Universitat Autònoma de Barcelona

2017/2018

Protein Engineering

Code: 102521
ECTS Credits: 6

Degree	Type	Year	Semester
2502444 Chemistry	OT	4	0

Contact

Name: Francesc Xavier Avilés Puigvert
Email: FrancescXavier.Aviles@uab.cat

Use of languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Teachers

David Reverter Cendrós

Prerequisites

There are no previous formal requirements, but it is assumed that the student acquired beforehand solid knowledge on the subjects of the three first courses, particularly on the subjects Fundamentals of Molecular and Cellular Biology of the 1st course and Biochemistry of the 3rd course,

As in other subjects, most of the bibliography is in english, language that is also used in an important way in the presentations displayed at the classes and other activities. The use of this language by the students in the supervised activities (Problems and Practical classes, Seminars ....etc), will be positively evaluated.

Objectives and Contextualisation

General goals. This subject will deal with the structural and functional characteristics as well as with the reactivity/interaction of amino acids, peptides and proteins. Also, on how they have evolved biologically and how they can be transformed by rational redesign, directed evolution or chemo-biological modifications at the laboratory in order they adopt structures, superstructures and properties of fundamental and applied interest. Proteins are structural molecules, regulatory and effectors in most biochemical and biological processes, natural/ pathological/ of industrial interest, as well as frequent protagonists, and among the most diverse among them. The knowledge on their properties and strategies to transform them is fundamental for the deep understanding of a significant number of subjects within the degree of Chemistry.

Specific goals.

- Get a deep knowledge of the physico-chemical characteristics of amino acids, peptides and proteins, as well as of their reactivity and modifications.
- Describe and apply the methodologies for the analysis of the sequence of proteins and the synthesis of peptides.
- Recognize the structural elements, the different levels of complexity, the types of folding for proteins and their capability in the formation of higher order structures..
- To know how to consult and get access to the information sources to analyze and classify proteins structurally.

- To know and be able to describe and apply the most used methods for the analysis of the conformation and stability of proteins, including the three-dimensional analysis.
- Describe the molecular basis of the folding of proteins, of its molecular dynamics, post-translational modification, intra- and extra- cellular transit.
- To know how to establish the evolutionary relationships among proteins, and know the methods for the structural analysis and prediction.
- Understand and know how to apply the most usual methodologies for the production and purification of recombinant proteins.
- To know how to select the best strategies for the modification and optimization of the properties of peptides and proteins. Understand the basis for its design, for the construction of mini-, super-structures and mimetics, and the methodologies used in such processes. Also, to know about approaches that have been valid to form nanostructures and nanoprobes with them.
- Get an overall view of the structure-function relationships in proteins, and about the applications of such biomolecules in medicine, industry and research.
- Integrate the acquired theoretical knowledge to interpret the results of scientific experiments and to solve experimental problems, using the proper scientific terminology.

Content

List of topics of theory proposed for the subject PROTEIN CHEMISTRY AND ENGINEERING

I. Fundamental properties of amino acids and proteins (A).

II. The peptide bond and the polypeptidic sequence (A).

III. Structural determinants. Secondary structures (A).

IV. Structural classification of proteins (A).

V. Structure-function correlations in proteins. Examples (A).

VI. Protein quaternary structure (A).

VII. Determination of the three-dimensional structure of proteins (B).

VIII. Protein folding and conformational dynamics (B).

IX. Post-translational processes and modifications (B).

X. Protein-ligand interactions (C).

XI. Biochemical evolution of proteins. (C)

XII. Protein engineering: heterologous production (B).

XIII. Protein engineering: redesign and de novo synthesis (B).

Important notice for the Program of theory and contents: depending of the time availability for other formative tasks besides theory classes, such as problems, seminars and practical cases, sections I to VI of the Program (marked with A) might be done in a quicker and lighter way than those VII to XIII (marked with B) because of considering the former as a revision to be acquired beforehand. Also, and depending of the degree of advancement along the Program in the course, sections X and XI (marked with C) might be left aside or given in a lighter way.