



## Teaching Guide

Identifying Data					2022/23
Subject (*)	Fundamentals of Biotechnology	Code	610G04029		
Study programme	Grao en Nanociencia e Nanotecnoloxía				
Descriptors					
Cycle	Period	Year	Type	Credits	
Graduate	2nd four-month period	Third	Obligatory	6	
Language	Spanish				
Teaching method	Face-to-face				
Prerequisites					
Department	Bioloxía				
Coordinador	De Castro De Antonio, María Eugenia	E-mail	m.decastro@udc.es		
Lecturers	Bernal Pita da Veiga, María de los Ángeles Carrillo Barral, Néstor De Castro De Antonio, María Eugenia Pomar Barbeito, Federico Saavedra Bouza, Almudena	E-mail	angeles.bernal@udc.es n.carrillo@udc.es m.decastro@udc.es federico.pomar@udc.es almudena.saavedra@udc.es		
Web	<a href="https://www.udc.es/es/centros_departamentos_servizos/departamentos/departamento/?codigo=D158">https://www.udc.es/es/centros_departamentos_servizos/departamentos/departamento/?codigo=D158</a>				
General description	Biotechnology is a clearly interdisciplinary branch of biology, which encompasses concepts and methodologies from numerous sciences. In combination with nanotechnology, biotechnology plays a fundamental role in the development and implementation of new tools with applications both in basic research and in solving practical problems and obtaining goods and services. The course Fundamentals of Biotechnology is essential to acquire the basic knowledge and learn to use biotechnological tools, both in animal cells and in plant cells, as well as knowing their application in the field of nanotechnology.				

## Study programme competences / results

Code	Study programme competences / results
A1	CE1 - Comprender los conceptos, principios, teorías y hechos fundamentales relacionados con la Nanociencia y Nanotecnología.
A3	CE3 - Reconocer y analizar problemas físicos, químicos, matemáticos, biológicos en el ámbito de la Nanociencia y Nanotecnología, así como plantear respuestas o trabajos adecuados para su resolución, incluyendo el uso de fuentes bibliográficas.
A6	CE6 - Manipular instrumentación y material propios de laboratorios para ensayos físicos, químicos y biológicos en el estudio y análisis de fenómenos en la nanoescala.
A7	CE7 - Interpretar los datos obtenidos mediante medidas experimentales y simulaciones, incluyendo el uso de herramientas informáticas, identificar su significado y relacionarlos con las teorías químicas, físicas o biológicas apropiadas.
A8	CE8 - Aplicar las normas generales de seguridad y funcionamiento de un laboratorio y las normativas específicas para la manipulación de la instrumentación y de los productos y nanomateriales.
A10	CE10 - Comprender la legislación en el ámbito del conocimiento y la aplicación de la Nanociencia y Nanotecnología. Aplicar principios éticos en este marco.
B3	CB3 - Que los estudiantes tengan la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética
B4	CB4 - Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado
B6	CG1 - Aprender a aprender
B7	CG2 - Resolver problemas de forma efectiva.
B8	CG3 - Aplicar un pensamiento crítico, lógico y creativo.
C3	CT3 - Utilizar las herramientas básicas de las tecnologías de la información y las comunicaciones (TIC) necesarias para el ejercicio de su profesión y para el aprendizaje a lo largo de su vida
C7	CT7 - Desarrollar la capacidad de trabajar en equipos interdisciplinares o transdisciplinares, para ofrecer propuestas que contribuyan a un desarrollo sostenible ambiental, económico, político y social.



C8	CT8 - Valorar la importancia que tiene la investigación, la innovación y el desarrollo tecnológico en el avance socioeconómico y cultural de la sociedad
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Learning outcomes			
Learning outcomes	Study programme competences / results		
Recognize the main applications of biotechnology	A3	B3 B4 B7	C3
Identify the main tools of Molecular Biology, metabolic engineering, protein engineering and cell and tissue engineering.	A1 A3	B3 B4 B7	
Apply the main biotechnological techniques	A6 A8	B3 B4 B8	C3 C7 C8
Solve basic biotechnology problems	A3 A6 A7	B3 B4 B6 B7 B8	C3 C7 C8
Recognize and apply ethical and legal principles in the field of Biotechnology	A10	B3 B4 B8	C8

