



IDENTIFYING DATA

Biomedical Applications of Nanotechnology

Subject	Biomedical Applications of Nanotechnology			
Code	V02M123V01202			
Study programme	(*)Máster Universitario en Ciencias Biológicas: Biología Molecular, Computacional e Ambiental e Bio-Industrias			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	1st	2nd
Language				
Department				
Coordinator	Salgueiriño Maceira, Verónica			
Lecturers	González Fernández, María África Salgueiriño Maceira, Verónica			
E-mail	vsalgue@uvigo.es			
Web				
General description	<p>The aims of the subject are:</p> <p>(1) to show the main principles of nanoscience and nanotechnology applicable to the bio-related applications, (2) to show the main tools available in terms of properties of nanoparticles for the assessment of biomedical applications such as magnetic separation, induction of heat, drug delivery, vaccines and also in the development of biosensors.</p> <p>(3) to show the immunological properties and potential toxicity induced by nanomaterials, including regulatory aspects.</p>			

Competencies

Type A	Code	Competences Specific
	A1	(*)To know the scientific method and the correct use of the scientific terminology as well as to acknowledge the contribution that scientific research provides to the overall knowledge and professional practice.
	A2	(*)Ability to describe and to analyse biological diversity, the mechanisms determining the interactions with the biotic and abiotic environment and being able to select those which might have technical applications.
	A3	(*)Ability to manage and/or to develop basic tools for validating and analysing data by means of statistics and bioinformatics.
	A4	(*)To know the ethical and legal aspects governing the collection and the handling of biological samples, organisms and habitats.
	A5	(*)Ability to design, evaluate and implement models of biological structures, systems and processes.
	A6	(*)To learn the sampling techniques and the instrumental methodologies, in the field and laboratory, for their application in the Biological Sciences
	A7	(*)To have an integrated view of the R&D processes and their possible transfer to the industrial sector. Planning and supervising facilities together with managing their human and economic resources.
	A8	(*)Ability to classify, evaluate, conserve, restore and manage natural and productive systems. Developing and implementing land management and sustainability plans.

A9	(*To understand and know how to apply quality control systems and safety protocols in any biological laboratory of the public or private sector.
A10	(*To acquire the professional ability to teach and spread Biology and to offer expertise advice for elaborating scientific, technical and socioeconomic biology reports. Address environmental consulting.
A11	(*To perform an individual Master Project (critical and in-depth study) under the supervision of a tutor in a research or working environment demonstrating that skills have been acquired.

Type B Code Competences Transversal

B1	(*Dissemination of results and conclusions of the biological studies, in oral and written English, through complex presentations that address ideas related with R&D in Biology.
B2	(*Managing computational, laboratory, field and industrial techniques in order to obtain, process and apply the acquired information.
B3	(*Disseminating and broadcasting ideas in contexts both academic and non-specialised.
B4	(*Reflecting on social and ethical responsibilities.

Learning aims

Subject competences	Typology	Competences
Knowledge of the basic concepts that rule the colloidal chemistry and colloidal stability of the nanoparticles in solution.	know Know How	A1 B1 B3
Qualitative description of the properties of metallic, magnetic and semiconductor nanoparticles. Knowledge of the basic concepts of magnetism.	know Know How	A1 B1 B3
Qualitative description of the magnetic and plasmonic properties of nanoparticles that rule the bio-related applications.	know Know How	A1 B1 B3
Demonstration of knowledge and comprehension of basic concepts related to nanoscience and nanotechnology.	know Know How	A1 B1 B3
Description of the potential application of the nanomaterials on biomedicine.	know Know How	A1 B1 B3
Knowledge on the basic concepts of immunogenicity and toxicity.	know Know How	A1 B1 B3
Training in several techniques applied to nanotechnology.	know Know How	A1 B1 B3
Knowledge on the regulatory aspects concerning toxicity studies.	know Know How	A1 B1 B3

Contents

Topic	
Colloids; synthesis and stability in solution	Colloids, synthesis and characterization, stability of colloids
Nanoparticles	Synthesis and characterization of nanoparticles
Magnetic, metallic and semiconductor nanoparticles	Magnetism, plasmonics and optical properties.
Basic Magnetism	Magnetic materials, hysteresis loops and main parameters
Nanoparticles in bio-related applications	Magnetic separation, Drug and heat delivery
Nanotechnology for biomedical applications	Nanomedicine
Physicochemical characterization	Physicochemical studies, sterility, endotoxin content
Immunological properties of nanomaterials	Recognition, induction or inhibition of the immune responses
Nanoparticle interaction with plasma proteins	Protein corona. Conformational changes and complement activation
Uptake mechanisms of nanomaterials	Routes of cellular uptake

Planning

	Personalized attention	Assessment	Ordinary class hours A	Face-to-face hours outside the classroom Guided academic environment B	Student's work factor C	Outside the classroom hours D	Total hours (A+B+D) E
Laboratory practises	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	17	0	2.1	35.7	52.7
Master Session	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	14	0	5.8	81.2	95.2
Short answer tests	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2	0	0	0	2
Total hours E:							149.9
Work load in UVIGO ECTS credits:							5.996

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

Methodologies

	Description
Laboratory practises	Practical work will be carried out based on programmed experiments
Master Session	Individual lectures Debates on scientific articles and reports

Personalized attention

	Description
Master Session	Every student will ask for guidance for the complete understanding of the work to be carried out
Laboratory practises	Every student will ask for guidance for the complete understanding of the work to be carried out

Assessment

	Description	Qualification
Master Session	Attendance, involvement and fulfillment of exercises individually or in a team and/or dissertations	10
Laboratory practises	Attendance and fulfillment of practical work	20
Short answer tests	Tests consisting of short answers	70

Other comments and second call

Test consisting of short answers

Attendance to master sessions and laboratory practises is compulsory

Sources of information

J. C. Berg, Introduction to Interfaces and Colloids, 1st, World Scientific

K. J. Klabunde, Nanoscale Materials in Chemistry, 1st, Wiley

N. A. Spaldin, Magnetic Materials, 2nd, Cambridge University Press

M. A. Dobrovolskaia, Handbook of immunological properties of engineered nanomaterials, 1st, World Scientific

R. E. Palmer, Nanobiotechnology: Inorganic nanoparticles vs organic nanoparticles, 1st, Elsevier

Recommendations**Subjects that continue the syllabus**

Structural Biology/V02M123V01211

Subjects that are recommended to be taken simultaneously

Infection and Immunity/V02M123V01107

Subjects that it is recommended to have taken before

