Award ID:
RP120558

Project Title:
Development of a Novel High-resolution Photoacoustic Microscopy System for Noninvasive in vivo Imaging of Melanoma

Award Mechanism:
Individual Investigator

Principal Investigator:
Ye, Jing Yong

Entity:
The University of Texas at San Antonio

Lay Summary:

Melanoma is a highly metastatic/spreading skin cancer of pigment-producing cells called melanocytes. Melanoma is often diagnosed after metastasis thus leading to a poorer patient survival. All persons are at risk for melanoma, although lighter skin or hair confers a higher risk. New early diagnosis technologies for melanoma are thus urgently needed. An ideal system would be noninvasive imaging that could be used repeatedly by physicians to track small changes in moles/nevi prior to a biopsy. While some noninvasive imaging methods have been explored, they have serious limitations: such as insufficient light penetration and ultrasound contrast, that prevents accurate measurement of thickness, and poor image contrast between melanoma lesions and other tissue that prevents good imaging for accurate diagnosis. We propose to develop a new sensitive, high-resolution detection system, called functional photoacoustic microscopy (fPAM), for early detection of melanoma. To overcome limitations of older systems, the proposed fPAM system utilizes optical pulses to generate ultrasound and utilizes a unique optical sensor for detecting the ultrasound signals. We will evaluate and then validate the system with a mouse model of melanoma. The hepatocyte growth factor/scatter factor (HGF/SF) transgenic mice develop melanomas after exposure to ultra-violet/UV light that closely resemble human melanoma development. We will fabricate the optical sensor with a photonic-crystal structure in a novel configuration. This sensor allows direct exposure to ultrasound waves generated by a pulsed laser from tissues without interference. More importantly, the sensor allows using materials highly responsive to ultrasound signals. Thus, a substantial increase in sensitivity can be realized. Our improved fPAM system will measure melanoma thickness accurately, and can be used to visualize blood vessels and other tissues during development of new melanoma treatments.