Single Walled Carbon Nanotube (SWCNT) Detection of Interleukin 1 β (IL-1β)

Atara R. Israel, Pooja Gaikwad, Myesha Thahsin, Ryan M. Williams

Single walled carbon nanotubes (SWCNTs) are known for their fluorescent properties in the near-infrared region, as well as their photostability and emission within the "biological transparency window". This makes them useful as nanosensors for in vivo signal detection. The stability of SWCNTs also allows for repeated, long-term measurements. Implantation of these sensors in vivo allow for detection of biomarkers of specific diseases. Interleukin 1 β (IL-1β) is a pro-inflammatory cytokine involved in pleiotropic cellular processes. IL-1β is commonly found at elevated levels in cancerous tissues and other chronic diseases. We are working to design an IL-1β nanosensor by evaluation of optical band gap changes in the presence of the desired antigen. This is accomplished by conjugating an antibody of interest to the SWCNT wrapped with TAT6-NH_2 DNA oligonucleotide and passivating the surface of the SWCNT with bovine serum albumin (BSA). This causes the SWCNT's hydrophobic surface to be less available for non-specific protein interference, creating a more functional sensor. We observed significant changes in the sensor's center wavelength and change in fluorescence intensity in the antigen's presence, serving as an indication of the functionality of the nanosensor. We are also working on studying the capability of fluorescent dyes to exacerbate the wavelength shift seen in SWCNTs. This is accomplished by conjugating the dye to a nanosensor and introducing its complimentary antigen that will remove the dye from the SWCNT surface, intensifying its shift in wavelength. The overall goal of developing this type of nanosensor is to use it in point-of-care scenarios to measure biomarker levels in patient samples or in vivo, allowing for detection of chronic diseases that may be difficult to diagnose early on.