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EDITORIAL

Editorial

Dear Reader of Biointer*phases*,

Volume 7 is completed, and it is the first volume of Biointer*phases* published by SpringerOpen. The printed version contains the papers from the "In Focus" issues "Nanomedicine" and "Future of Biosensors", and several contributions which demonstrate the continuous progress being made to quantitatively understand the phenomena we encounter in our laboratories, such as the complex interphase between cells and artificial surfaces. The "Nanomedicine" In Focus issue, edited by Benjamin Thierry and Marcus Textor, contains 15 articles covering the present research in the field. In their editorial "Nanomedicine *In Focus*: opportunities and challenges ahead" (*Biointerphases*, *2012*, *Volume 7*, *Numbers 1–4*, *19*) Benjamin Thierry and Marcus Textor summarize the present state-of-the art and give an outlook on the development in the field.

The "Future of Biosensors" In Focus issue contains five contributions. In the paper by Schirwitz et al., "Sensing immune responses with customized peptide microarrays," a new laser printing technology to produce peptide microarrays—which can contain up to 775 peptide spots—is described. The position of each peptide spot, and thus the amino acid sequence of the corresponding peptide, is exactly known. Compared to other techniques, more features per cm^2 can be synthesized at lower costs, demonstrating that laser printed peptide microarrays are efficient and affordable biomedical sensors. An overview and review on "Information visualization to enhance sensitivity and selectivity in biosensing" is presented by Oliveira et al. Traditional techniques are first discussed, including the advantages and limitations of linear and non-linear methods to generate visualizations that emphasize similarity/dissimilarity relationships among data; this is followed by a description of recent methods that allow the processing of high-dimensional data, such as is encountered in electronic noses and tongues. These are made of sensor arrays whose electrical or electrochemical responses are combined to provide "finger print" information for aromas and tastes. An outlook is given for the detection of tropical diseases using multidimensional projection techniques. Xian Huang and coworkers present the design and use of "epidermal electronics". An ultrathin and stretchable sensor system capable of conformal lamination onto the skin is used for the measurement and spatial mapping of levels of hydration. The sensor contains miniaturized arrays of impedance-measurement electrodes arranged in a differential configuration to compensate for background effects. Experimental results obtained with different frequencies and sensor geometries demonstrate excellent precision and accuracy and its potential use in skin care and athletic monitoring. The possibility of deducing surface properties relevant for marine fouling protection from the exploration behavior of marine organisms is reviewed in the article "Surface sensing and settlement strategies of marine biofouling organisms" by Rosenhahn and Sendra. They show that the swimming behaviour of motile spores reveals if the surface is attractive for settlement or not, providing a fast screening method for anti-fouling coatings.

ToF–SIMS (time-of-flight secondary ion mass spectrometry) has become a powerful method in biointerface analysis through the use of multivariate analysis (MVA) methods in the processing of data. Graham et al. reviewed how MVA can aid the user in processing data from complex, multicomponent surfaces of biomaterials and in biosensors. In their article "Multivariate analysis of ToF–SIMS data from multicomponent systems: the why, when, and how", they explain how MVA can help the user identify differences within a sample or between samples, and spatially resolve where certain compounds exist on a sample. The method specifically discussed here is principal component analysis (PCA). Guidelines for the application of PCA (and other MVA methods) to multicomponent ToF–SIMS data are given.

Volume 7 contains a total of 68 perspectives, research papers and reviews. A very relevant and timely discussion on “The new (challenging) role of academia in biomaterial translational research and medical device development”—addressing the issues encountered by an academic researcher working on biomedical devices—was published by Kleinbeck et al. Those interested in the “structure” of water at interfaces should read the perspective “No ice-like water at aqueous biological interfaces” by Mischa Bonn and coworkers, in which they show that the vibrational spectrum of water at both water–lipid and water–protein interfaces is *inconsistent* with the presence of “ice-like” structures.

It would be beyond the scope of this editorial to mention or summarize all the articles in Volume 7, so let me only highlight some papers which demonstrate the breadth of our journal. The majority of articles are original research articles which study cell adhesion, proliferation and tissue formation on micro-topographic or nanostructured surfaces, with the aim to understand the synergy between surface composition, topography and cell behavior or specific transmembrane proteins and focal adhesions. This volume also contains several reports of the behavior of cells on topographically controlled or functionalized TiO_2 surfaces with implications for implants. Interesting is a report on carbon dioxide gating in silk cocoons: the cocoon membrane is asymmetric, so it allows preferential gating of CO_2 from inside to outside and regulates a physiological temperature inside the cocoon irrespective of the surrounding environment temperature.

Articles which introduce new quantitative techniques or methods to study biointerphases are of particular importance, since they may help members of the community to improve their experiments. In this volume there are descriptions of new 4D optical techniques (holography and stereo-microscopy) to track micro-organisms in marine environments, the measurement of adhesion strengths of cells and bacteria with a programmable microfluidic shear flow system, the use of PNIPAAm brushes for quantitative cell detachment studies, and the measurement of cytoskeletal rearrangements in real-time by QCM-D. An important development with relevance for clinical work is the paper by Nick et al., “Three-dimensional carbon nanotube electrodes for extracellular recording of cardiac myocytes”, where they can show that the transducer properties of the carbon nanotube electrodes are superior to conventional gold and titanium nitride electrodes. Two further papers present new ways of photo- and laser patterning of surfaces.

Last but not least, Biointer*phases* publishes papers on theoretical aspects of biointerphases and simulations. Important are the contributions of Collier et al., who compare empirical protein force fields for the simulation of the adsorption behavior of structured LK peptides on functionalized surfaces, and Snyder et al., who develop improved interfacial force field parameters set for the simulation of protein adsorption to silica glass. Simulations, which await confirmation by experiments, are reported by Pertsin and coworker. They calculated the adhesion energy between phospholipid bilayers and functional self-assembled monolayers in aqueous media.

Enjoy reading Volume 7 of Biointer*phases*, and I hope that Volume 8 will contain one of your papers!
Michael Grunze