Universidad Zaragoza

Year : 2019/20

69313 - Nano-therapy

Syllabus Information

Academic Year: 2019/20
Subject: 69313 - Nano-therapy
Faculty / School: 110 -

Degree: 547 - Master's in Biomedical Engineering

ECTS: 3.0
Year: 1
Semester: Second semester
Subject Type: Optional
Module: ---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. It is based on the cooperative work between the teacher and the student as well as student participation. It follows the traditional lecture methodology but supported by the active participation of the students and class discussions.

4.2.Learning tasks

The course includes the following learning tasks:

- **A02 Lectures** (26 hours). The professor will describe the main contents of the course during those lectures. In these sessions, the student will achieve the learning outcomes and learning skills. Student attendance is strongly recommended.
- **A01 Autonomous work** (49 hours). It includes assignments, assessment tasks, elaboration of projects, public defenses and study.
- **Research project**. The professor will propose relevant topics related to the course contents, the student's personal interests, professional development, or the Master's dissertation. The research project will have the structure of a scientific paper:

- Title
- Author
- Abstract: With no more than 250 words, the student should summarize the content described in the paper and its implications in the Nanobiomedical field.
- Introduction: 1 or 2 paragraphs, between 250 to 750 words defining and describing the topic of the review paper.
- Review of the state-of-the-art: There is not length limitation in this section. This section will review the most relevant advances in the field related to the topic, highlighting those that supposed a breakthrough in the area. Future directions and implications for the coming years should also be described.
- Conclusions: A summary of the main conclusions of the work. A total of 1 or 2 paragraphs with a maximum of 250-750 words will be required.
- Bibliography: Main relevant references used for the preparation of the project.
    - The student will give a talk summarizing the main aspects of his/her work in a public defense.

- **A03 Tutorials.** Tutoring time to discuss with the professor in charge of the course all the contents and aspects related to the course in order to solve any question or doubt that the student might have.
- **A04 Assessment.** A written exam. The relevant information about the exam is described in section 4 (Global evaluation).

4.3.Syllabus

The course will address the following topics:

- Topic 1. Nanotherapy overview. Introduction to drug and gene delivery. Magnetic and photothermal hyperthermia, and tissue engineering.
- Topic 2. Drug delivery overview. Drug adsorption and desorption mechanisms in mesoporous and microporous materials and polymeric matrixes. Drug delivery routes. Drug encapsulation and conjugation to nanocarriers. Nanoparticles functionalization. Mechanism of evading the reticuloendothelial system (RES). Physical and chemical synthesis of organic (micelles, liposomes, dendrimers, etc.) and inorganic nanomaterials (SiO_2, TiO_2, etc). Biomimetics.
- Topic 3. Gene therapy. Gene therapy overview. Introduction to gene therapy: basics, gene nanocarriers, gene transfer mechanisms.
- Topic 4. Main nanocarriers in drug delivery. Tracers (MRI, fluorescent tomography, sonoacustic). Dendrimers, polymers, micelles. Stimuli responsive polymers: photosensitive, thermosensitive, pH sensitive, etc. Other aspects including the stoichiometry control will also be discussed. Inorganic nanoparticles, applications in drug delivery. Meso and micro nanoparticles. Microcapsules and microspheres. Biodegradable silica gel.
- Topic 5. Application of nanoparticles in theranostics. Nanoparticles as tracers for in-vivo (MRI, fluorescent tomography, sonoacustic, etc..) Theranostic nanomaterials with diagnosis/ therapy dual role. Biological barriers to theranostic nanoparticle for drug/gene delivery.
- Topic 6. Localized drug delivery systems: active and passive mechanisms. Active mediated techniques in drug delivery: magnetic, light, ultrasound, etc. Biochemical mediated drug delivery. Drug conjugated nanocarriers and bio-receptors. Chemical interactions: lectin-carbohidrate, ligand-receptor and antigen-antibody.
- Topic 7. Pharmacokinetics and pharmacodynamics. Main requirements to translate the production of therapeutic nanocarriers from lab to the market. Analytical techniques to track the drug delivery and assessment of side effects. Description of commercialized nanocarriers.

4.4.Course planning and calendar

Deadlines for project presentation or assignment submission will be posted in the virtual platform Moodle (https://moodle.unizar.es/) or in the Alfresco server.

It is mandatory to follow the safety procedures described by the University of Zaragoza to work in laboratories in practical sessiones: safety googles and coat.

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website and the Master's website (http://www.masterib.es).

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=69313&year=2019