis of general secondary education, and is typically at a level which, although it is supported by advanced textbooks, includes some aspects that involve knowledge of the Forefront of their field of study.
- CB2: That the students can apply their knowledge to their work or vocation in a professional manner and have competence typically demonstrated through devising and defending arguments and solving problems within their field of study.
- CB3: That the students have the ability to gather and interpret relevant data (usually within their studying field) that allows them to inform judgments that include reflection on social, scientific and ethical relevant issues.
- CB4: That the students can communicate information, ideas, problems and solutions to an audience both specialist and non-specialist

CB5: That the students have developed those necessary learning skills that allow undertaken later studies with a high autonomy degree.

Specific competences

- CE10: Understand the essential aspects of the metabolic processes and his control, and to have an integrative vision of the regulation of the metabolism under different physiological situations, with special emphasis in humans.
- CE11: Have an integrated vision of the cellular function (including metabolism and gene expression), regulation and relationship between the different cellular compartments.
- CE15: Know the current problems and the future challenges of the Molecular Biosciences, as well as the ethical and social implications of the Biochemistry and Molecular Biology application in the sanitary and biotechnological sectors.
- CE16: Know the principles and applications of the main experimental and instrumental methods used in Biochemistry and Molecular Biology, emphatically in the biological macromolecules isolation and characterization techniques.
- CE20: Know the principles of manipulation of nucleic acids, as well as the main technique that allow the study of the gene expression and function.
- CE22: Work in an appropriated way in a biochemistry laboratory with biological and chemical samples, including safety, mainupulation and elimination of these samples, and written down record of activities.
- CE23: To be able to apply experimental laboratory protocols of the Biochemistry and Molecular Biology area.

CE25: To be able to seek, obtain and interpret the information of the main biological database



(genomic, transcriptomic,

Transversal competences

- CT3: Have an ethical commitment and professional ethics concern.
- CT4: Have learning and autonomous skills.
- CT5: Have applied the scientific method principles.
- CT9: Know how to communicate in a clear-way scientific information, including the ability to present a paper, orally and in writing manner, to a professional audience, and to understand the language and proposals of others specialists.

OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)

- To understand the concepts of transgenic food and genetically modified organisms.
- To know the cellular culture methods for both prokaryote and eukaryotic useful for the food industry.
- To know the cell transformation and transfection techniques with prokaryote and eukaryotic food-grade vectors.
- To understand the gene expression methods modulate by nutrients and others food components in eukaryotic
- To analyze the production technique of transgenic food.
- To describe different examples of the utility of the genetic engineering and celular culture techniques for the production of:
 - Food-grade genetically modified bacteria.
 - Herbicide, insect and drought resistant plants, nutritionally improved plants and delayed ripening plants.
 - Food additive
 - Transgenic animals: improved production and nutritional composition.
- Know the development, evaluation, approval, commercialization, labelled and tracking of genetically modified organisms of food industry utility.
- Know the methods and techniques used in the determination of food genetically manipulated.
- Learn how to manage scientific bibliography.
- Seek information about molecular target for food transgenic production. Manage database and DNA sequences programs.



DETAILED PROGRAM

Program of theoretical lessons:

First part: Gene expression regulation by nutrients and by others food bioactive components.

- Unit 1. Introduction Molecular base of gene expression regulation. Promoters and enhancers. Transcription factors, DNA binding motive, epigenetic. Experimental techniques for studying the gene expression regulation. One hour and a half.
- Unit 2. Metabolic adjustment to the contribution of nutrients and other food components. Nutrigenomic, nutrigenetic and nutriepigenetic. Half an hour.
- Unit 3. Transcription and translator regulation by glucose and other carbohydrates en mammals. Insulin gen regulation by glucose. Gene expression modulation of glucose transporters. Regulation by glucose of lipogenic enzymes. An hour and half hour.
- Unit 4. Gene expression regulation by lipids. Gene expression modulation by fatty acids. Transcription factors modulate by fatty polyunsaturated fatty acids: PPAr, SREBP, HFN4, LXR and NF- κ B. Gene expression modulation by sterols. Gene expression modulation by others lipid components. An hour and half hour.
- Unit 5. Gene expression regulation by aminoacids. Transduction regulation by leucine and by others essential aminoacids. Transduction pathway regulated by aminoacids privation. Transduction pathway regulated by mTOR. Transcription regulation by leucine, glutamine, methionine and other non-essential aminoacids. An hour and half hour.
- Unit 6. Gene expression regulation by vitamins. Nuclear receptors. Gene expression regulation by A and D vitamins. Gene expression regulation by hydrosoluble vitamins. An hour and half hour.
- Tema 7. Gene expression regulation by iron, zinc and copper. mRNA stability and translation regulation by iron, zinc and copper. Transcription factors regulated by other metals. Gene expression regulation by others metals. An hour and half hour.
- **Second part: Molecular Biology application to the food industry.**
- Unit 8. Genetic transformation of lactic bacteria, yeast and fungus. Isolation, development and modificaci3n of probiotics microorganims. Food-grade vectos used in the industry for lactic batería transformation. Specific yeast and fungus vectors. Yeast and fungus cloning. CRISPR/Cas system. Four hours and a half.
- Unit 9. Genetic engineering application to the prodibiotcs design and production. Lactic acid bacteria. An hour and half hour.



