Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 310 - Faculty of Science and Technology **Cycle** .

Degree BMYBM204 - Master in Molecular Biology and Biomedicine **Year** .

COURSE

505866 - Advanced nanomedicine in metabolic and inflammatory diseases: development and applications **Credits, ECTS:** 5

COURSE DESCRIPTION

Nanomedicine is the application of nanotechnology to achieve innovation in healthcare. It uses the properties developed by a material at its nanometric scale, which often differ in terms of physics, chemistry or biology from the same material at a bigger scale. Moreover, the nanometric size is also the scale of many biological mechanisms in the human body allowing nanoparticles and nanomaterials to potentially cross natural barriers to access new sites of delivery and to interact with DNA or small proteins at different levels, in blood or within organs, tissues or cells. Thus, nanomedicine has the potential to enable early detection and prevention and to drastically improve diagnosis, treatment and follow-up of many diseases, including metabolic and inflammatory diseases, among others.
¿Advanced nanomedicine in metabolic and inflammatory diseases: development and applications¿ covers leading and emerging technologies for nanoparticle preparation, characterization and functionalization. The subject described numerous techniques and procedures for the preparation of nanoparticles of different nature, including organic (lipidic, polymeric, etc) and inorganic (magnetite, silica, gold, etc) ones. The students will be introduced to the methods to functionalize nanoparticles for biomedical applications, including functionalization for specific cell/tissue targeting and drug or RNA delivery. In addition, the most recent biomedical applications of nanoparticles will be described, paying special attention to their use in the diagnosis and treatment of metabolic ad inflammatory diseases.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

COMPETENCIAS DE LA ASIGNATURA

RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

Theoretical and Practical Contents

1.- Introduction to nanomedicine
2.- Production and characterization of HDL nanoparticles
3.- Functionalization of HDL nanoparticles for atherosclerosis treatment
4.- Production and characterization of magnetite nanovehicles.
5.- Use of nanoparticles for the treatment of intestinal inflammatory diseases.
6.- Use of nanoparticles for the prevention of diabetes.
7.- Personalized RNA-NPs for the design of therapeutic strategies.
8.- Antibody engineering for therapeutic purposes and the development of lipid nanoparticle platforms for their in vivo delivery.

Laboratory practical lessons
During the laboratory practical lessons, the students will produce and characterize HDL nanoparticles (NPs). In addition, they will functionalize the surface of the nanoparticles with small interfering siRNAs targeting a transcription factor implicated in the activation of inflammation in pancreatic beta cells. To probe the effectiveness of the siRNA-loaded nanoparticles, the student will introduce the siRNA-NPs in the rat INS-1E cell line and analyze the expression of some inflammatory genes by qPCR.
The laboratory practical lessons will allow the students to apply the concepts learned during the theorical lessons.

METODOLOGIA (ACTIVIDADES FORMATIVAS)

Actividad Formativa	Hours	Porcentaje presencialidad
Work with computer equipment and preparation of reports	25	40 %
Experimental practices and report preparation	50	40 %
Lectures	50	40 %

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	20			20	10				
Horas de Actividad No Presencial del Alumno/a	30			30	15				

Legend:
M: Lecture-based — S: Seminar — GA: Applied classroom-based groups
GL: Applied laboratory-based groups — GO: Applied computer-based groups — GCL: Applied clinical-based groups
TA: Workshop — TI: Industrial workshop — GCA: Applied fieldwork groups

Evaluation tools and percentages of final mark

Denominación	Ponderación mínima	Ponderación máxima
Attendance and participation	50 %	50 %
Evaluation of works/reports	50 %	50 %

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

MANDATORY MATERIALS

e-Gela platform from the UPV/EHU https://egela.ehu.eus/login/index.php

BIBLIOGRAPHY

Basic bibliography

1. Bionanotechnology. Concepts and Applications. Ljiljana Fruk & Antonina Kerbs.Cambridge University Press, 2021.
2. Nanotechnology:An Introduction 2ª ed.Jeremy J. Ramsden.Elsevier,2016.
3. Nanotechnology. Understanding small systems.3ª ed.B. Rogers, J. Adams y S. Pennathur. CRC Press, 2015.
4. Understanding Nanomedicine: An Introductory textbook. R. Burgess. Pan Standford Publishing, 2012.
5. Structural DNA Nanotechnology. Nadrian C. Seeman. Cambridge University Press 2016.
6. Introduction to Nanoscience. GL Hornyak, J. Dutta, HF Tibbals y AK Rao. CRC 2008.
7. Fundamentals in Nanotechnology. GL Hornyak, JJ Moore, HF Tibbals y J. Dutta, CRC, 2009.
8. BioNanotechnology. Elisabeth S. Papazoglou y Aravind Parthasarathy. Morgan y Claypol eds, 2007.
9. NANOTECHNOLOG IN BIOLOGY AND MEDICINE: Methods, Devices, and Applications. Tuan Vo-Dinh (ed) CRC 2007
10. Nanobiotechnology. Concepts, Applications and Perspectives. C.M.Niemeyer y C.A. Mirkin(eds.). Wiley
11. & sons 2004.
12. Nanobiotechnology II: More concepts and applications. Chad A. Mirkin and Christof M. Niemeyer (eds) Wiley 2007
13. Nanobiotechnology of Biomimetic membranes. D.T. Martin.Springer 2007
14. Protein Nanotechnology. T. Vo-Dinh. Humana Press 2005.

Detailed bibliography

Journals

Web sites of interest