Regional Biophysics Conference - RBC2016

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The Regional Biophysics Conference is an International Workshop series involving several countries from the central European region, comprising Austria, Hungary, Italy and Slovakia as well as the Balkan countries from the former Yugoslav Federation. The seventh such meeting was organized in Trieste (Italy) by the Italian Society for Pure and Applied Biophysics (SIBPA) in collaboration with the CNR Institute of Biophysics and the Department of Life Sciences at the University of Trieste. It was held at the 'Ospedale Militare', a historical and recently-refurbished residential and congress centre of the University of Trieste.

Based on accumulated past experience, as summarized by Andjus (2012), the meeting included seven sessions on various frontier areas of Biophysics, covering (1) molecular and cell biophysics, (2) supramolecular assemblies and aggregation, (3) synthetic biology and integrative biophysics and complex systems, (4) nanoclustering of membranes and membrane proteins, (5) biophysical medicine and neuroscience, (6) material science and nanobiophysics, and (7) emerging methods in biophysics (e.g. live imaging and nanoscopies). The contributions to this special issue, loosely deriving from talks given at the Conference, are therefore wide-ranging and cover theoretical and experimental biophysical approaches, leading also to more applied topics.

A first group of papers deal with changes in cell shape—Macková et al. (2017) use confocal microscopy and electrophysiological techniques to characterize postnatal development of the cellular system devoted to excitation–contraction coupling machinery. A knowledge of the changes occurring over time for these cellular calcium signaling mechanisms is pivotal to our understanding how cardiac contraction is regulated.

In their contribution, Mesarec et al. (2017) investigate the reshaping of cell form and changes in the mechanical properties of cells. In particular, these authors present a theoretical study of the role of anisotropic membrane components in the stability of membrane tubular structures generated or stabilized by actin filaments.

Radotić et al. (2017) present a study of the influence of micro-patterned solid surfaces on neurite vectorial growth, making use of Fast Fourier Transform analyses of isotropic substrates to investigate neurite alignment and orientation. The main goal of these studies is to promote the development of optimal microelectrode arrays for directing neurite growth.

The following group of papers deals with the biophysics of biomolecular interactions and effects of nanomaterials. It is well established that anion–π interactions are an important, if as yet not well-understood, binding mode for biomolecules. They have in fact been suggested to stabilize the structure of nucleic acids and proteins and to contribute to protein-DNA and enzyme–substrate recognition. In his review article, Jiří Kozelka (2017) summarizes what is known, and has been recently published, about the occurrence, function, and physical origin of biologically relevant lone pair-π interactions.

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Saša Svetina (2017) presents a possible correlation between cell-to-cell variability and vesicle self-reproduction, by summarizing his scientific contributions to this field of synthetic biology, spanning some decades.

Nanoparticles stabilized by patterned surface monolayers are an emerging category of nanomaterial with great potential, for example in nanomedicine. An up-to date review paper by Pengo et al. (2017) concentrates on patterned gold nanoparticles, describing characterization protocols, both experimental and computational, and the interactions of these nanomaterials with biological systems. Future challenges for studying nanoparticle behavior in biological environments are extensively discussed.

Albumin is the most abundant plasma protein, and is involved in fatty acid and drug binding. A better understanding of the subtle structural changes occurring in albumin after binding specific ligands is therefore essential for pharmacological applications. The paper by Mojović et al. (2017) reports on a labeling strategy that has been successfully used to evaluate binding position and albumin structural variations by using an EPR approach.

The complexity of the interaction between macromolecules is emphasized in the paper by Eva Žerovnik (2017), where she describes the interactions between cystatins and crystallins, where an amyloidogenic molecule may act as a chaperone for another amyloidogenic molecule to prevent its self-association and aggregation.

Nguyen and Greinacher (2017) propose to use the unbinding force between molecular partners to discriminate between pathogenic and non-pathogenic antibodies. The effects of pH and salt concentration on the binding strength were a particular focus.

Another two papers study extracellular vesicles, and in particular exosomes. Potrich et al. (2017) propose the extracellular system as a new communication route among cells. They used microRNA as specific indicators for information transfer. Parisse et al. (2017) provide a critical analyses of AFM imaging techniques used for studying extracellular vesicles deposited and immobilized on different substrates.

Finally, the review by Zavadlav et al. (2017) summarizes recent results on hybrid atomistic-mesoscopic solvent models for multiscale biomolecular simulations. In particular they focus on many applications of a particular adaptive resolution scheme particularly effective to simulate complex biomolecular systems.

The papers in this issue showcase an excellent series of talks, sampling those presented at the RBC2016 meeting. The combination of multiple methods to analyse biophysical approaches at very different scales highlights the impact of biophysics as an approach in improved science and engineering.

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