- Unit 10. Principles of industrial enzymology. An hour and half hour.
- Unit 11. Processing and purification of interest products make by genetic manipulation. Practical aspect of protein purification. An hour and half hour.
- Unit 12. Genetic transfer in plants. Transgenic plants extraction. *Agrobacterium tumefaciens*, Ti plasmid, T fragment and opines. *Agrobacterium tumefaciens* as a vector. *Agrobacterium rhizogenes*. Ri Plamid. DNA and RNA viral vectors. Transposons in plant genetic engineering. Four hours and a half. Vectores basados en virus DNA y RNA. Uso de transposones en ingeniería genética de plantas. Four hours and a half.
- Unit 13. Parasite and microorganisms resistant plant production. Producer plants of interest molecules in the food and nutrition field. An hour and half hour.
- Unit 14. Transgenic animals. Vectors. An hour and half hour.
- Unit 15. Improving production of meat and milk by using transgenic animals. Other transgenic animals applications. An hour and half hour.
- Unit 16. Cellular growth to a big scale. Monolayer and cell suspension. Cell separation. Immobilization of cells and cell components. An hour and half hour.

Third part: Applicable legislation to the production, marketing and consumption of genetically modified organisms.

- Unit 17. Protocols desing, development and evaluation of GMO's. An hour and a half.
- Unit 18. Rules on labelling, marketing and traceability of GMO's in Europe and other countries. An hour and a half.
- Unit 19. Detection and analysis techniques of GMO's in food. An hour and half hour.

Program of practical lessons:

Seminars and Works.

Students will prepare a job autonomously that will be orally presented in class.

Laboratoty practical lessons

Food GMO detection by recombinant DNA techniques.

1. Introduction. Genomic DNA isolation from food samples.
2. Characterization and quantification of DNA. Amplification of authorized transgenes by PCR.



3. Electrophoresis in agarose gel of PCR amplicons.
4. Results discussion

BIBLIOGRAPHY

FUNDAMENTAL BIBLIOGRAPHY

- Krebs JE, Goldstein ES, Kilpatrick ST. Lewin's Genes XII. 12ª edición. Massachusetts: Jones and Barlett Publishers, 2017.
- Renneberg R, Lorocho V. Biotechnology for Beginners. 2ª edición. Elsevier/Academic Press, 2016.
- Lodish H, Berk A, Kaiser CA, Amon A, Ploegh H, Bretscher A, Krieger M, Martin KC. Molecular cell biology, 8ª edición. New York: WH Freeman-Macmillan Learning, 2016.
- Primrose SB y Twyman RM. Principles of Gene Manipulation. 7ª edición. Blackwell Scientific Publications, 2007.
- Vinderola G, Ouwehand A, Salminen S, von Wright A. Lactic Acid Bacteria: Microbiological and Functional Aspects, 5ª edición. CRC Press, Taylor & Francis Group, 2019.
- Heller KJ. Genetically engineered food. Methods and detection. 2ª edición. Wiley-Blackwell, 2006.
- Burns M, Foster L, Walker M. DNA Techniques to verify food authenticity: Applications in food fraud. RSC Pub, 2019.
- International Service for the Acquisition of Agri-biotech Applications (ISAAA) <http://www.isaaa.org/>
- Gil A. Tratado de Nutrición. 3 edición. Editorial Panamericana. Tomo II Bases Moleculares de la Nutrición. Tomo III Composición y Calidad Nutritiva de los Alimentos.

