Nanoparticle-Mediated Sorting of Circulating Tumor Cells

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According to the National Cancer Institute, breast cancer is the most common malignancy in United States women, accounting for more than 40,000 deaths each year. The main cause of death in breast cancer patients is the growth of remote metastatic disease that is difficult to predict and diagnose in its early stages. In the study of metastatic disease, circulating tumor cells (CTC) were found to play a crucial role in tumor dissemination and progression and carry important information that can be useful in developing therapeutics to treat these diseased cells. At present, the detection of metastatic diseases can only be done at the time of diagnosis and surgery through the sampling of the lymph nodes or bone marrow. These methods are inaccurate, time-consuming, and unsuitable for easy routine screening. Consequently, there is a need for a simple, quick, painless, and accurate diagnostic test utilizing the hematogenous system, a source of CTCs in cancer patients. In this study, we will develop such a device by combining iron oxide nanoparticles with microfluidic chip technology. Avidin-functionalized SPIONs were successfully synthesized using the coprecipitation method. A microfluidic chip was designed and fabricated effectively using soft lithography and chemically activated using chemicals methyltrimethoxysilane (MPTMS) GMBS which allowed for avidin-loaded SPIONs to then bind to the chip. MCF7 cells were successfully conjugated biotin then labeled with avidin-functionalized SPIONs The next steps will be to test the efficiency of the binding of SPIONs to the surface of the microfluidic channels and capturing CTCs spiked in blood.