Editorial

Biophysical Journal Special Issue: Focus on Quantitative Cell Biology

Biophysics has thrived by applying reductionist approaches to unravel biological mechanisms, and to this day, such approaches continue to bring fresh insights into the functions of cells and organisms. X-ray crystallography, molecular dynamics simulations, single molecule microscopy, and single channel recordings are but a few of the powerful and varied biophysical techniques widely used in today's biomedical research labs to elucidate the structure and functions of biomolecules. Of course, we also know that biomolecules do not function on their own, but work instead through complex interactive networks within cells. These networks produce emergent properties that are difficult to predict solely from an understanding of the constituent parts. For this reason, we have witnessed rapid growth of quantitative cell biology research, often leveraging the superb spatiotemporal resolution available from light microscopy and fluorescent probe techniques. At the same time, we are learning that cell-to-cell variability is not only universal, it is also functionally important. Thus, in the same ways that single molecule experiments have informed our understanding of functional distributions of molecules, single cell experiments are revealing the significant biological consequences of heterogeneity.

The major goals of Quantitative Cell Biology are to further our understanding of the interactions between molecules within cells, elucidate how these interactions are regulated, and recognize the functional consequences of these interactions. Understanding such mechanisms and interactions at the cellular and multicellular level is facilitated by the multidisciplinary approaches that have always formed the backbone of biophysics. This special issue of the *Biophysical Journal* focusing on Quantitative Cell Biology highlights a broad range of biophysical approaches applied to mechanistic questions in cell biology. Three reviews cover the state-of-the-art in cell adhesion and spreading, noise analysis for establishing causation in cellular signaling, and the need for precise quantitative measurements in understanding complex cellular events. Original research articles describe the use of advanced instrumentation and computational modeling to improve our understanding of phenomena such as cell motility, membrane protein dynamics and signaling, intracellular forces, and cell-cell interactions. Of course, development of novel instrumentation is another hallmark of biophysics, and this issue also presents a new scanning x-ray nanodiffraction method. Finally, this issue inaugurates a new feature in the *Biophysical Journal* called Computational Tools—short descriptions of new open software or database resources that are available to the research community. It is clear from the breadth and depth of this snapshot that biophysical approaches are making a big impact on our understanding of cell biology.

As the Associate Editor for the Cell Biophysics Section of the *Biophysical Journal*, it has been exciting for me to witness the progress of this multidisciplinary field and to appreciate the strength of the research we publish twice a month. Indeed, it is the strength of the regular Cell Biophysics section that prompted us to celebrate the field with this special issue—the first special issue ever published by the *Biophysical Journal*. As multidisciplinary teams continue to form and bring new physics- and engineering-based approaches to bear on longstanding problems, we can expect that the impact of these approaches will continue to grow. It is clearly an exciting time in cell biology research, and I hope our readers enjoy this special issue as much as we have enjoyed putting it together.

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