A Rapid and Cost Effective Carbon Nanotube Sensor for Biomarker Detection Using Cancer as a Model Disease

Lee, Christopher

The ability to detect and diagnose cancer greatly influences patient survival rates. Current cancer detection methods take multiple days to process, are inefficient, and relatively expensive. The purpose of this study was to develop a novel sensing platform for cancer detection that could overcome these obstacles, using ovarian and prostate cancers as model diseases. The HE4 antigen was chosen as the ovarian cancer biomarker due to early detection potential and the uPA antigen was used as a prostate cancer biomarker due to linkage between aggressiveness of the cancer and uPA levels. Two novel sensors were created with carbon nanotubes that were wrapped with a strand of DNA to which antibodies for HE4 and uPA were attached. Antigens were detected through fluorescent wavelength shifts of the nanotubes. The sensors worked in human serum, bovine serum and clinical patient samples at much faster and cheaper rates than other platforms for antigen sensing. In addition, non-toxic sensing in a live mouse model was demonstrated with the HE4 sensor." Thus, this study has established a novel, in vitro and in vivo cancer detection platform using antibody carbon nanotubes that is more rapid and cheaper than current detection methods and has high clinical relevance. Furthermore, the sensing architecture has the potential to detect any antigen-linked disease by changing the antibody attached to the nanotubes.