Therapeutic Technologies

Academic Year: (2019 / 2020) **Review date: 24-09-2019**

Department assigned to the subject: Bioengineering and Aeroespace Engineering Department

Coordinating teacher: GARCIA DIEZ, MARTA

Type: Compulsory ECTS Credits : 5.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Bachelor courses closely related to Biochemistry and/or Cellular and Molecular Biology.

OBJECTIVES

BASIC COMPETENCES

CB6. Acquire knowledge and understanding to provide the basis to develop and/or apply original ideas, often in a research context.
CB7. Apply the acquired knowledge and the ability to solve problems in new contexts within broader (or multidisciplinary) contexts related to their field of study.
CB8. To be able to integrate the acquired knowledge and handle complexity of formulate judgments based on incomplete or limited information, including reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.
CB9. To be able to communicate their conclusions and thoughts to a specialized and non-specialized audience in a clear and unambiguous manner.
CB10. Learn skills that will enable the students to continue their studies.

GENERAL COMPETENCES

CG1. Achieve a multidisciplinary scientific view, with a clear translational orientation and applied to the field of biomedical science and technology.
CG2. Demonstrate a deep theoretical and practical knowledge about both the principles and the most advanced technologies in biomedical sciences.
CG3. Ability to lead and manage groups and research teams and also to promote teamwork, knowledge management and competitive intelligence.
CG4. Ability to analyze, synthesize and apply knowledge to propose original solutions to biomedical problems.
CG5. Develop abilities to identify and understand the social needs and to provide scientific and technological solutions in the biomedical field.
CG6. Identify the keys of technology transfer in the Spanish and in the EU market, and understand the basis for the management and building of a biomedical based company.

SPECIFIC COMPETENCES

CE1. Know the state-of-the-art and future perspectives in both cellular and gene therapies and also in tissue engineering to design and develop experiments in these fields.
CE2. Know in depth the different types of stem cells (natural and induced), for their collection and management, their application in Regenerative Medicine, as well as their present limitations and their foreseeable future development.
CE3. Understand the fundamentals of different genetic tools used for the modification of cellular genomes, know how to use them, and their clinical application.
CE4. Know and interpret the legislation and the ethical aspects related to the use of stem cells, gene therapy and tissue engineering.

LEARNING RESULTS

1. Learn how to choose the strategy and the cell type, and also design the appropriate vector for cell/gene therapy applications.
2. Understand and integrate the acquired knowledge in order to apply it for a fast resolution of current and future problems in the field of regenerative medicine, genetic and tissue engineering as well as in biotechnology applied to health. At the end of the course, students must be able to express a reasoned and elaborated scientific-tecnologic opinion and should be able to express it in both written and oral form in front of an expert professional audience.
3. Apply the acquired knowledge to the Biomedical Technologies field.

DESCRIPTION OF CONTENTS: PROGRAMME

a. Stem cells biology and regenerative medicine.
- Repair, regeneration and degeneration (aging).
- Stem cells and regeneration in the pathobiology and treatment of human diseases. Human Adult Stem Cells. Human Embryonic Stem Cells. Human Induced Stem Cells (IPSc).
- Cancer stem cell. Cancer biology.
- Genetic mechanisms of cell differentiation.

b. Cell bioengineering, genetic engineering.
- Viral and non-viral vectors
- Gene therapy to treat / repair genetic and immunological diseases: Gene addition and gene editing (homologous recombination and trans-splicing).
- Cancer gene therapy

c. Biological therapies based on recombinant DNA technology

d. Advanced topics in tissue bioengineering
- Morphogenesis and organogenesis, molecular regulation of tissue formation.
- Cartilage and Bone Tissue engineering. Neural tissue engineering. Cardiac tissue engineering. Gene and Cell Therapy in skin and in the hematopoietic system
- Gene therapy and tissue engineering

e. Application of these technologies: practical examples

LEARNING ACTIVITIES AND METHODOLOGY

LEARNING ACTIVITIES
- Theoretical classes
- Theoretical-practical classes
- Tutorships
- Group work
- Student´s individual work

TEACHING METHODOLOGIES
- Teacher explanations supported with audiovisual media and information technology, in which the main concepts of the subject are developed and the reference literature is provided to supplement student learning.
- Critical reading of international references recommended by the professor: journal papers, reports and manuals for further discussion in class, to enhance and consolidate the acquired knowledge.
- Solving practical biomedical cases, presented by the professor to the students either individually or in groups.
- Presentation and discussion in class, under the moderation of the professor, of subjects related to the course.
- Reports and projects (working individually or in groups).

ASSESSMENT SYSTEM

Attendance to 80% of sessions is mandatory to be evaluated.

GRADING:
Total score: 10 points
Continuous evaluation: 6 points out of 10
Final exam: 4 points out of 10

Continuous evaluation: It accounts for up to 60% of the final score of the subject (6 points of the TOTAL SCORE), and includes a midterm exam (4 points) and follow-up questions of each lecture (2 points). Failure to attend any test or submit the exercises before the deadline will result in a mark of 0 in the corresponding continuous evaluation block.

Final exam: The final exam will cover the whole subject and it will account for the 40 % of the final score (4 points of the TOTAL SCORE). The minimum score in both the midterm exam and the final exam will be 4.5 over 10. The minimum score to pass the subject will be 5.

Extraordinary exam: the mark for students attending any extraordinary examination will be either a) 100% extraordinary exam mark, or b) 40% extraordinary exam mark and 60% continuous evaluation if it is available on the same course and if the student requests it.

Academic conduct: Unless otherwise specified, the tests will be closed book, no computer or phone, or

anything else other than a writing instrument and the examination itself. Plagiarism, cheating or other acts of academic dishonesty will not be tolerated. Any infringement of any kind will result in a failing grade.

% end-of-term-examination:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

BASIC BIBLIOGRAPHY

- Lanza RP, Langer R, Vacanti J Principles of Tissue Engineering, Academic Press, 2007

- Saltzman MW Tissue Engineering: Engineering Principles for the Design of Replacement Organs and Tissues, Oxford University Press, 2004

ADDITIONAL BIBLIOGRAPHY

- Bruce Alberts Essential Cell Biology, Ed. Garland Publishing, Inc. New York and London, 2014

- Harvey Lodish et al.. 5th Edition. Ed. Freeman and Company, New York.. Molecular Cell Biology,, Ed. Freeman and Company, New York, 2008