PREFACE

EDITORIAL

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The editors and the staff of Biointer*phases* are proud to present Volume 3 of our journal to the community in Biointerface and Biomaterial Science. It contains the first four In Focus sections, which document the following active and growing research topics: Solid Supported Membranes (Editor: Wolfgang Knoll), Synchrotron Radiation and Neutrons in Biointerface Science (Editors: Peter Fratzl and Michael Grunze), Structure and Properties of Soft Organic-Aqueous Interfaces (Editors: Alexander Pertsin and Michael Grunze), and Surface Plasmon Resonance-Plasmonics (Editor: Bo Liedberg). These special sections contain the state-of-the-art in experiment and theory, summarized by the leading experts in the respective fields to give the interested reader a comprehensive overview and reference list.

Solid supported membranes complement the set of platforms traditionally used for biophysical and interfacial studies of lipid bilayers and lipid/protein composites, such as Langmuir films, bulk vesicle (liposomal) dispersions, or bimolecular lipid membrane (BLMs). As described in this In Focus section, solid supported membranes, such as tethered bimolecular lipid membranes (tBLMs), suspended bilayers, and tethered vesicle systems offer the possibility of very detailed biophysical studies of membrane structure, order and dynamics, and the correlation of these parameters with the function of incorporated (or surface-associated) proteins or protein aggregates.

Synchrotron radiation and neutrons are essential tools to elucidate the relations between function, structure and dynamics in biological materials. Large-scale facilities provide the infrastructure and instruments that can be used to unravel the synthesis, adaptation and healing strategies used by Nature to build, maintain, and repair very complex materials. All materials used by Nature are hierarchical in their structure over many length scales; they are nanostructured and contain multiple interfaces and interphases between the nanosize building blocks, such as proteins, filaments, membranes, or mineral particles. These nanostructures fulfill multiple functions and are assembled into larger assemblies. The design principles of Nature are an essential input and inspiration for engineered artificial multifunctional and adaptive materials. As demonstrated in this In Focus section, synchrotron radiation and neutrons complement laboratory-based analytical techniques. They probe materials over many length scales, and thus help to correlate the properties of nanostructures with the structure and function of mesoscopic and macroscopic assemblies.

Understanding the structure and properties of soft organic-aqueous interfaces is an active and controversial research area. But the discussions are essential to derive quantitative molecular descriptions of basically all biointerphase phenomena. Many experimental techniques are employed to study aqueous interphases, but despite substantial progress in improving sensitivity and selectivity, their abilities in revealing the detailed molecular organization of soft organic-aqueous interfaces are rather limited. More important, then, are computer simulations, which provide a molecular-level description of the interfaces, but are based on various simplifying assumptions. This In Focus section of Biointerphases contains representative articles which explain to the nonexpert reader the basic problems involved in experimental and computational studies of soft organic-aqueous interfaces.

The In Focus section on surface plasmon resonance gives a historical perspective of the first biosensors and a description of the most recent developments in the field. Topics discussed include SPR-microscopy or imaging surface plasmon resonance (iSPR) with a spatial resolution on the micrometer length scale. SPR has also been successfully combined with other surface analytical techniques for multiparameter characterization of surfaces and sensing. Surface plasmon fluorescence spectroscopy (SPFS) for label-free monitoring of binding events allows sub-fM concentrations of the target molecules to be detected. More recently, the research focus in SPR has been in localized surface plasmon resonance (LSPR), which is sensitive to nanoparticles and surface nanostructures. In this In Focus section, the sensitivity and figure of merit of LSPR in nanoparticles and nanoholes is compared with traditional SPR. However, there are still problems to be solved before SPR and its derivatives become a routine and general detection method for complex solutions of biomolecules. Nonspecific binding of proteins to surfaces and the limited shelf life of protein biochips are examples of problems that need to be solved.

We hope that readers will not only find the In Focus sections of Volume 3 useful for learning about important developments in the field, but will also be inspired by the regular articles published in Biointer*phases* over the last year. Any comments or letters to the editor addressing general or specific aspects of the content of Biointer*phases* are welcome, and will help to develop the journal further as a communication platform for the community. We will continue to publish In Focus sections, so subscribe to the RSS feed of Biointer*phases* and check out our webpage to learn about the most recent advances in Biointerphase Science.