

Degree programme	Type	Course
Biomedical Sciences	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

No specific requirements.

Objectives

To provide students with an overview of the materials and substances used in nanotechnology applied to Biomedicine, the existing preparation protocols, and the main characterization tools employed. Additionally, the course will address modification strategies to make these nanomaterials biocompatible, to direct their transport, and, when necessary, to control their internalization into cells and their biodistribution in animal models. Potential toxicity issues and selected examples of biomedical applications of these materials will also be considered.

Learning outcomes

1. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.
2. Search for and manage information from various sources
3. Read specialised texts both in English and one's own language
4. Describe the physicochemical and mathematical principles behind biomedical diagnostic techniques.
5. Explain the most important diagnostic techniques in biomedicine.
6. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
7. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.

8. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
9. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
10. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
11. Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.

Contents

Chapter 1. Introduction. Concept of Nanomedicine. Basic concepts in nanomedicine: nanoparticles in biological environments, biocompatibility, stability, and aggregation. Functionalization of nanomaterials and their application in nanomedicine.

Chapter 2. Routes of administration of nanomaterials, advantages and disadvantages, and challenges to overcome. Cellular trafficking. Biological barriers. Smart nanomaterials: applications in therapy and diagnosis. Theranostic nanomaterials. Nanomaterials and immune response.

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

Chapter 4. Nanosystems for targeted drug transport and release. General concepts. Relevant physicochemical properties of drug delivery systems. Nanocarriers used in drug delivery. Challenges in nanomedicine manufacturing. Examples of clinical and marketed products.

Chapter 5. Nanoscience and nanotechnology in medical imaging techniques. Basic principles of imaging techniques: ultrasound, magnetic resonance imaging, computed tomography, positron emission tomography, contrast agents. Comparison of imaging modalities. Future trends.

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

Chapter 7. Nanotoxicology. Nanoparticle toxicity. Blood compatibility. Exposure routes. Accumulation and deposition in tissues. Strategies to reduce toxicity. Environmental effects. FDA regulation for nanobiotech products.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Problems based teaching	13	0.52	1, 2, 3
Studying for exams	10	0.4	2, 3

Theory classes	26	1.04	3, 4, 5, 8, 10
Information retrieval, study, processing of gathered information and electronic delivery of supervised homework through "Campus Virtual"	46.5	1.86	1, 2, 3
Writing the laboratory work report	6	0.24	1, 2, 3
Laboratory work	12	0.48	1, 3, 8, 10
Homework delivery and associated interaction through "Campus Virtual"	14	0.56	1, 2, 3
Tutor supervision	2	0.08	
Solving problems	10	0.4	1, 2, 3

The course will be delivered through theoretical lectures and classroom-based practical sessions, with a strong emphasis on active participation and meaningful learning by the students. The teaching staff will act as facilitators, promoting interaction by posing questions and discussion topics that students will be expected to work on and answer. These activities will contribute to the continuous assessment system (see the corresponding section).

Fifteen minutes of one class will be allocated to completing 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
Homework delivery	50%	6	0.24	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Partial exams	40%	4	0.16	2, 3, 4, 5
Laboratory work evaluation and delivery of the lab work report	10%	0.5	0.02	1, 2, 3, 4, 5

This course will not apply the single assessment system.

All oral or written assessed contributions made in English will be subject to a multiplier factor ranging from a minimum of 1.0 to a maximum of 1.1.

- Coursework assessment: 51% will come from assessed submissions; 10% from the laboratory report and work; 40% from a written exam composed of two partial assessments.
- Exams: The written exam will consist of short-answer and problem-solving questions, with access to notes. The final grade for the written exam will be the arithmetic mean of the two partial exams.
- Coursework assessment: will include problem-solving, interpretation of scientific publications, literature search tasks, seminar presentations, etc., as proposed by the teaching staff.
- According to academic regulations, all submitted tasks and problem responses (minimum of 9) provided during the course will contribute to the global evaluation (50% of the final mark).
- Students unable to attend an individual assessment for justified reasons (e.g., illness, death of a first-degree relative, or accident) and who present an official justification to the Degree Coordination will

be entitled to reschedule the assessment. The Degree Coordination will ensure this right is upheld with the responsible course lecturer.

- To attend laboratory sessions, students must provide proof of having passed the biosafety and safety assessments available on the Virtual Campus and must be familiar with and accept the rules for laboratory use in the Faculty of Biosciences.
- Resit procedure: To be eligible for final grade recovery, students must have been assessed in activities representing at least two-thirds of the final course score. Students will be marked as \"Not Assessable\" if their completed assessment activities prior to the resit account for less than 67% of the total grade.

Any grade obtained in the identified resit activities will replace the previous grade, whether higher or lower. The resit session will apply to activities representing at least 50% of the final score. Therefore, resit components will replace grades from Exams 1 and 2 (40% of the global grade) and 1/6 of the participatory and lab work score (10% of the global grade: problems, coursework, and lab evaluations).

Access to all course materials will be allowed during the resit activity. To avoid unnecessary printing or room bookings, students will have 48 hours to declare their intention to attend the resit session. Only those who register through the Virtual Campus before the deadline will be admitted. If no student registers, the resit session will be cancelled.

- Use of AI technologies: The use of Artificial Intelligence tools is permitted only for support tasks, such as bibliographic or informational searches, text correction, or translations. Students must clearly identify which parts were generated using AI, specify the tools used, and include a critical reflection on how these influenced the process and the final outcome. Lack of transparency in AI use for assessed activities will be considered academic dishonesty and may result in partial or full penalties to the grade, or more serious sanctions in severe 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

Reference Books

1. Nanomedicine. An Introductory Textbook. Rob Burgess. Pan Stanford Publishing 2012.
2. Nanoparticles in translational science and medicine. Ed Antoni Villaverde, in "Progress in Molecular Biology and Translational Science and Medicine" Vol. 104, Elsevier, Amsterdam, 2011.
3. Nanobiotechnology. Eds. Christof Niemeyer and Chad Mirkin, 2004, Wiley-VCH.
4. Nanobiotechnology II. Eds. Chad Mirkin and Christof Niemeyer, 2007, Wiley-VCH.
5. Bionanotechnology. Concepts and applications, by Ljiljana Fruk and Antonina Kerbs. Cambridge University Press 2021.

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