

## FOREWORD

We are pleased to publish the third issue (Vol. 2, No. 1) of *Journal of Innovative Optical Health Sciences* (JIOHS) which focuses on the developments and biomedical applications of nonlinear optical (NLO) microscopy. NLO microscopy is becoming a powerful tool for bioimaging due to several unique advantages over traditional methods. Nonlinear dependence on excitation intensity gives NLO microscopy inherent three-dimensional (3D) imaging capability without the need for a confocal pinhole. This is particularly advantageous in the case of tissue imaging where significant scattering can reduce the signal collection efficiency by confocal detection. Laser scanning facilitates real-time NLO imaging of live tissues and animals. NLO microscopy utilizes near IR excitation which provides both superior optical penetration into tissues as well as reduced photodamage due to reduced interaction with endogenous molecules. This issue includes seven original papers and five review articles.

The work by Alvin T. Yeh and co-workers demonstrated multispectral nonlinear optical microscopy using sub-10-fs pulses and the application of the technique to study the cell-matrix interaction in a 3D tissue model of angiogenesis. Offerhaus and co-workers presented a nice application of coherent anti-Stokes Raman scattering microscopy to imaging drug release from a lipid-based tablet. Jianxin Chen's laboratory applied nonlinear spectral imaging microscopy to investigate hypertrophic scar of a human skin. Shaoqun Zeng and co-workers reported the recording of calcium dynamics in neurons using a random access two-photon fluorescence microscope. In addition to the research article on nonlinear optical microscopy, Yi-Wei Shi *et al.* reported a high-performance hollow fiber for laser power delivery. Optical coherence tomography remains a hot topic, reported by Datian Ye *et al.* on their latest result in glucose measurement and Dong Wu *et al.* on the development of OCT system using a high-speed swept-source.

The five review articles covered several important applications of nonlinear optical microscopy. Le *et al.* reviewed the application of nonlinear optical imaging to study obesity-related health risks including atherosclerosis and obesity-cancer relationship. Watanabe *et al.* reviewed the various uses of femtosecond lasers for intracellular manipulation. Chen-Yuan Dong and co-workers reviewed the application of multiphoton microscopy to ophthalmology. The authors emphasized the combination of multiphoton fluorescence and second harmonic generation as a powerful tool for imaging structures of the ocular surface. Zhu *et al.* reviewed the recent advances in photobiomodulation. Huang *et al.* discussed the clinical applications of photodynamic therapy.

Overall, the articles in this special issue showcase the exciting potentials of nonlinear optical microscopy in biological and biomedical research via the development of multimodality, high-speed acquisition, and spectral imaging capabilities.

Ji-Xin Cheng and Ling Fu  
January 2009