Molecular and Biophysical Imaging Seminar

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“Illuminating biology and medicine with multi-spectral opto-acoustic tomography (MSOT)”

Optical imaging is unequivocally the most versatile and widely used visualization modality in the life sciences. Yet it is significantly limited by photon scattering, which complicates imaging beyond a few hundred microns. For the past few years however there has been an emergence of powerful new optical imaging methods that can offer high resolution imaging beyond the penetration limits of microscopic methods. Of particular importance is the development of multi-spectral opto-acoustic tomography (MSOT) methods that bring unprecedented imaging performance in visualizing anatomical, physiological and molecular imaging biomarkers through several millimetres to centimetres of tissue. Some of the attractive features of the method is the ability to offer 10-100 microns resolution and real-time imaging. In parallel we have now achieved the first-in-human clinical translation of targeted fluorescent probes, which opens the way for advanced surgical and endoscopy procedures and personalized theranostics and screening.

Coupled to the increasing availability of photo-absorbing molecules and nano-particles with physiological and molecular specificity, including common fluorescent proteins and probes, MSOT can enable unprecedented insights to cellular and sub-cellular processes through entire small animals, embryos, fish and insects and have revolutionized the role of imaging on the laboratory bench, well beyond the capability of conventional microscopy. This talk describes current progress with instruments, methods and applications for in-vivo optical and opto-acoustic tomography of whole intact animals and model biological organisms. We show how new opto-acoustic and fluorescence imaging concepts are necessary for accurate and quantitative molecular investigations in tissues and why it could be potentially a valuable tool for accelerated investigations of therapeutic efficacy and outcome. We further demonstrate that cellular function and bio-chemical changes can be detected in-vivo, through intact tissues at high sensitivity and molecular specificity. Pre-clinical and clinical results are presented and the advantages and limitations of these methods and future directions are discussed.

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