UNIVERSITÀ DEGLI STUDI DI PADOVA

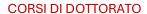|	
Course unit English denomination	Smart drug delivery systems
SSD	CHEM-08/A
Teacher in charge (if defined)	SALMASO Stefano (12h), MASTROTTO Francesca (12h)
Teaching Hours	24
Number of ECTS credits allocated	3
Course period	06-07/2026
Course delivery method	☐ In presence ☐ Remotely ☒ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (75% minimum of presence) ☐ No
Course unit contents	Objectives. The course aims at introducing the features expected from advanced nanocarriers for drug delivery, their critical attributes and properties affecting the biopharmaceutical performances in vivo, the rational for design of "smart" multifunctional nanocarriers to exploit the phenotypic and microenvironmental features of peculiar tissues affected by diseases (e-g. tumor, inflammation) to increase site-selectivity. The concept behind remotely activated carriers will be discussed. Contents. Scope of nanomedicines in advanced therapies: advantages, expectations, risks. General concepts on the required properties to generate drug nanocarriers with suitable biopharmaceutical features: guidelines and rational. Peculiar microenvironments of disease sites that motivate the approach with "smart delivery systems". The concept of "smart" nanocarriers: how nanocarriers can be endowed with active targeting capacity and responsiveness to microenvironment to improve their biopharmaceutical behaviour. Case studies with liposomes and metal based nanoparticles. Metal based nanoparticles: SPIONS and gold nanoparticles, characterization methods, approaches to confer responsiveness and targeting capacity, potential uses in diagnostics and drug delivery, remote activation of therapeutic activities. Liposomes: biophysics of lipid based carriers, loading strategies, microfluidics, interface ability with biological barriers. Polymer based nanoassemblies: novel copolymers design by using living radical polymerization techniques to obtain defined architecture, composition and molecular weight. Assembly of smart and functional nanocarriers (e.g. micelles, polyplexes, nanoparticles) for controlled release of drugs/therapeutic nucleic acids and specific targeting. Principles governing the assembly and drug loading. Nanotoxicity of drug nanocarriers: concept behind assessment of nanotoxicity and strategies to mitigate or remove nanotoxicity of drug carriers.
Learning goals	Knowledge: understand the need for novel delivery systems, understand the risks and applicability of nanomedicine, understand the issue of nanotoxicity

Skills: rational design of targeted and smart nanomedicines; critical thinking concerning the potential use of nanomedicines.
Competencies: multicultural approach to develop novel nanomedicines

Teaching methods	Frontal teaching
Course on transversal, interdisciplinary, transdisciplinary skills	☒ Yes ☐ No
Available for PhD students from other courses	☒ Yes ☐ No Students external to the PhD Course admitted upon evaluation of the CV by the teachers
Prerequisites (not mandatory)	Background information about chemistry and material sciences. Preferred basic level of biological knowledge.
Examination methods	Project proposal and defense based on knowledge/skills/competencies acquired along the course
Suggested readings	Slides/articles provided by the teacher
Additional information (not mandatory)	max 3750 caratteri