

Degree programme	Type	Course
Nanoscience and Nanotechnology	OP	4

Contact lecturer

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Teaching staff

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Group languages

You can consult this information at the [end](#) of the document.

Prerequisites

None

Objectives

To give students a perspective on what materials and substances are used in nanotechnology applied to Biomedicine, what are the synthetic protocols, and the main tools for their characterization. Likewise, modification strategies will be considered to make these nanomaterials biocompatible, vectorize their transport, and, if necessary, control their internalization in the cells, and their biodistribution in animal models. We will also consider possible toxicity problems and some examples of the biomedical applications of these nanomaterials.

Learning outcomes

- CM22 (Identify innovations in nanobiotechnology and their economic and social impact on the field of health.) Identify innovations in nanobiotechnology and their economic and social impact on the field of health.
- CM23 (Identify the ethical and social responsibilities of developing bionanotechnology.) Identify the ethical and social responsibilities of developing bionanotechnology.
- CM24 (Assess the existence of gender inequalities in the development of nanobiotechnologies applied to health.) Assess the existence of gender inequalities in the development of nanobiotechnologies applied to health.
- KM41 (Identify the scientific basis, techniques and applications of tissue engineering and drug delivery nano-systems.) Identify the scientific basis, techniques and applications of tissue engineering and drug delivery nano-systems.
- SM32 (Use digital tools and documentary sources to obtain, analyse and present information from a

critical perspective in the field of nano biotechnology, both orally and in writing.) Use digital tools and documentary sources to obtain, analyse and present information from a critical perspective in the field of nano biotechnology, both orally and in writing.

- SM35 (Successfully solve problems related to biotechnology.) Successfully solve problems related to biotechnology.
- SM36 (Identify and design nanomaterials and nano-systems applied to diagnosis and treatment in the field of biomedicine.) Identify and design nanomaterials and nano-systems applied to diagnosis and treatment in the field of biomedicine.

Contents

Topic1. Basic concepts in nanomedicine: nanoparticles in biological environments, biocompatibility, stability, and aggregation. Functionalization of nanomaterials and their application to nanomedicine.

Topic 2. Nanomaterial administration routes, advantages and disadvantages, and obstacles to overcome. Cellular traffic. Biological barriers. Smart nanomaterials: applications in therapy and diagnostics. Theranostic nanomaterials. Nanomaterials and the immune response.

Topic 3. Biosensors and integrated devices of medical interest. Biosensors: definition, characteristics, classification, and applications. Bioreceptors and analytical nanodevices.

Topic 4. Nanoscience and nanotechnology in medical imaging techniques. Basic fundamentals of the different medical imaging techniques: Ultrasound, Magnetic Resonance Imaging, Computerized Tomography, Positron Emission Tomography, Contrast Agents. Comparison of different types of images. Future trends.

Topic 5. Nanosystems of transport and selective release of drugs. General concepts Relevant physical-chemical characteristics of "drug delivery" systems. Nanotransporters used in "drug delivery". Challenges in the synthesis of nanomedicines for "drug delivery". Examples of products in the clinical phase and in the market.

Topic 6. Tissue engineering applied to regenerative medicine. Nanofibres and "nanoscaffolds" for regeneration of the nervous and cardiovascular tissue. Nanomaterials for implants. Nanotubes as "scaffolds" for bone and joint growth. Nanotechnology in wound repair.

Topic 7. Nanosurgery. Nanotechnology for hemostasis during surgery. Catheters as biosensors for minimally invasive surgery. Nanoscale surgery, Nanorobotic surgery.

Topic 8. Nanotoxicology. Toxicity of nanoparticles. Blood compatibility. Routes of exposure. Accumulation and deposits of nanoparticles in tissues. Measures to reduce the toxicity of nanoparticles. Environmental effects of nanoparticles. FDA and EMA regulation for nanobiotechnology products.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
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Tutor supervision	8	0.32	CM22, KM41, SM32, SM35, SM36
Student work and learning	61	2.44	CM22, CM23, CM24, KM41, SM32, SM35, SM36
Lectures	30	1.2	CM22, CM23, CM24, KM41, SM36
Classroom activities	8	0.32	CM22, CM23, CM24, KM41, SM32, SM35, SM36
Recommended readings and solving problems	25	1	CM22, CM23, CM24, KM41, SM32, SM35, SM36
laboratory work	12	0.48	CM22, CM23, KM41, SM32, SM35, SM36

The subject consists of theory master classes, problem classes and practical laboratory classes.

15 minutes of class will be devoted to answering the UAB institutional surveys.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Theory	70	4	0.16	CM22, CM23, CM24, KM41, SM32, SM35, SM36
Work Delivery	30	2	0.08	CM22, CM23, CM24, KM41, SM32, SM35, SM36

This subject will not apply the single evaluation protocol.

Coursework evaluation: 30% of the total in three different work deliveries; written exam 70% of the total, divided into two partial exams.

Exams: There will be two exams with more or less half of the subject matter in each one. The final mark will be the average of the two partial ones. There is a retake exam to recover the partial ones.

Assessment of work during the course: Three tasks will be carried out during the course. They can be bibliographic searches, presentations of seminars, data interpretation of works, etc. According to the teacher, they can be individual or group activities to be delivered in printed form or through the virtual campus.

The minimum mark to pass will be 5 out of 10. The average of the exams will be done only with those grades that are ≥ 4.0 .

To participate in the retake exam, the students must have been previously evaluated in a set of activities whose weight equals to a minimum of two-thirds of the total grade of the subject, and a grade of at least 3.5.

The retake (final) exam will include the theoretical content, and that will be worth up to 70% of the final grade.

For this course, the use of Artificial Intelligence (AI) technologies is permitted exclusively for support tasks such as literature or information searches, text correction, or translations. The student must clearly identify which parts have been generated using such technology, specify the tools used, and include a critical reflection on how these tools have influenced both the process and the final outcome of the activity. Lack of transparency regarding the use of AI in this assessed activity will be considered academic dishonesty and may result in partial or total penalization of the activity's grade, or more severe sanctions in serious cases.

Any irregularity committed during an assessment activity (academic misconduct, plagiarism, or improper use of AI, unless such use is expressly authorized in the course syllabus) that may lead to a significant alteration of the grade will result in that activity being graded as 0. If the course syllabus stipulates that obtaining a minimum mark in this assessment is an essential requirement to pass the course, or if multiple irregularities occur in the assessment activities of the same course, the final grade for the course will be 0. Furthermore, disciplinary proceedings may be initiated against any student who incurs any of these irregularities.

Bibliography

Libros de referencia:

- 1- Nanomedicine. An Introductory Text Book. Rob Burgess. Plan Sanford Publishing 2012.
- 2- Nanoparticles in translational science and medicine. In "Progress in Molecular Biology and Translational Science and Medicine" Vol. 104. Elsevier, Amsterdam, 2011.
- 3- Applications of Targeted Nano drugs and Delivery systems. Elsevier 2018.
- 4- Principles of Nanomedicine. Taylor and Francis ebooks. 2019.

Software

None

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	1	Catalan/Spanish	first semester	morning-mixed
(PAUL) Classroom practices	1	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	1	Catalan/Spanish	first semester	afternoon
(PLABs) Suport a les pràctiques de laboratori	1	Catalan/Spanish	first semester	afternoon