

ASIGNATURA: ENZYMOLOGY AND PROTEIN CHEMISTRY

ESTUDIOS: INGENIERÍA QUÍMICA (ciclo 2º)

CÓDIGO:

TIPO: LC	CURSO:	CUATRIMESTRE:
CRÉDITOS (horas/semana): 4,5		
CRÉDITOS ECTS: 3,5		
PROFESOR: Dr. Antoni Planas Sauter		
IDIOMA: Inglés		

PREREQUISITOS: Biochemistry, Chemical kinetics, Organic Chemistry, Advanced Analytical Chemistry.

CONOCIMIENTOS PREVIOS: Cell Biology, Metabolism, Basic Enzymology, Separation techniques (chromatography, electrophoresis). Spectroscopic techniques.

ASIGNATURAS QUE SE HAN DE CURSAR SIMULTANEAMENTE:

DESCRIPCIÓN ASIGNATURA:

Advanced course on protein structure and function, with special emphasis on research methodologies in protein chemistry and protein engineering. The course starts with a detailed overview of protein biosynthesis in eukaryotic cells (transcription + translation) as well as protein trafficking and post-translational modifications. Then the main core of the course involves protein chemistry methodologies, enzyme mechanisms, protein engineering, and the use of enzymes in biotransformations.

Students are requested to prepare and give a 20-minutes seminar about the structure, function, and mechanism of a selected enzyme, including the key experiments that supports the accepted mechanism.

OBJETIVOS ASIGNATURA¹:

1. To provide general knowledge on protein structure and function, as well as the experimental techniques in protein chemistry and protein engineering [2].
2. To develop the ability of identifying the experimental techniques required to solve specific problems related to proteins and enzyme functions [3].
3. To train students in the evaluation of the consequences of biochemical and biological tools in their professional activities [5 and 7].

TEMARIO:

Chap. 1.- Protein biosynthesis: from gene to functional protein

Structure of prokaryotic and eukaryotic genes

Molecular biology of DNA: replication, transcription, and translation

Regulation of transcription.

Mechanism of translation: tRNA and ribosomes.

Chap. 2.- Post-translational modifications of proteins

Endoplasmatic reticulum.

¹ Los n^{os} en corchetes hacen referencia a los *outcomes*

Topogenesis and protein trafficking
Post-translational modifications.

Chap. 3.- Chemical modification of proteins

Identification of functional residues
Reactivity and selectivity
Reagents for chemical modification of selected functional groups

Chap. 4.- Proteolysis. Peptidic maps

Limited proteolysis: chemical and enzymatic
Proteolytic enzymes classified by specificity.
Reaction conditions
Separation and peptide analysis
Sequencing

Chap. 5.- Techniques in protein analysis

Gel electrophoresis
Mass spectrometry
Introduction to proteomics

Chap. 6.- Enzyme mechanisms:

Mechanistic enzymology
Effects of pH and temperature. Kinetic isotope effects,
isotopic labeling, stereospecificity
Case study: selected enzymes (1 per student)

Chap. 7.- Introduction to protein engineering

Cloning and expression of proteins
The Polymerase Chain Reaction (PCR)
Directed mutagenesis
Application in biotechnology

Chap. 8.- Enzymes in synthetic organic chemistry

Advantages and drawbacks of the use of enzymes:
stability, solubility, specificity
Immobilized enzymes
Enzymes in organic solvents

PRÁCTICAS DE LABORATORIO: No.

METODOLOGÍA:

As an advanced course, supplementary information is provided to the student on specific subjects in order to get further insights in research topics. All teaching material is delivered through the website of the course, which contains the presentations used by the professor in class. This course is lectured in English since the academic year 2003-04, and all basic and supplementary material is delivered in English language.

The introduction and the main aspects of each chapter are lectured by the professor, but the student has to complete each topic with additional readings.

Students are requested to prepare and give a 20-minutes seminar about the structure, function, and mechanism of a selected enzyme, including the key experiments that supports the accepted mechanism. Selected enzymes (one per student) cover the spectrum of different enzyme families and mechanisms. This homework together with the presentation in class is

addressed to train the student in literature searching and to develop the ability to communicate in a public presentation the key experiments that have led to the currently accepted enzyme mechanism.

The technologies presented in class are illustrated with practical examples in applied fields including pharmaceuticals, food industry, and biotechnology.

EVALUACIÓN:

A. Exams

J. In class participation

M. Otros: Give a public seminar

Exam: 2-hours final exam at the end of the course (80% final score)

Participation in class: active participation can add 0.5 points to the final score (based on 10 points)

Seminar: The seminar about the enzyme assigned to each student contributes 20% to the final score.

CRITERIOS DE EVALUACIÓN DE RESULTADOS²:

Objetivo 1:

- The student should demonstrate his/her knowledge about structure/function of proteins and enzymes [A].

Objetivo 2:

- The student should demonstrate his/her ability to select the proper experimental methodologies to solve specific problems in protein science [A y M].

Objetivo 3:

- The student should demonstrate his/her capacity to evaluate the consequences of the use of biological tools when addressing specific problems in his/her professional activity [J]

BIBLIOGRAFÍA BÁSICA:

- Bioquímica, Mathews, Van Holde, Ahern, 3ª Edición, Addison Wesley, 2002
- Proteins. Structure and Molecular Properties, Creighton, Proteins. W.H. Freeman and Company, 1993
- Estructura y mecanismo de los enzimas, Alan Fersht, Reverté

BIBLIOGRAFÍA o MATERIAL COMPLEMENTARIO:

- Enzyme mechanisms, by Christopher Walsh
- Research papers

PREPARADO POR: Dr. Antoni Planas Sauter (April 2005)

² Las letras en corchetes hacen referencia a la forma de evaluación