

## Biophotonics feature: introduction

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**Abstract:** We introduce the feature issue on the Optics in the Life Sciences Congress held on April 2–5, 2017 in San Diego, CA. The Congress consisted of 5 topical symposia: (i) Biophotonics Design and Application; (ii) Novel Techniques in Microscopy; (iii) Optical Molecular Probes, Imaging and Drug Delivery; (iv) Optical Trapping Applications; and (v) Optics and the Brain. These separate symposia also held joint sessions of common interest. The following highlights some of the topics from the Congress.

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## Bio-optics design and application (BODA)

The BODA conference is a biennial event aimed at nourishing a discussion between researchers from academia, industry, and clinical practice and discussing aspects of design, applications, and translation. The design/application theme of this conference was emphasized by the selection of session topics and opportunities for networking between technology developers, clinical end-users, regulatory experts, and commercial entities.

This collection of presentations from 2017 BODA by OSA conference comprised of sessions on Clinical systems and application; Micro/nano optics and optofluidics; Visual optics and eye imaging; OCT and applications; Novel optical imaging technologies; and Design and fabrication of optical imaging systems. The meeting featured invited talks [1,2] bringing attention to new microscopic systems (like Scape), new OCT techniques, wearable sensors, and rapid in-vivo imaging among others.

## Novel techniques in microscopy (NTM)

Over the last several decades, physicists, chemists, engineers, and biologists have worked to exploit the physical properties of light and its interaction with matter to create novel ways to better visualize cells and tissues. These developments have resulted in the ability to image such biological specimens with improved speed, resolution as well as extracting more detailed structure information.

The NTM symposium illuminated the enabling role that new optical techniques and approaches continue to play in biological imaging. The symposium presented a broad range of innovations in optical microscopy, from advances in optical tomography, to developments in nonlinear optical imaging, new methods in tissues imaging, to new methods in super resolution fluorescence microscopy, and also quantitative phase contrast.

In this feature issue of *Biomedical Optics Express*, we have collected several papers [3–5] that represent some of the technologies discussed at the NTM symposium that moved the field, both in terms of the technology and also the biological applications.

## Optical molecular probes, imaging, and drug delivery

This symposium summarized advances in technology for non-invasive diagnosis and drug delivery, based on optical physics, photonics, nanoscience, and photochemistry. Participants presented novel strategies for molecular probe development and label-free imaging; optical methods for monitoring, activating, or predicting treatment response; and provided updates on progress in clinical translation of technologies [6–8]. This symposium held joint sessions with both Bio-optics Design and Application and Novel Techniques in Microscopy, highlighting the interdisciplinary nature of this area.

## Optical trapping applications

In its fifth iteration, the Optical Trapping Applications (OTA) conference drew together a broad spectrum of researchers from almost every continent to present the latest advances in optical tweezers and related micromanipulation techniques. OTA provides a forum for discussing fundamental aspects of manipulation techniques as well as emerging applications in both the physical and biological sciences. In 2017, we saw some tantalizing insights into what will surely be future directions for this highly adaptable field. Highlights include the application of novel optical materials for trapping at the nanoscale, which has enabled studies in laser cooling and quantum sensing. Advances in near field and nanoscale geometries are pushing trapping to the single macromolecules level and providing new insights into protein-protein interactions. In the area of cell biology, we have seen the novel methods from high throughput screening of cells populations to probing the mechanics of the intracellular process.

In this special issue, we highlight two exciting optical trapping applications [9-10] in the area of cell biology.

### **Optics and the brain**

The optics and the brain conference always attracts a wide variety of contributions since it is the optical application that faces the greatest challenges with respect to spatial resolution, temporal resolution, and volumetric acquisition while at the same time often requiring measurements be performed in vivo. For instance, an emerging field where methodology and technology developments meet lies in the deciphering of the circuitry of the brain: new methods and new algorithms were on display at the conference. Another example comes from the emerging field bridging medicine and biomedical technology where an enhancement of translation of fundamental research to patient care is shown. Such biophotonics solutions may offer in the future interesting alternatives to diagnosis and therapies [11].

This feature issue of *Biomedical Optics Express* collects up to date contributions from participants of the Optics and the Brain symposium ranging from the effects of biostimulation, to hyperspectral imaging opportunities. Label free imaging is shown as an alternative solution to detect morphofunctional aspects of tissues together with a new optical solution capable to combine adaptive optics with high sensitivity and high resolution imaging.