

International Scientific Conference on

LASERS, OPTICS, PHOTONICS AND SENSORS



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Discoverer, Golden Optical Window,
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Discoverer, Heavy water labeling a relatively new imaging method, stimulated Raman scattering microscopy

Understanding the dynamics of metabolism in a multicellular organism is essential to unraveling the mechanistic basis of many biological processes. It is the synthesis, transformation and degradation of biomolecules (the definition of metabolism) that carry out the genetic blueprint. Traditional imaging methods such as MRI, PET, Fluorescence, and Mass Spectrometry have fundamental limitations. Being an emerging non-linear vibrational imaging microscopy technique, stimulated Raman scattering (SRS) can generate chemical specific imaging with high resolution, deep penetration of depth, and quantitative capability. In the present work, we developed a new method that combines deuterium isotope probing and Stimulated Raman Scattering microscopy to visualize metabolic dynamics in live animals. The enzymatic incorporation of deuterium (D) into biomolecules will generate carbon-deuterium (C-D) bonds in macromolecules. Within the broad vibrational spectra of C-D bonds, we discover lipid-, protein-, and DNA-specific Raman shifts and develop spectral unmixing methods to obtain C-D signals with macromolecular selectivity. This technology platform is non-invasive, universal applicable, and it can be adapted into a broad range of biological studies such as development, aging, homeostasis, tumor progression, etc. We applied this method to study the myelination in the postnatal mouse brain, the identification of tumor boundaries, the intra-tumoral metabolic heterogeneity, and the differential protein/lipid metabolism during aging process.

Biography

Dr. Lingyan Shi is an assistant Professor in the Department of Bioengineering at UCSD, her Lab is developing and applying novel optical imaging techniques for solving important biological questions. Her major achievements in scientific research include the discovery of the "Golden Optical Window" for deep brain imaging, and a breakthrough platform (DO-SRS) for high resolution optical imaging of metabolic activities in animals in situ. Dr. Shi has published 43 peer reviewed journal papers and has 6 awarded patents. She won the Blavatnik Regional Awards for Young Scientists in 2018. She received OSA Senior Member Designation in 2020 and was selected as an Advancing Bioimaging Scialog Fellow in 2021.

KEYNOTE SPEAKER