60462 - Chemistry at the Frontiers of Biology

Información del Plan Docente

Academic Year	2017/18
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

1.1.Introduction

The subject *Chemistry at the Frontiers of Biology* 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. On the other hand, the applicability of enzymes as catalysts for asymmetric synthetic transformations will be shown (in particular their use for the preparation of biomolecules in enantiomerically pure form). Throughout the course, those aspects that stand out for its novelty and current interest will be addressed.

1.2.Recommendations to take this course

It is highly desirable to have a degree in Chemistry, although the course is also suited to graduates from related disciplines. Attendance to lectures and continued work has a significant impact on performance**.**

1.3.Context and importance of this course in the degree

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 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 and technological point of view will be covered.

1.4.Activities and key dates

The information about schedules, calendars and exams is available at the websites of the Sciences Faculty, https://ciencias.unizar.es/calendario-y-horarios, the Master, http://masterqmch.unizar.es, and the platform Moodle at the University of Zaragoza, https://moodle2.unizar.es/add.

2.Learning goals

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2.1.Learning goals

To stablish 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

2.2.Importance of learning goals

The knowledge and understanding of the subject shall enable students to acquire expertise in the field of molecular chemistry and catalysis. Specifically, they will be able to understand biological processes at the molecular level and be aware of methods for the preparation of biologically active compounds of importance in enantiomerically pure form.

3.Aims of the course and competences

3.1.Aims of the course

To provide students with knowledge on the main organic biomolecules involved in biological processes and the importance of metals in biomolecules and enzymes.

To train students in the design of synthetic strategies for the preparation of biomolecules and its structural analogues in enantiomerically pure form.

To provide insight into the applicability of enzymes in organic synthesis (with focus on the preparation of the main biomolecules).

3.2.Competences

To be able to understand the biochemical behaviour of the main organic biomolecules and inorganic elements

Capacity to recognize the impact that structural changes in simple biomolecules play in their biological activity

To be able to design syntheses of analogues of biomolecules that mimic the activity of the natural substances

To be able to apply the knowledge of enzymatic catalysis to synthesis

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4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

Continuous assessment

This mode of assessment includes the following activities:

1.- Attendance and meaningful class participation (20 %).

2.- Tutorial work: written report that covers a topic related to the program of contents (40 %).

3.- Submission of summary reports of seminars dedicated to highlight outstanding synthetic and technological aspects related to the main biomolecules and their analogues (40 %).

Continuous assessment grade = (0.20 x grade attendance) + (0.40 x grade tutorial work) + (0.40 x grade seminars). Minimum mark threshold: 5 out of 10 points.

Summative assessment

Students who do not meet the minimum mark threshold during continuous assessment may pass the course in a summative assessment, which will take place according to the official final examination schedule of Universidad de Zaragoza. The summative assessment includes a written exam with questions on important content of the course.

Students have also the option to improve their final grade of continuous assessment in the summative assessment.

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) The latest document will also regulate the general design and scoring criteria of the assessment activities, as well as the exam schedules and timetable for the post-examination review.

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

The learning methods and strategies designed for the course are based on lectures, which should provide an interactive environment to discuss the course contents, and seminars that should reinforce some of the topics. Specifically, seminars are aimed at addressing contemporary developments in the fields of chemistry and biology.

On the other hand, students will undertake a formative written assignment that will require a specialized literature search to choose a current topic in order to reinforce or extend the course contents.

5.2.Learning tasks

The course includes the following learning tasks:

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- Lectures (1.5 ECTS).
- Seminars (0.5 ECTS).
- Written assignment.

5.3.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.

5.4.Course planning and calendar

Further information concerning the timetable, classroom, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Faculty of Science website https://ciencias.unizar.es/.

Submission dates of assignments and summaries will be announced in advance on the Moodle's course page.

Course materials and readings will be available on the website for the course on Moodle: https://moodle2.unizar.es/add.

5.5.Bibliography and recommended resources

BB Asymmetric organic synthesis with enzymes / edited by Vicente Gotor, Ignacio Alfonso, and Eduardo García- Urdiales Weinheim**:** Wiley-VCH, cop. 2008

BB Blackburn, G. M. [et al.]. Nucleic acids in chemistry and biology. 3rd. ed. Royal Society of Chemistry. 2006

BB Kaim, Wolfgang. Bioinorganic chemistry**:** inorganic elements in the chemistry of life**:** an introduction and guide / Wolfgang Kaim, Brigitte Schwederski, Axel Klein. - 2nd ed. Chichester [etc.]**:** Wiley, 2013

BB Lindhorst, T. K**.** Essentials of Carbohydrate Chemistry and Biochemistry. 3rd. ed. Wiley-VCH. 2007

BB Sewald, N.; Jakubke, H.-D**.** Peptides: Chemistry and Biology. 2nd. ed. Wiley-VCH. 2009

BC Chemical synthesis of nucleoside analogues / edited by Pedro Merino Hoboken, N.J.**:** Wiley, c2013

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BC Fraser-Reid, B. O. [et al] Eds**.** Glycoscience. 2nd. ed. Springer. 2008

BC Introducción a la química bioinorgánica / María Vallet (coord.)**;** Juan Faus, Enrique García-España, José Moratal Madrid**:** Síntesis, D.L. 2003

BC Química bioinorgánica / Coordinador, José Sergio Casas Fernández**;** autores, José Sergio Casas Fernández**.**.[et al.] Madrid**:** Síntesis, D.L. 2002

BC Vranken, D. van; Weiss, G**.** Introduction to Bioorganic Chemistry and Chemical Biology. Garland Science, Taylor& Francis Group, 2013