Temperature Modulated Fluorescence Tomography

Tech ID: 22530 / UC Case 2012-326-0

BRIEF DESCRIPTION

Fluorescence tomography (FT) is a sensitive but intrinsically low spatial resolution imaging modality due to strong photon scattering in biological tissue. Recently, a temperature-responsive fluorescence contrast agent has been reported using ICG loaded pluronic nanocapsules. The temperature dependence of these contrast agents provides a major opportunity to overcome the spatial resolution of regular FT by using temperature modulation/tagging.

Researchers at the University of California, Irvine have developed a new molecular optical imaging modality termed “temperature-modulated fluorescence tomography (TM-FT)” that can provide high resolution images without sacrificing the exceptional sensitivity of fluorescence-based detection. TM-FT is based on the temperature modulation of fluorescence quantum efficiency in a highly scattering medium. The medium is irradiated by both excitation light and a high intensity focused ultrasound (HIFU) wave. The crucial benefit of HIFU is that the temperature of the medium is modulated with a very high spatial resolution (~1.5 mm) due to the absorption of acoustic power in the ultrasound focal zone. When the temperature sensitive fluorescence agent presents within HIFU focal zone, the local temperature increases and in turn, changes the fluorescence quantum efficiency inside the focal zone. As a result, the emitted fluorescence light intensity and lifetime have detectable change only when the agent is present within the focal zone. In other words, it allows fluorescence reconstruction with high spatial resolution by scanning focused ultrasound column over the medium while detecting the change in fluorescence signal. Using a proper reconstruction algorithm, this technique can also provide quantitatively accurate fluorescence images. Finally, the temperature sensitive agents can be modified to target molecular pathways and processes associated with many diseases and hence, TM-FT technique can provide a suitable platform for true molecular in vivo imaging.

SUGGESTED USES

The invention may be used for mice imaging for basic science research, cancer imaging, stem cell imaging, cell therapy monitoring, and drug development. Or the invention may be developed for clinical imaging in patients. The invention may also be used for guiding HIFU therapy, which is currently used to destroy tumors by heating.

ADVANTAGES

High Spatial Resolution, High Quantitative Accuracy, Molecular In vivo Imaging

PATENT STATUS

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<td>United States Of America</td>
<td>Issued Patent</td>
<td>9,192,303</td>
<td>11/24/2015</td>
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OTHER INFORMATION

KEYWORDS
Fluorescence tomography, TM-FT, HIFU, In vivo imaging, Ultrasound, Fluorescence

CATEGORIZED AS
- Optics and Photonics
  - All Optics and Photonics
- Engineering
  - Engineering
- Imaging
  - Medical
  - Molecular
- Medical
  - Delivery Systems
  - Diagnostics
  - Disease: Cancer
  - Disease: Kidneys and Genito-Urinary System
  - Disease: Women’s Health
  - Imaging
  - Research Tools
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