Bankhead-Coley Cancer Research Program

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Department of Biomedical Engineering — *2006 Program*
Florida International University — *Bridge (1-year project)*

Project Title: Hand-Held Optical Probe for Fluorescence Imaging of Breast Cancer

Project Summary: Breast cancer screening is recommended by the National Cancer Institute and the American Cancer Society, and x-ray mammography is used as the primary screening test for breast cancer. However, the conventional x-ray mammography technique is limited by: (i) its harmful x-ray radiation, (ii) lack of sensitivity and specificity for early stage cancer or dense breasts, and (iii) patient discomfort due to the compression of the breast tissue. A non-ionizing and non-invasive optical-based approach for cancer diagnosis minimizes the radiation exposure to the patient as well as the clinicians in comparison to the widely used x-ray mammography. Near-infrared (NIR) optical imaging using external fluorescence contrast agents is an emerging non-invasive modality that can become an important tool in the diagnosis of early-stage breast cancer and prognosis of the disease. To date, most of the work in fluorescence-enhanced optical tomographic imaging is carried out using: (i) small volume phantom or in vivo animal models that lack clinically relevant depth information; (ii) nonflexible optical probes that are restricted to image-only specific tissue volumes or shapes; or (iii) measurement geometries that interrogate limited tissue volumes with longer imaging times. Hence, the current research proposes to design and develop a hand-held based optical probe using a unique measurement approach that images large tissue volumes with no compression and rapid imaging rates. The hand-held optical probe will be unique in terms of its: (i) flexibility to image any tissue shape and volume; (ii) non-compressibility, portability, and patient comfort due to its hand-held based design; and (iii) novel measurement geometry that can interrogate greater tissue volumes with reduced imaging time. The future goal is to develop a hand-held based optical imager by integrating the novel hand-held optical probe to an NIR sensitive and rapid data-acquiring detector, such that high-resolution diagnostic and prognostic breast cancer imaging can be obtained in a clinical environment. The optical sensitivity of the novel imager to precancerous conditions can eventually increase the survival rate of breast cancer patients via early diagnosis and treatment of the disease, which currently affects 1 in every 7 women in the United States.