Enabling technologies: omic technologies

Academic Year: (2019 / 2020) **Review date: 07-05-2020**

Department assigned to the subject: Bioengineering and Aeroespace Engineering Department

Coordinating teacher: LEON CANSECO, CARLOS

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 and/or Bioinformatics.

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

CE5. Understand the scientific and technological fundamentals of high throughput analytical technologies (omics) in the biomedical field.

LEARNING RESULTS

1. Understand the importance of the application of big data technologies to the resolution of complex problems in the biomedical field. Become familiarized with these techniques and develop criteria to apply them to the resolution of specific problems.
2. Learn how to interpret and integrate the results from different omic technologies (holistic view) to determine pathogenic mechanisms, focusing the therapeutic approach in a more efficient way.
3. Apply the acquired knowledge to the Biomedical Technologies field.

DESCRIPTION OF CONTENTS: PROGRAMME

Description of contents: The goals of the course are to understand the fundamentals and applications of massive omic technologies in biomedicine, to learn the importance of the application of omic technologies (generation and analysis of massive biological data) to solve complex problems in Biomedicine and to be familiarized with these technologies and develop criteria to apply them to the resolution of specific problems.

At the end of the course, students should be able to:

a. Learn the basis behind omic technologies.
b. Design experiments using these technologies depending on the biomedical problem: selection of the appropiate methodology and platform.
c. Bioinformatic treatment of the generated data to evaluate the quality of the process.
d. Understand the design, components, arquitecture and software of the equipment involved in the different technologies.

"Omic technologies" programme:

a. Introduction to new generation omic technologies.
b. Next Generation Sequencing. Description of existing platforms and others in development.
c. Transcriptomics. Microarrays and RNA-Seq. Different types (genotyping, CGH...)
d. Proteomics. Description of advanced high throughput tools for the analysis of proteins: bidimensional electrophoresis (2D-DIGE), mass spectrometry (ESI, MALDI, MALDI-TOF, MALDI TOF /TOF, NLC MS/MS, etc.)
e. Metabolomics. Methods for quantitative measurement of the metabolic response in living organisms. NMR and mass spectrometry.
f. Application of computing and information technologies to the treatment of biological data
g. Components, architecture, software and performance of the most relevant appliances
h. Computer practices and/or visits to hospitals or related companies: tecnological analysis of the most relevant appliances.

LEARNING ACTIVITIES AND METHODOLOGY

LEARNING ACTIVITIES
- Theoretical classes
- Theoretical-practical classes (computer room)
- 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 knowledge acquired.
- 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.

The evaluation will consist on a 50% continuous evaluation (of which, 20% will be exercises and problems, 20% class participation and 60% presentation of a work project/poster) and a 50% final exam (divided in a midterm exam and other at the end of the course).

To pass the course, students need a 5 out of 10 (a minimum mark of 4 is needed in the final exam for the continuous assesment to compute).

Extraordinary exam: the mark for students attending any extraordinary examination will be either a) 100% extraordinary exam mark, or b) 50% extraordinary exam mark and 50% 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:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- Carolina Simó Alejandro Cifuentes Virginia García-Cañas Fundamentals of Advanced Omics Technologies: From Genes to Metabolites, Elsevier, 2008
- Debmalya Barh and Vasco Azevedo omics Technologies and Bioengineering, Academic Press, 2017