

Quantitative Phase Imaging

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Introduction

2015, The International Year of Light, marks also, in a fortunate coincidence, the launch of the first conference on Quantitative Phase Imaging (QPI) at Photonics West, BiOS. It was a tremendous success! For four full days, February 7–10, the QPI conference hosted a dense program of oral presentations, covering both novel methodologies and applications to biomedicine. Each presentation was followed by insightful comments, questions, and truly engaging discussions about the state of the art and future directions of the field. Including the poster presentations, the inaugural year of the conference included more than 100 contributions. Clearly, this is a strong message that the QPI field is maturing and that the timing for organizing the conference is right.



Figure 1. A morning session during the QPI Conference at Photonics West, BiOS (San Francisco, 7-10 Feb. 2015)

QPI is a special type of imaging that allows for quantitative biological investigations. It enables label-free quantitative assessment of biological samples, including cells and tissues. There has been a recent growth in the study of techniques and applications of QPI aimed at addressing important biological questions, previously not possible using conventional optical imaging techniques. This rapidly emerging field enables the investigation of cells and tissues in terms of morphology and dynamics with nanoscale sensitivity over temporal scales from milliseconds to days. Quantitative measurements of intrinsic properties, optical, chemical, and mechanical, are likely to open a new window into the pathophysiology of cells and tissues. Employing the principles of interferometry and holography, QPI provides unique capabilities not only for imaging, but for propagation of optical fields as well. As a result, QPI grants opportunities for non-iterative adaptive optics and for measuring light scattering. Thus, quantitative phase imaging has recently bridged the gap between the imaging and scattering disciplines.

This is the inaugural proceedings volume on Quantitative Phase Imaging. The papers published in this issue cover the latest developments and applications in one of the most extensive and fast growing fields in biomedical optics. The objective of this volume is to highlight recent progress and trends in novel optical technology developments, as well as their biological, clinical, and industrial applications. The papers published here can be categorized under the following major topics:

1. Imaging
2. Spectroscopy
3. Light scattering measurement
4. Algorithms and Imaging Processing in QPI
5. QPI of cells and tissues.

These topics are discussed in the contributed papers, covering original results and recent developments. Many of the papers published in this special issue represent in-depth elaboration of topics presented at the Quantitative Phase Imaging conference, Photonics West, BiOS, 2015. As Chairs of the QPI conference, we are grateful to the contributors to this volume and all the conference participants who have helped shape this exciting field of quantitative phase imaging.

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YongKeun Park