Biophysics 1: Molecular, Cell and Tissue Physical Biology

Academic Year: (2023 / 2024) **Review date: 12-02-2024**

Department assigned to the subject: Bioengineering Department

Coordinating teacher: MEDRAÑO FERNANDEZ, IRIA

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 2

SKILLS AND LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.
CB4. Students should be able to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.
CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.
CG2. Learn new methods and technologies from basic scientific and technical knowledge, and being able to adapt to new situations.
CG3. Solve problems with initiative, decision making, creativity, and communicate and transmit knowledge, skills and abilities, understanding the ethical, social and professional responsibility of the engineering activity. Capacity for leadership, innovation and entrepreneurial spirit.
CG5. Use the theoretical and practical knowledge acquired in the definition, approach and resolution of problems in the framework of the exercise of their profession.
CE10. Know and describe in a general way the structure of living beings at the molecular, cellular, tissue and systemic levels, as well as to analyze the limitations imposed by physical laws on the development of biological systems and biological solutions to engineering problems.
CT1. Work in multidisciplinary and international teams as well as organize and plan work making the right decisions based on available information, gathering and interpreting relevant data to make judgments and critical thinking within the area of study.

RA1. To have acquired sufficient knowledge and proved a sufficiently deep comprehension of the basic principles, both theoretical and practical, and methodology of the more important fields in science and technology as to be able to work successfully in them.
RA2. To be able, using arguments, strategies and procedures developed by themselves, to apply their knowledge and abilities to the successful solution of complex technological problems that require creating and innovative thinking.
RA3. To be able to search for, collect and interpret relevant information and data to back up their conclusions including, whenever needed, the consideration of any social, scientific and ethical aspects relevant in their field of study.
RA6. To be aware of their own shortcomings and formative needs in their field of specialty, and to be able to plan and organize their own training with a high degree of independence.

OBJECTIVES

CB1. Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
CB2. Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues

CB4. Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
CB5. Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
CG2. Learn new methods and technologies from basic scientific and technical knowledge, and being able to adapt to new situations.
CG3. Solve problems with initiative, decision making, creativity, and communicate and transmit knowledge, skills and abilities, understanding the ethical, social and professional responsibility of the engineering activity. Capacity for leadership, innovation and entrepreneurial spirit.
CG5. Use the theoretical and practical knowledge acquired in the definition, approach and resolution of problems in the framework of the exercise of their profession.
CE10. Know and describe in a general way the structure of living beings at the molecular, cellular, tissue and systemic levels, as well as to analyze the limitations imposed by physical laws on the development of biological
CT1. Work in multidisciplinary and international teams as well as organize and plan work making the right decisions based on available information, gathering and interpreting relevant data to make judgments and critical thinking within the area of study.
RA1. To have acquired sufficient knowledge and proved a sufficiently deep comprehension of the basic principles, both theoretical and practical, and methodology of the more important fields in science and technology as to be able to work successfully in them;
RA2. To be able, using arguments, strategies and procedures developed by themselves, to apply their knowledge and abilities to the successful solution of complex technological problems that require creating and innovative thinking;
RA3. To be able to search for, collect and interpret relevant information and data to back up their conclusions including, whenever needed, the consideration of any social, scientific and ethical aspects relevant in their field of study;
RA6. To be aware of their own shortcomings and formative needs in their field of specialty, and to be able to plan and organize their own training with a high degree of independence.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Regulation of Gene Expression. From genes to proteins.
2. Biosignaling.
3. Regulation of the Cell Cycle
4. Oncogenes, Tumor Suppressor Genes, and Programmed Cell Death
5. Membrane Structure and Function. Channels and Transporters. Regulation of Membrane Transport of Proteins and Signaling Receptors.
6. The Cell Cytoskeleton. Cell Mechanics. Mechanotransductio
7. Molecular Machines, Motors, and Nanoscale Biophysics. Biophysics of molecular motors (cytoskeletal and non-cytoskeletal)
8. Energy Generation in Mitochondria and Chloroplasts
9 Principles of Tissue Organization

Laboratory practices:
1. Bacterial transformation and isolation of DNA plasmids
2. Human cell culture techniques

LEARNING ACTIVITIES AND METHODOLOGY

THEORETICAL-PRACTICAL CLASSES. They include the knowledge and concepts students must acquire. The students receive course notes (which include appropriate digital materials) as well as reference books. Master lectures will be in-site for all the students. Practical lectures will be for reduced groups and in-site.
TUTORING SESSIONS. Individualized attendance (individual tutoring) or in-group (group tutoring) for students requesting it.
STUDENT INDIVIDUAL WORK OR GROUP WORK.
LABORATORY PRACTICAL SESSIONS. Applied/experimental learning/teaching in workshops and laboratories in-site under the tutor's supervision.

ASSESSMENT SYSTEM

The evaluation method will consist on CONTINUOUS ASSESMENT (42,5%), a FINAL EXAM (42,5%) and a test on laboratory practices (15%).
Continuous assessment will consist on: 60 % Molecular Biology (2 exams and a work group) + 40% Cell Biology (1 exam and a work group).

% end-of-term-examination:	42
% of continuous assessment (assigments, laboratory, practicals…):	58

BASIC BIBLIOGRAPHY

- Bruce Alberts et al Essential Cell Biology, Ed. Garland Publishing, Inc. New York and London., 3rd edition
- Harvey Lodish et al Molecular Cell Biology, Ed. Freeman and Company, New York., 5th Edition
- J. Sambrook, E.F. Fritash and T. Maniatis Molecular Cloning: A laboratory Manual, Ed. Cold Spring Harbour Press., 3rd Edition
- Jennie P. Mather and David Barned Animal Cell Culture Methods, Ed. Associated Press..
- John D. Bancroft and Marilyn Gamble Theory and Practice of Histological Techniques, Elsevier, 5th edition

ADDITIONAL BIBLIOGRAPHY

- Abraham L. Kierszenbaum Histology and Cell Biology., Ed. Mosby Elsevier.
- Bruce Alberts et al Molecular Biolgy of the Cell, Garland Publishing, Inc. New York and London, 5th Edition
- James D. Watson et al Molecular Biology of the Gene, Cold Spring Harbour Laboratory (CSHL) Press. New York., 6th Edition
- Lizabeth A. Allison Fundamental Molecular Biology, Ed. Wiley-Balckwell.