RELEVANT LEGISLATION ON GENETICALLY MODIFIED ORGANISMS

- Gil A. Tratado de Nutrición 3er. Edición. Capítulo 23 Alimentos transgénicos, Tomo III Composición y Calidad Nutritiva de los Alimentos
- Directiva 90/220/CE del Consejo de 23 de abril de 1990 sobre la liberación intencional en el medio ambiente de organismos modificados genéticamente. Diario Oficial de las Comunidades Europeas (DOCE). 08-05-1990
- Reglamento (CE) nº 49/2000 de la Comisión de 10 de enero de 2000 por el que se modifica el Reglamento (CE) nº 1139/98 del Consejo relativo a la indicación obligatoria, en el etiquetado de determinados productos alimenticios fabricados a partir de organismos modificados genéticamente, de información distinta de la prevista en la Directiva 79/112/CEE. Diario Oficial de las Comunidades Europeas (DOCE). 11-01-2000
- Reglamento (CE) nº 50/2000 de la Comisión de 10 de enero de 2000 relativo al etiquetado de los productos alimenticios e ingredientes alimentarios que contienen aditivos y aromas modificados genéticamente o producidos a partir de organismos modificados genéticamente. Diario Oficial de las Comunidades Europeas (DOCE). 11-01-2000



- Decisión de la Comisión, de 24 de julio de 2002, por la que se establecen unas notas de orientación complementarias al anexo II de la Directiva 2001/18/CE del Parlamento Europeo y del Consejo sobre la liberación intencional en el medio ambiente de organismos modificados genéticamente y por la que se deroga la Directiva 90/220/CEE del Consejo [notificada con el número C(2002) 2715]. Diario Oficial de las Comunidades Europeas (DOCE). 30-07-2002
- Dictamen del Comité Económico y Social sobre la "Propuesta de Reglamento del Parlamento Europeo y del Consejo sobre alimentos y piensos modificados genéticamente". Diario Oficial de las Comunidades Europeas (DOCE). 17-09-2002
- DECISIÓN DEL CONSEJO de 3 de octubre de 2002 por la que se establece, de conformidad con la Directiva 2001/18/CE del Parlamento Europeo y del Consejo, el modelo de resumen de la notificación de la puesta en el mercado de organismos modificados genéticamente como producto o componente de productos (2002/812/CE)
- Decisión del Consejo, de 3 de octubre de 2002, por la que se establecen unas notas de orientación complementarias al anexo VII de la Directiva 2001/18/CE del Parlamento Europeo y del Consejo sobre la liberación intencional en el medio ambiente de organismos modificados genéticamente y por la que se deroga la Directiva 90/220/CEE del Consejo. Diario Oficial de las Comunidades Europeas (DOCE). 18-10-2002
- Posición común (CE) nº 17/2003, de 4 de marzo de 2003, aprobada por el Consejo de conformidad con el procedimiento establecido en el artículo 251 del Tratado constitutivo de la Comunidad Europea, con vistas a la adopción de un Reglamento del Parlamento Europeo y del Consejo relativo al movimiento transfronterizo de organismos modificados genéticamente. Diario Oficial de las Comunidades Europeas (DOCE). 06-05-2003
- Posición común (CE) nº 22/2003, de 17 de marzo de 2003, aprobada por el Consejo de conformidad con el procedimiento establecido en el artículo 251 del Tratado constitutivo de la Comunidad Europea, con vistas a la adopción de un Reglamento del Parlamento Europeo y del Consejo sobre alimentos y piensos modificados genéticamente. Diario Oficial de las Comunidades Europeas (DOCE). 13-05-2003
- Posición común (CE) nº 21/2003, de 17 de marzo de 2003, aprobada por el Consejo de conformidad con el procedimiento establecido en el artículo 251 del Tratado constitutivo de la Comunidad Europea, con vistas a la adopción de un Reglamento del Parlamento Europeo y del Consejo relativo a la trazabilidad y al etiquetado de organismos modificados genéticamente y a la trazabilidad de los alimentos y piensos producidos a partir de éstos, y por el que se modifica la Directiva 2001/18/CE. Diario Oficial de las Comunidades Europeas (DOCE). 13-05-2003
- REGLAMENTO (CE) No 1829/2003 DEL PARLAMENTO EUROPEO Y DEL CONSEJO de 22 de septiembre de 2003 sobre alimentos y piensos modificados genéticamente (18.10.2003 Diario Oficial de la Unión Europea)
- REGLAMENTO (CE) No 1830/2003 DEL PARLAMENTO EUROPEO Y DEL CONSEJO de 22 de septiembre de 2003 relativo a la trazabilidad y al etiquetado de organismos modificados genéticamente y a la trazabilidad de los alimentos y piensos producidos a partir de éstos, y por el que se modifica la Directiva 2001/18/CE
- REGLAMENTO (CE) No 65/2004 DE LA COMISIÓN de 14 de enero de 2004 por el que se establece un sistema de creación y asignación de identificadores únicos a los organismos



