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Introduction

This proceedings volume is from the Optical Elastography and Tissue Biomechanics VI conference held Saturday-Sunday, 2–3 February 2019, at SPIE BIOS, Photonics West, in San Francisco, California. Optical elastography can be broadly defined as the use of optics to probe and exploit the mechanical properties of cells and tissues including their ability to apply forces on the surrounding environment, as well as respond to forces of the surrounding microenvironment. The development of advanced optical techniques fits the larger context of tissue biomechanics studies where non-optical elastography techniques (ultrasound, magnetic resonance) have been established for many years as well as cell biomechanics research where the biological relevance of the mechanical metrics has triggered the development of many techniques such as atomic force microscopy, traction force microscopy, micropipette aspiration, particle rheology, and optical tweezers.

Many biological processes are strongly dependent on mechanical properties and forces at all scale, from sub-cellular organization to cellular function to tissue development to physiological and pathological behavior. As a result, a wide variety of contexts require different solutions to the evaluation of mechanical forces and mechanical properties of biological entities. In the past ten years, optical methods have emerged as important tools for these characterizations, both leading to clinically useful diagnostic and therapy-monitoring methods and helping illuminate the important mechanical interactions occurring at cell and tissue scale. In addition, the information provided by optical methods is recently being incorporated with computational modeling efforts to accurately predict cell and tissue behavior.

This sixth annual conference continued the growth of the first five conferences and displayed a strongly multidisciplinary character, bringing together optical technology experts, clinical scientists, cell biologists, biophysicists, and biomechanics computational modeling experts. The meeting demonstrated increased attendance year to year. Also, this year, over 60 contributed papers were built around 2 days of talks and posters. Here are the keynote and invited talks of the program:

Keynote Presentation:

C. Ross Ethier, Georgia Institute of Technology (United States), "How imaging is informing diagnosis and treatment of glaucoma."

Invited Papers:

Assad A. Oberai, The Univ. of Southern California, (United States), "Linear and nonlinear optical coherence elastography in three dimensions."

Kandice Tanner, National Cancer Institute (United States), "High-frequency active microrheology in 3D reveals mismatch between tumor cell cytoskeletal and extracellular matrix mechanics."

Jannick P. Rolland, Univ. of Rochester (United States), "Perspectives and advances in optical elastography."

Karol Karnowski, Institute of Physical Chemistry of the Polish Academy of Sciences (Poland), "Imaging of anterior segment pathologies: challenges and future opportunities."

J. Bradley Randleman, USC Roski Eye Institute (United States), "The importance of corneal biomechanics in clinical practice."

Darryl R. Overby, Imperial College London (United Kingdom), "Brillouin spectroscopy is insensitive to stiffness after correcting for the influence of water content in hydrogels."

Peter T. C. So, Massachusetts Institute of Technology (United States), "The application of interferometric imaging in quantitative mechanobiology."

Stefan Catheline, INSERM, Univ. of Lyon (France), "Passive elastography: from organ to cell."

The highlight of this year's meeting was the keynote lecture by Ross Ethier on the relevance of biomechanics in the diagnosis and treatment of glaucoma. Prof. Ethier is a biomechanicist and a glaucoma expert. After an overview on the biology of glaucoma, he reported his group's recent results establishing how outflow tissue stiffness reflects tissue function in glaucoma and optical coherence tomography methods to assess outflow tissue functional status. Special acknowledgement goes to Thorlabs Inc., whose sponsorship supported the keynote presentation.

Overall, this sixth annual conference continued to serve as a catalyst for the growth of the emerging area of optical technology development for cell and tissue biomechanical research. Several sessions also pointed at interesting developments to be expected in the next year. We hope you will enjoy the papers submitted for this volume.

Kirill V. Larin
Giuliano Scarcelli