What Life Scientists Should Know About Molecular Imaging

Optical Imaging, Ultrasound, Photoacoustics

O**ptoacoustic Imaging**

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Learning Objectives:

- Learn why optoaoustic imaging is the future in optical imaging technology
- Principles of multispectral photoacoustic tomography
- Methods for spectral absorption properties
- Methods for blood oxygenation measurements
- Advantages and limitations
- Application examples

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. These methods can prove essential in cancer research. Of particular importance is the development of multi-spectral opto-acoustic tomography (MSOT) that brings unprecedented optical imaging performance in visualizing anatomical, physiological and molecular imaging biomarkers. Some of the attractive features of the method are the ability to offer 10-100 microns resolution through several millimetres to centimetres of tissue and real-time imaging. In parallel we have now achieved the clinical translation of targeted fluorescent probes, which opens new ways in the interventional detection of cancer in surgical and endoscopic optical molecular imaging. This talk describes current progress with methods and applications for in-vivo optical and opto-acoustic imaging in cancer and outlines how new opto-acoustic and fluorescence imaging concepts are necessary for accurate and quantitative molecular investigations in tissues.

Relevant Publications:

1. Ale A, Ermolayev V, Herzog E, Cohrs C, de Angelis MH, Ntziachristos V. “FMT-XCT: in vivo animal studies with hybrid fluorescence molecular tomography-X-ray computed tomography” Nat Methods, 9(6); 615-620 (2012).
2. Van Dam G., Themelis G., Crane LMA, Harlaar NJ., Pleijhuis RG., Kelder W., Sarantopoulos A., Bart J., Low PS., Ntziachristos V., “Intraoperative Tumor-Specific Fluorescent Imaging in Ovarian Cancer by Folate Receptor-α Targeting: First In-Human Results”, Nature Medicine, 17(10): 1315-9 (2011).
3. Ntziachristos V. “Going deeper than optical microscopy: High resolution photonic molecular imaging for next generation biology” Nature Methods, 7(8): 603-614, (2010).
4. Razansky D, Vinegoni C, Distel M, Ma R, Perrimon N, Koster RW, Ntziachristos V. “Multispectral opto-acoustic tomography of deep-seated fluorescent proteins in vivo”, Nature Photonics 3, 412-417 (2009).

5. Vinegoni C, Pitsouli C, Razansky D, Perrimon N, Ntziachristos V. “Live imaging of Drosophila pupae with Mesoscopic Fluorescence Tomography” Nature Methods, 5(1):45-7 (2008).

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