Application of "omic" technologies in the diagnosis of complex diseases and the development of new drugs

Academic Year: (2019 / 2020) **Review date: 08/05/2020 22:39:24**

Department assigned to the subject: Bioengineering and Aeroespace Engineering Department

Coordinating teacher: MORENO PELAYO, MIGUEL ANGEL

Type: Compulsory ECTS Credits : 5.0

Year : 1 Semester : 2

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
CE6. Learn how and when to apply omic and bioinformatic technologies in the biomedical field specifically for the identification of new targets and the development of new drugs and diagnostic methods.

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. At the end of the course, students should be able to:
a. Understand and use massive technologies (omics) in biomedicine.
b. Design algorithms for filtering and analyzing large amounts of data generated by these technologies, focusing on the problem to be analyzed.

Programme:

a. Introduction to complex diseases, whose studies and diagnosis are the subject of omic technologies. Personalized medicine.

b. Application of next generation sequencing (NGS) tools and microarrays for the diagnosis of genetically heterogeneous pathologies.
- NGS: exome sequencing vs gene panels.
- NGS: RNA-Seq, small RNA-Seq. Characterization of pathological molecular signatures.
- Bioinformatics: pipelines and Big-Data Analysis in complex pathologies.
- SNPs arrays: applications in pharmacogenomics and hereditary diseases.
- CGH microarrays in genetic diagnosis
- Methylation arrays in cancer diagnosis

c. Advance proteomic applications (functional, structural and expression) in Biomedicine for the development of drugs, the identification of tentative pharmacological targets, diagnosis, the development of vaccines and the search for biomarkers and molecular signatures involved in signal transduction and pathologies.

d. Metabolomics applications for the identification of ¿metabolic fingerprints¿, in order to differentiate normal and pathological situations (cancer, neurological and metabolic diseases, etc.). Identification of metabolites in response to therapeutic or nutritional interventions. Metabolomics in the development of new drugs, organ transplant and identification of population risk factors.

e. Use of these technologies: practical examples.

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

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

Attendance to 80% of sessions is mandatory to be evaluated

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

CONTINUOUS EVALUATION: 40% of the final score of the subject and includes a midterm activity consisiting on a test and practical computer exercises (20%) and group work (20%).

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

FINAL EXAM: The final exam will cover the whole subject and it will account for the 60 % of the final score. The minimum score in the final exam to pass the subject is 4 over 10, notwithstanding the mark obtained in continuous evaluation.

EXTRAORDINARY EXAM: the mark for students attending any extraordinary examination will be either a) 100% extraordinary exam mark, or b) 60% extraordinary exam mark and 40% 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.

BASIC BIBLIOGRAPHY

- Arthur M. LesK Bioinformatics, OXFORD, 2008

- David W. Mount Bioinformatics. Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, 2004