Spectroscopy and Photoscience Lectures

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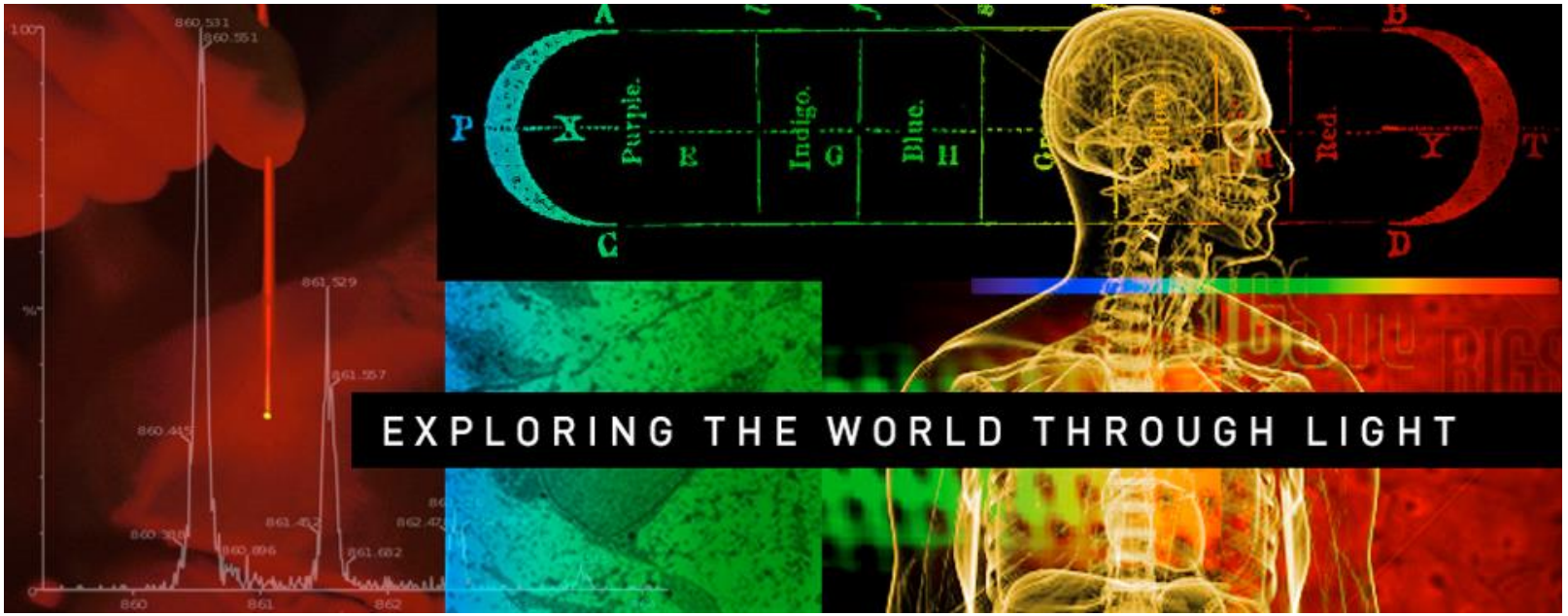

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Spectroscopy and Photoscience Lectures

First lecture

Title: Color of Disease: Biomedical Spectroscopy

Time: 2016/5/19, 13:00 – 14:30

Place: Rm.

We report a method to achieve high speed and high resolution live cell Raman images using small spherical gold nanoparticles with highly narrow intra-nanogap structures responding to NIR excitation (785 nm) and high-speed confocal Raman microscopy.

The three different Raman-active molecules placed in the narrow intra-nanogap showed a strong and uniform Raman intensity in solution even under transient exposure time (10 msec) and low input power of incident laser (200 μW). These SERS-active nanoparticles were modified with cell penetrating peptide (RGD), mitochondria-targeting peptide (MLS), and nucleus-targeting peptide (NLS).

The bright SERS-intensity of Au-NNP in solutions and a custom-built high-speed confocal Raman microscopy enabled to accomplish high-resolution (50 × 50) single live-cell Raman imaging within 30 sec without inducing significant cell damage. The current methods also showed excellent subcellular organelle targeting capabilities as clearly evidenced by the co-localized Raman images with fluorescent probes and multiplexed imaging capabilities for informative cellular imaging. The high speed Raman-based live cell imaging allowed us to monitor rapidly-changing cell morphologies during cell death induced by the addition of highly toxic KCN solution to cells.

These results strongly suggest that the use of SERS-active nanoparticle can greatly improve the current temporal resolution and image quality of Raman-based cell images enough to obtain the detailed cell dynamics for Raman-based high throughput and high contents drug screening.

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Second lecture

Title: Needle tip tissue identification: Raman spectroscopy for epidural space

Time: 2016/5/24, 16:30 – 18:00

Place: Rm.

Many medical procedures use a blind, or semi-blind, approach for needle tip placement. These procedures include epidural catheter placement, laparoscopic surgery trocar placement, tissue biopsies, joint injection, lumbar puncture, and fluid collection aspiration. Complications related to these procedures can be serious and are commonly a result of needle tip misplacement. There is a tremendous need for devices which allows identification of tissues at the tip of needles in vivo. Each year, 2.4 million epidural catheters are placed for labor and delivery. An equal number are placed for postoperative acute pain control annually as well. There is a high rate of obesity in surgical patients and this population is associated with a greater number of epidural blockade complications. The failure rate for epidural catheter analgesia is 12-13% due to the failure to accurately locate the epidural space.

Multi-modal spectroscopy using Raman spectroscopy, diffuse reflectance spectroscopy, and intrinsic fluorescence spectroscopy can measure biochemical and morphological information about tissues non-destructively. MMS has previously been shown to differentiate between cancerous and normal tissues and to enable identification of atherosclerotic plaques. We have shown that Raman spectroscopy can differentiate the tissues overlying the epidural space (skin, fat, muscle, supra-/intra-spinous ligament, ligamentum flavum) and those beyond it (epidural fat, dura mater, spinal cord) in an ex vivo animal model. Target area (ligamentum flavum) was clearly distinguished from surrounding tissue layers. We have also shown that RS can differentiate tissues of the abdominal wall and abdomen (skin, fat, muscle, liver, spleen, pancreas, kidney) in the same model.