modificados genéticamente

- Ley 9/2003, de 25 de abril, por la que se establece el régimen jurídico de la utilización confinada, liberación voluntaria y comercialización de organismos modificados genéticamente. Jefatura del Estado (BOE:100-2003). 26-04-2003

Links

<http://farmacia.ugr.es/BBM2/BMA.html>

<https://swad.ugr.es/?CrsCod=789>

TEACHING METHODOLOGY

The theoretical lessons will be imparted in the classroom, so that after an initial exposure of 40 minutes, the rest of the time will be devoted to discuss the literature and web pages information related to the class. CT4, CE10, CE11, CE15, CE16, CE20, CE22, CE23, CE25, CE28, CB3, CG5. CT9, CE10, CE11, CE15, CE16, CE20, CE22, CE23, CE25, CE28, CB4, CG4

The practical lessons are presented so that the basics of genetic engineering techniques fundamental and characterization and identification of genetically modified foods will be exposed, then the student autonomously will be able to follow the protocols. At the end of the practical lessons, the results will be discussed with the teacher. Finally, the students should present an abstract of the results and discussion. CT5, CE10, CE11, CE15, CE16, CE20, CE22, CE23, CE25, CE28, CB3, CG2.

EVALUATION (ASSESSMENT INSTRUMENTS, EVALUATION CRITERIA AND PERCENTAGE OF THE FINAL RATE, ETC.)

Continuous evaluation

According to the rules of evaluation and qualification of students of the University of Granada, adopted on 26 October 2016, the evaluation will be continuous.

Dates of written tests: 2nd December 2020 and 15 January of 2021

- Written and/or oral test (up to a 60% of the qualification) CT9, CE10, CE11, CE15, CE16, CE20, CE22, CE23, CE25, CE28, CB3, CG4
- Practical lesson resolution (up to a 10% of the qualification). CT5, CE10, CE11, CE15, CE16, CE20, CE22, CE23, CE25, CE28, CB3, CG3
- Seminars (up to 20% of the qualification) CT5, CE10, CE11, CE15, CE16, CE20, CE22, CE23, CE25, CE28, CB3, CG2
- Participation and assistance to theoretical classes, seminars, works presentations etc. (up to 10% of the qualification) CT9, CE10, CE11, CE15, CE16, CE20, CE22, CE23, CE25, CE28, CB4, CG4

EVALUATION FOR THE UNIQUE FINAL EVALUATION



To obtain the approval for the final unique evaluation assessment, the student, in the first two weeks of the student enrollment date, he/she must submit specifically to the Head of Department a motivate requirement for the approval. The Head of Department shall transmit it to the corresponding faculty, providing the reason for which the student will not be able to follow the continuous assessment system". Students who have chosen this system will have to make and pass a written format similar to continuous assessment on the entire agenda (90%) test, and proof of practical training (10%)

SCENE A (FACE TO FACE AND VIRTUAL TEACHING)

TUTORING

TIMELINE

The same.

TOOLS FOR THE TUTORING

Google meet, Skype and PRADO.

ADAPTATION METHODOLOGY

- The theoretical class will be face to face in the case that the healthy rules can be follow up. Additionally, virtual theoretical class will be impart through the google meet platform.
- Practical class will be face to face, following the healthy rules.

EVALUATION

The evaluation will be the same that previously described.

SCENE B (VIRTUAL TEACHING)

TUTORING

TIMELINE

No se modifica el horario.

TOOLS FOR THE TUTORING

Google meet, Skype and PRADO

ADAPTATION METHODOLOGY

Theoretical and practical class will be virtual through the google meet and PRADO platform.

EVALUATION

The evaluation criteria will be the same that previously described. Written test and seminars will be perform virtually through google meet platform. Practical class will be perform virtually through the



google meet and PRADO platform

ADDITIONAL INFORMATION