Contents	
Topic	Sub-topic
1. INTRODUCTION TO BIOTECHNOLOGY	Current concept of Biotechnology. History and development of Biotechnology. Outlook. Importance of Nanobiotechnology.
2. CLONING	Purposes of molecular cloning. Basic steps of gene cloning. Polymerase chain reaction. DNA fragmentation: restriction enzymes. Binding of DNA molecules. Cloning and Nanotechnology.
3. GENOMIC LIBRARIES	Library concept. Genomic DNA libraries. cDNA libraries. Expression libraries. Amplification, storage and replication of libraries. Libraries in Nanotechnology.
4. PROTEIN ENGINEERING	Production of heterologous proteins in bacteria and yeast (Selection of microorganisms. Expression vectors. Expression in transformed cells. Secretion.) Production of recombinant proteins in animal cells (Expression vectors. Baculovirus-mediated protein expression in insect cell cultures ). Applications in Nanotechnology.
5. PROTEIN IMMOBILIZATION	Enzyme stability. Immobilized biocatalyst concept. immobilization systems. Nano-scale immobilization.
6. TRANSFORMATION AND GENE EDITING	Concepts of modification, transformation and gene editing. Direct and indirect genetic transformation methods. Transgenic plants and animals. Transgenic foods. Nanotechnology in genetic modification.
7. CELL AND TISSUE ENGINEERING	Introduction to animal and plant cell cultures. Types of crops. Cell culture requirements. Quantification of cellular parameters. contaminations. Cytotoxicity.
8. ETHICAL AND LEGAL ASPECTS	Current situation of regulatory regulations, patents. Ethical issues, security, risks. Social perception.

<b>Planning</b>
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Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student's personal work hours	Total hours
Laboratory practice	A3 A6 A7 A8 B3 B4 B6 B7 C3 C7	15	5	20
Document analysis	A1 A10 B3 B4 C7 C8	6	8	14
Mixed objective/subjective test	A1 A3 A7 B3 B4	2	10	12
Guest lecture / keynote speech	B3 B6 B8 C8	28	70	98
Personalized attention		6	0	6

(\*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
Methodologies	Description
Laboratory practice	A series of activities will be carried out in the practice laboratory, so that students learn to handle basic scientific instruments used in biotechnology.
Document analysis	Directed activity of group work that will be carried out during the interactive group classes. Students will analyze various documentary sources and must prepare texts or audiovisual materials individually or in small groups.
Mixed objective/subjective test	Written test used to assess learning and that can combine different types of questions: multiple choice, association, explanatory or calculation questions and problem solving.
Guest lecture / keynote speech	The contents of the subject will be taught by the teachers. The presentations and other documentation will be made available to the students on the Virtual Campus platform.

Personalized attention	
Methodologies	Description
Document analysis Guest lecture / keynote speech	For all the students, personalized tutorials will be carried out focused on the orientation for the acquisition of basic knowledge, the realization of problems, the study of practical cases, the resolution of doubts and clarifications. The tutorial schedule will be specified at the beginning of the course. Students can also request tutorials and ask specific questions via email.

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Document analysis	A1 A10 B3 B4 C7 C8	Evaluation in which the work during the interactive group sessions and the materials delivered by the student will be taken into account (quality of the works, discussion capacity, use of correct scientific language and verified bibliographic information).	30
Mixed objective/subjective test	A1 A3 A7 B3 B4	Assessment of theoretical knowledge	50
Laboratory practice	A3 A6 A7 A8 B3 B4 B6 B7 C3 C7	Laboratory practices are considered a MANDATORY attendance activity to pass the subject. A test will be carried out to evaluate the acquired knowledge.	20

Assessment comments
Attendance to laboratory practices is mandatory. In order to pass the subject, the score obtained in each of the evaluable parts (laboratory practices, document analysis and mixed objective) must be greater than 45%.
For students with recognition of part-time dedication and academic exemption, the teachers will adopt appropriate actions, so they can be properly evaluated. For those students who do not attend the keynote speech classes, it is highly recommended to make use of the tutorials to resolve doubts and orient themselves in the subject.



Sources of information

<b>Basic</b>	<ul style="list-style-type: none"><li>- Basra, A.S. (2000). Plant growth regulators in agriculture and horticulture. Their role and commercial uses. Ed. Food Products Press.</li><li>- Benítez Burraco, A (2005). Avances recientes en Biotecnología vegetal e ingeniería genética de plantas. Editorial Reverté.</li><li>- Taji, A., Kumar, P., Lakshmanan, P. (2002). In vitro plant breeding. Ed. Food Products Press.</li><li>- Tzfira, T. e Citovsky, V. (2006). Agrobacterium-mediated genetic transformation of plants: biology and biotechnology. Curr. Opin. Biotechnol. 17:147?154.</li><li>- Omran, B. (2020). Nanobiotechnology: A Multidisciplinary Field of Science. Springer</li><li>- Niemeyer, C.M., Mirkin, C.A. (2004). Nanobiotechnology Concepts, Applications and Perspectives. Wiley</li></ul>
<b>Complementary</b>	

Recommendations

Subjects that it is recommended to have taken before

Structural Biochemistry/610G04019

Molecular and Metabolic Biochemistry/610G04023

Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus

Other comments

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.