

60462 - Chemistry at the Frontiers of Biology

Syllabus Information

Academic year: 2024/25

Subject: 60462 - Chemistry at the Frontiers of Biology

Faculty / School: 100 - Facultad de Ciencias

Degree: 543 - Master's in Molecular Chemistry and Homogeneous Catalysis

ECTS: 2.0

Year: 1

Semester: Second semester

Subject type: Optional

Module:

1. General information

Chemistry at the Frontiers of Biology is a 2 ECTS optional course, which is taught in the second semester, and it is part of the module Horizons in Molecular Chemistry and Catalysis. The course aims to show the importance of applying chemistry principles to understand biological processes at molecular level and to the preparation of biologically active molecules. The study of the structure, chemical behaviour and function of natural products and compounds of biological interest will be addressed. In addition, the synthesis of simple biomolecules and their corresponding analogues will be covered, and the importance of structural modification for modulating biological activity will be highlighted. The course applies concepts of synthetic organic chemistry acquired in previous courses, such as, Strategies in Advanced Organic Synthesis, to the preparation of carbohydrates, amino acids, nucleosides and their analogues. In addition, it offers the students insight into the importance of metals in biomolecules (mainly as parts of enzymes) and the applicability of enzymatic catalysis for the preparation of biomolecules in enantiomerically pure form. The impact of this type of catalytic processes from the industrial point of view is shown. Throughout the course, those aspects that stand out for its novelty and current interest are addressed.

This course aims to provide knowledge about the main organic biomolecules involved in biological processes and about the importance of metals in biomolecules and enzymes, as well as to train the student in synthetic strategies that allow obtaining the main biomolecules and their structural analogues in enantiomerically pure form. On the other hand, it aims to provide an applied vision of enzymatic chemistry to organic synthesis, especially to the preparation of the main organic biomolecules.

2. Learning results

- To establish relationships between structure and chemical properties of natural products and biologically active compounds
- To understand changes in biological activity as consequences of structural changes
- To design organic synthesis of natural products and biologically active compounds
- To design non-natural analogues of biologically active compounds
- To understand the biochemical behaviour of the inorganic elements
- To know the biochemical activity of essential trace elements
- To solve problems and questions with critical thinking

3. Syllabus

The course will address the following topics:

Topic 1. Chemistry at the frontiers of biology. Biomolecules.

Topic 2. Metal-containing biomolecules. Metalloproteins.

Topic 3. Carbohydrate chemistry. Chemical glycobiology.

Topic 4. Amino acid and peptide chemistry. Non-natural amino acids. Applications.

Topic 5. Chemistry of nucleosides and nucleotides. Applications.

Topic 6. Asymmetric organic synthesis with enzymes.

4. Academic activities

The course includes the following learning tasks:

Participatory lectures.

Practical application exercises and seminars.

Supervised academic works.

Individual or small-group tutorials.

5. Assessment system

Continuous assessment of this subject is based on the following activities:

- 1.- Class participation, exercises and questions proposed by the teacher, and test on the content of the solved questions (30%).

2.-Oral presentation and group discussion of the contents of selected scientific papers (70%).

The students that have not passed the subject or wish to improve their score have the option to carry out a global test, that will represent 100% of the final student's grade. The overall test will consist of a written test based on theoretical and practical questions on the contents covered in the subject.

The number of official examination calls per registration and their use will be subjected to the statements of the Regulation of Permanence in Master Studies and the Regulation of the Learning Assessment (<http://www.unizar.es/ice/images/stories/calidad/Reglamento%20Evaluacion.pdf>) (<https://ciencias.unizar.es/normativas-asuntos-academicos>).

6. Sustainable Development Goals

- 3 - Good Health & Well-Being
- 4 - Quality Education