A Novel, Noninvasive Approach to Melanoma Diagnosis Using Optical Coherence Tomography and Bioconjugated Gold Nanoparticles

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Melanoma is the deadliest skin cancer with over 9,000 deaths per year, but melanoma detected early results in over 90% chance of cure. Currently, a biopsy is the most common method of melanoma diagnosis, but it can take up to two weeks to receive results, cost hundreds of dollars, and is invasive and traumatizing to the patient. Thus, there is an unmet clinical need for noninvasive, quick, and inexpensive diagnosis of melanoma. Optical Coherence Tomography (OCT) is a relatively new non-invasive imaging modality which is cost-effective and portable. However, without contrast agents, OCT's use in biological imaging is limited. My project developed a new contrast agent to noninvasively diagnose suspicious melanoma lesions and tested various concentrations and sizes to determine the ideal parameters for this contrast agent. I conducted an in-vitro study of OCT signal where I demonstrated that my novel contrast agent, gold nanospheres conjugated with Galectin-3 protein antibodies as a biomarker, binds significantly greater to melanoma than to fibroblast cell lines. The resulting dramatic signal difference enables a melanoma diagnosis. OCT signal contrast peaked at nanoparticle sizes of 5nm and 10nm, while 10nm and 50nm displayed relatively low toxicity based on light microscope images to compare cell death. My study has laid the groundwork for the use of this novel contrast agent and OCT technology in the early detection of melanoma in a clinical setting. By using this noninvasive diagnostic technique, up to 60% of suspicious cases will be spared a biopsy. Ultimately, this approach represents a new paradigm whereby noninvasive screening yields a greater incidence of early, cost-effective skin cancer diagnosis, saving thousands of lives globally.

Awards Won:

Intel ISEF Best of Category Award of $5,000

First Award of $3,000

Craig R. Barrett Award for Innovation