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Optical Elastography and Tissue Biomechanics

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Editors

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Introduction

Optical elastography is the use of optics to characterize cells and tissues based on their elastic and viscoelastic mechanical properties. In utilizing the high-resolution capability of optics, this rapidly emerging field builds on and complements the related fields of ultrasound and MR elastography, as well as existing methods for biomechanics, such as atomic force microscopy and rheology.

Mechanical forces play an important role in the behavior and development of cells at all spatial scales, from cells and their constituents, to tissues and organs. Such forces profoundly influence the health, structural integrity, and normal function of cells and organs. Accurate determination of cell and tissue biomechanical properties (e.g., Young's or shear modulus) is a vitally important area. High-resolution optical methods could help further the understanding of mechanical interactions, and mechanical properties, with application to clinical diagnosis and interpretation of a wide range of diseases.

The inaugural subconference was very vibrant and displayed a strongly multidisciplinary character bringing together technology and application experts in bioengineering, biophysics, cell biology, clinical sciences, medical imaging, optics and photonics, and tissue engineering. More than 35 contributed papers were built around two days of invited and contributed talks. Exceptional invited talks headlined the contributed program:

- Stephen A. Boppart M.D., University of Illinois at Urbana-Champaign (United States) Optical coherence elastography techniques for assessing biomechanical properties of tissues and cells

- Susana Marcos, Consejo Superior de Investigaciones Científicas (Spain) Corneal biomechanical properties from air-puff corneal deformation imaging

- Kishan Dholakia, University of St. Andrews (United Kingdom) New light on cell manipulation and rheology

- Ruikang K. Wang, University of Washington (United States) Use of phase sensitive OCT to track and visualize dynamic mechanical wave propagation within tissue

Many topics were covered and highlights include the impressive advances in optical coherence elastography techniques, particularly in compression methods and shear wave visualization. Applications in the anterior eye proved popular, with some interest also in breast cancer. Optical elastography and tissue biomechanics confirmed its status as a rapidly emerging area—we look forward with excitement and anticipation to see what the next twelve months will bring. In the meantime, please enjoy reading the papers submitted for this volume.

Kirill V. Larin
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