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FOREWORD

Special Issue
Optical Molecular Imaging

We are pleased to present this focus issue on optical molecular imaging, which has seen new developments in novel optical imaging techniques and functional optical probes for studying molecular events in living organisms. This focus issue covers optical biosensor development, probe targeting, multispectral tomography, and new imaging and signal processing techniques that improve the study of molecular and cellular events in living cells and small animals. The ultimate goal is to use optical imaging techniques to monitor genetic expression and protein function during cellular processes and elucidate biological phenomena, leading to earlier detection of diseases, more effective evaluation of treatment effects, and new approaches to speed drug discovery and development. This issue includes two review articles and nine original papers.

Hot topics in optical molecular imaging, molecular beacons and redox imaging are reviewed in this special issue. Antony K. Chen and Andrew Tsourkas reviewed current perspectives and challenges of imaging RNA in living cells with molecular beacons. Lin Z. Li *et al.* reviewed three dimensional redox imaging for cancer diagnosis and therapy in small animal models.

The nine original research articles cover several important issues in optical molecular imaging from optical probe to imaging technology. Yu Chen' lab developed a needle-based microendoscopy for fluorescence molecular imaging of breast tumor models. Maria Simantiraki and co-workers present a Fluorescence Molecular Tomography (FMT) system capable of recording simultaneously tomographic data at several spectral windows, and yielding absolute quantification of the concentration of each individual fluorophore. Britton Chance and Shoko Nioka's lab developed a novel CCD imaging system for imaging mitochondrial oxidation–reduction states by taking a ratio of mitochondrial fluorophores, which is capable of displaying the metabolic differences in normal and ischemic tissues and quantifying the redox ratio *in vivo*.

He Xu *et al.* report the development of the redox scanning technique by using a calibration method to quantify the nominal concentration of the fluorophores in tissues. Robabeh Rezaeipoor *et al.* report the fabrication of engineered iron oxide magnetic nanoparticles (MNPs) functionalized with human epidermal growth factor receptor type 2 (HER2) antibodies to target the tumor antigen HER2. Jinling Lu and co-workers generated a transgenic mouse line expressing the optical sensor specifically in pancreatic β-cells for detecting insulin-containing granule exocytosis *in vivo*.

Ralph S. DaCosta and Brian C. Wilson's lab developed a novel method to detect the colon adenocarcinoma at the molecular level in real time by combining the fluorescence-based endoscopy with the near-infrared fluorescent monoclonal antibody (CC49) bioconjugate which targets tumor-associated mucin. Ting Li and co-workers present a nice application of functional near-infrared spectroscopy in assessing working memory in real-life situations, and found that the hemodynamic change in the prefrontal cortex during all working memory tasks was highly associated with subjects' behavioral data. Marco Bonesi and co-workers applied Doppler Optical Coherence Tomography (DOCT) to evaluate the mechanical properties of elastic vessel model and image of sub-cranial rat blood flow *in vivo*.

Overall, articles in this special issue showcase the exciting potential of optical molecular imaging in biological and biomedical research via the development of optical probes and labeling method, imaging systems and quantificational calibration method.

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