Medical Imaging

Using Endogenous Fluorescence to Identify Cancerous Cells

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing an enhanced method and system for cancer detection.

Overview

Optical imaging techniques play a pivotal role in detecting disease, injury and other disorders at an early stage and monitoring progression or remission after treatment. Images are generated by detecting a source of energy that can be a combination of electromagnetic radiation, nuclear radiation, acoustic waves, electrical fields or magnetic fields. Unfortunately, because tissue becomes opaque at frequencies in the visual or ultraviolet regions of the electromagnetic spectrum, the usefulness of some imaging methods is limited.

Advanced infrared imaging techniques, such as multiphoton microscopy and second harmonic generation, can penetrate deeper within biological tissue. By more clearly visualizing different types of tissue, non-linear infrared optical imaging has emerged as a vital tool for visualizing processes at the cellular and subcellular levels. It potentially can be used to diagnose and evaluate disorders such as cancer and neurodegenerative diseases. But before non-linear infrared imaging can become useful as a clinical tool, histopathological features in the images must be characterized so they can be correlated to specific disease conditions.

The Invention

UW-Madison researchers have developed methods to identify, detect and characterize diseases, such as cancer, using non-linear infrared imaging. Changes in the fluorescent properties of tissue indicate changes in cellular metabolism that may signify the presence of disease. Specifically, the fluorescent properties of flavin adenine dinucleotide (FAD), a redox cofactor involved in several important metabolic reactions, can indicate the presence of cancer, particularly epithelial tumors such as breast tumor cells.

To detect cancer, tissue is exposed to near infrared radiation, which excites endogenous FAD fluorophors. The FAD fluorophors then emit measurable fluorescent signals that vary with different tissue properties. A partially or fully automated system analyzes the signals and compares them to previously acquired reference data. The findings can be used to identify, locate and characterize the presence and stage of carcinomas.

Applications

- Cancer detection and diagnosis

Key Benefits

- Provides nondestructive and noninvasive imaging of biological structures
- Evaluates tissue for invasiveness

- Useful for *in vivo*, *in vitro* and *ex vivo* tissue samples
- Complements information provided by other diagnostic methods
- Useful for imaging cancer in the breast, cervix, lung, prostate, esophagus, colon, skin and eye
- Can identify cancer in epithelial, stromal, mesenchymal, neuronal, immune and vascular tissue
- May be used for endoscopy, optical biopsy, diagnosis of cancer, evaluation of angiogenesis and metastasis and to monitor the progression of neurodegenerative diseases

Additional Information

For More Information About the Inventors

- Kevin Eliceiri

Publications

- Skala M.C., Riching K.M., Gendron-Fitzpatrick A., et al. 2007. *In Vivo* Multiphoton Microscopy of NADH and FAD Redox States, Fluorescence Lifetimes, and Cellular Morphology in Precancerous Epithelia. Proc. Natl. Acad. Sci. USA 104, 19494-19499.

Tech Fields

- Medical Devices : Diagnostics & monitoring tools
- Medical Imaging : Other diagnostic imaging

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846