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EDITORIAL

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Introduction

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Analytical ultracentrifugation (AUC) is a unique and important technique for the characterization of macromolecular assemblies and interactions. The commercialization of modern instrumentation combined with the improvement in data acquisition and analysis, including hydrodynamic modeling, allow biological or synthetic systems of increasing complexity to be described. It leads to the reliable characterization of non-interacting macromolecules in solution, and in certain cases of interacting ones over the entire range of molar masses, especially particle sizes in the colloidal range. The community of scientists involved in the methodological development of the technique, and/or in its use, is increasing. The scientific dynamism in this rapidly expanding field explains the strong need for scientific exchange of information, and motivated the organization of Advances in Analytical Ultracentrifugation and Hydrodynamics 2002.

The conference was organized in Autrans, France, from 6 to 11 June 2002. It consisted of a High-level Euroconference: ''Advances in Analytical Ultracentrifugation and Hydrodynamics: Macromolecular Solution Structure and Interactions in Biological and Synthetic Systems'' and a lecture and practical course: ''Advances in Analytical Ultracentrifugation and Hydrodynamics: Data Analysis and Modeling''. The major goal of the conference and course was to increase knowledge on AUC and hydrodynamics and promote their best uses, by establishing fruitful exchanges of ideas and contacts between biologists, chemists and physicists, not yet specialized users and developers of the technique, young and senior scientists from academic institutions or industries. The events attracted 100 scientists, with a wide range of ages and experiences, of 23 nationalities, including 11 European ones. Industry was represented (7 companies) and the fields of biological and colloid/polymer applications were covered (80% and 20%, respectively, of the participants).

This special issue of the *European Biophysics Journal* illustrates the diversity of the topics. The thermodynamic bases of AUC are emphasized in the context of the interactions of biological macromolecules with solvent (Eisenberg) and phase separation of Ca-alginate gels (Straatman and Borchard). The very elegant study of the compositional variation in vertebrate genomes demonstrates the precision of AUC (Clay et al.). Examples of the possibilities of data analysis are given in the study, by equilibrium sedimentation, of homologous and heterogeneous interactions of proteins and nucleic acids (Behlke and Ristau). AUC is used in combination with other hydrodynamic techniques to characterize the stoichiometry and dimensions of complex systems that are heterogeneous in composition and/or size, as in either the study of ferritin, which compares sedimentation coefficients and hydrodynamic radius distributions (Cölfen and Völkel), or that of polysaccharides: heparin, mainly based on the concentration dependency of hydrodynamic properties (Pavlov et al.), hyaluronic acid (Hopkutsa et al.) and chitosans (Fee et al.). The study of nematode fatty acid binding proteins, which reports their protein–protein self-interactions and predicts their shape based on low-resolution modeling, shows the combined potency of AUC and small-angle X-ray scattering in the absence of high-resolution structures (Solovyova et al.). The strong interest in macromolecule conformation modeling is highlighted in the presentations of the calculation of solution properties of flexible macromolecules (García de la Torre et al.) and of the consideration of protein hydration in front of high-resolution information (Durchschlag and Zipper). ''Crystallohydrodynamics'' uses the information of crystallography for estimation of the domain orientation of antibodies (Longman et al.). Finally, the validity of these approaches is examined in a detailed analysis of the errors in the prediction and measurements of the translational frictions (Errington and Rowe).

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