

Springer Series  
in Biophysics 10

José Luis R. Arrondo  
Alicia Alonso (Eds.)

# Advanced Techniques in Biophysics

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With 93 Figures, 17 in Color and 2 Tables



Springer

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## Preface

The present book of the Springer Series in Biophysics deals with some techniques that are being implemented nowadays. One of the motors that have driven the biosciences, like daily life, has been the technological boost produced by the advancement of microprocessor technology. A whole array of possibilities have been opened to develop the classical techniques that were used some years ago.

Abrahams and coworkers contribute with a chapter on protein nanocrystallography which deals with obtaining protein crystals in small, confined volumes, trying to overcome one of the setbacks in crystallography, the amount of material needed to obtain good samples for diffraction. This chapter is followed by one by Ibarra-Molero and Sanchez-Ruiz reviewing the recent advances of differential scanning calorimetry in the field of protein energetics and also in the energetic analysis of other biological systems. The following two chapters look at recent advances of IR spectroscopy. IR reflection-absorption spectroscopy (IRRAS) looks at the air-water interface of membranes and in the chapter by Mendelsohn and coworkers the general basis as well as the application to lipids and peptides or proteins are reviewed. Arrondo and coworkers address the analysis of IR spectra by a new approach called two-dimensional generalized spectroscopy, where information on protein changes after a perturbation is analysed by synchronous or asynchronous maps. This approach, essentially different from that of 2D-NMR spectroscopy, uses correlation analysis of the dynamic fluctuations caused by an external perturbation to enhance spectral resolution.

Three chapters are devoted to different technical developments of NMR. Szypersky deals with the principles of ultrafast NMR spectroscopy through the use of G-matrix Fourier transform (GFT) NMR as a technique for rapid sampling of multidimensional NMR data. Freeman and Kup e approach the problem of fast multidimensional NMR by outlining two radical new approaches, one using spatially encoded single-scan multidimensional NMR and the other using projection-reconstruction of multidimensional spectra. Size is one of the problems that NMR has to face in the study of proteins, Fernández and Wider analyse the use of transverse relaxation-optimized spectroscopy (TROSY) in combination with isotope-labelling techniques to extend applications of NMR spectroscopy in solution to much larger molecules, such as integral membrane proteins in detergent micelles, large proteins in monomeric form and in macromolecular complexes, and intermolecular interactions in large complexes.

Carrión-Vázquez and coworkers have addressed protein nanomechanics, a new multidisciplinary area of research to directly measure mechanical forces in single molecules, by applying atomic force microscopy (AFM). Large unilamellar

vesicles are the subject of the chapter by Bagatolli, who reviews the use of two-photon fluorescence microscopy in studying the lateral structure of compositionally simple vesicles and more complicated membranes. San Martín and Valle look at the three-dimensional organization and structural features of macromolecular assemblies, knowledge of which is indispensable for understanding their functions, by using three-dimensional electron microscopy.

This book constitutes a privileged observatory for reviewing novel applications of biophysical techniques that can help the reader utilize the efforts of the scientists contributing to the volume to enter an area where the technology is progressing quickly and where a comprehensive explanation is not always to be found.

Bilbao, June 2006

José Luis R. Arrondo  
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