

Photoacoustic Detection of Melanoma Cells *in Vitro*

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Cancer is one of the leading causes of death in developed countries. Cancer constitutes a great threat to health when it becomes metastatic, i.e. when it has spread to distant parts of the body via the blood or lymph systems and has created secondary tumors. Currently, cancer is diagnosed as metastatic when the secondary tumors are large enough to be detected by conventional imaging modalities. Such secondary tumors contain billions of cells. In many cases, surgical resection of the tumors is impossible and chemotherapy is ineffective. In order to detect metastasis at an earlier stage, we have developed a photoacoustic method for detecting tumor cells in blood samples of cancer patients. Specifically, our system detects melanoma cells present in the blood system prior to becoming secondary tumors. We exploit the native light absorber, melanin, within melanoma cells to induce a photoacoustic effect, creating a robust signal indicating the presence of these circulating melanoma cells. The method employs photoacoustic excitation coupled with an optical transducer capable of determining the presence of cells within the system. The transducer is based on stress wave induced changes of optical reflectance of a glass-water interface, probed with a continuous laser beam that is incident at an angle close to the critical angle of total internal reflection. We calibrated this system using black microspheres with a diameter of 10 microns. We tested this system on a human melanoma cell line, HS 936, in microcuvettes with a detection threshold of a single melanoma cell.