Universidad Zaragoza

Academic Year/course: 2024/25

27141 - Bioorganic Chemistry

Syllabus Information

Academic year: 2024/25
Subject: 27141 - Bioorganic Chemistry
Faculty / School: 100 - Facultad de Ciencias
Degree: 446 - Degree in Biotechnology
ECTS: 6.0
Year: 4
Semester: First semester
Subject type: Optional
Module:

1. General information

The general objective of the subject is to teach the possibilities offered by the application of basic knowledge of organic chemistry in all its aspects for the study of biological processes at the molecular level within different fields (glycobiology, molecular biology, drug design, biocatalysis in organic synthesis, bioorthogonal chemistry, etc.). In the first part, , basic concepts of Organic Chemistry and Biochemistry will be studied, while the second part will deal with the use of Bioorganic Chemistry in drug synthesis, bioorthogonal chemistry and biocatalysis.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 () 2030 of the United Nations (https://www.un.org/sustainabledevelopment/es/), so that the acquisition of the learning results of the subject provides training and competence to contribute to some extent to their achievement: Goals 4, 9 and 12.

2. Learning results

In order to pass this subject, the students shall demonstrate they has acquired the following results:

1. Be able to describe the interaction of simple biomolecules (carbohydrates, nucleosides, and amino acids) with the biological systems at the molecular level.

2. Be able to analyse analogues of a given biomolecule to establish the viability of its potential biological activity through similarities in its structure and/or reactivity .

3. Be able to design a simple organic synthesis of biomolecule analogues such as glycomimetics, peptidomimetics and nucleoside analogues.

4. Be able to describe the main modes of action of complex structures of therapeutic interest

(oligonucleotides, peptides and oligosaccharides).

5. Be able to describe the mechanism of action of the various types of enzymes and the different types of cofactors and coenzymes involved in enzyme catalysis

6. Be able to propose synthesis methods and strategies to obtain potential improved drugs from a lead drug

7. Be able to describe the concept of bioorthogonality and the chemical reactions that are compatible with the biological components of a living being and that can take place in the presence or inside living cells.

3. Syllabus

Introduction. Reactions and mechanisms of organic chemistry in biological chemistry.**

Carbohydrates. Conformational analysis. Types of compounds. Glycosylation reactions. Glycobiology. Glycosyltransferases. Glycomimetics. Molecular recognition.**

Amino acids and nucleosides, nucleotides, and nucleic acids. Peptides and enzymes. Peptide coupling. DNA and RNA. Peptide nucleic acids. Antisense therapies.**

Biocomputation. Docking. Molecular dynamics. Hybrid QM/MM methods.**

New trends. Bioorthogonal chemistry. Enzyme modification.**

PRACTICE

Biocomputation: Docking studies of small organic molecules in proteins, localization of allosteric sites in enzymes, and molecular dynamics using Schrödinger and AMBER software packages.**

4. Academic activities

Explanatory and participative lessons (all students). Presentation of contents by the teaching staff, by external experts or by the students themselves, viewing of videos/discussions, etc..: 30 hours

Problem solving and case studies (all students). Practical exercises will be carried out; they will be interspersed with the

theoretical classes to promote learning: 15 hours

Computer practices (in small groups). Docking and/or molecular dynamics studies: 8 hours

Tutorial work (individual or group) and oral presentation: 4 hours (face-to-face), 22 hours (non-face-to-face). **Autonomous work** (student): 70 hours

Assessment tests. 1 hour

5. Assessment system

GLOBALASSESSMENTN is carried out according to the calendar of the Faculty of Sciences for the two official calls. However, prior deliveries (papers and practice reports) may be made. It will be essential to achieve a grade of at least 5 out of 10 in each of the assessment activities described below.

THEORY EXAM: multiple-choice questions, true or false, short development questions and exercises that will cover basic concepts of the subjects seen during the term.

WORK: written report (maximum length 10 pages) + presentation (maximum 15 minutes) and classroom discussion.

PRACTICES: report (maximum length 4 pages) of the two practical sessions.

The following will contribute to the final grade of the subject

Individual work: 30 %; Theory exam: 60%; Practice reports: 10%. Up to 0.5 additional points may be added to the final grade for active participation in theory classes and problems, in classroom discussions and in the presentation of assignments.

The detailed definition of the assessment system will be presented in the introduction of the subject