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Nanotechnology driven sensors to monitor medical device associated bacteria presence

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As the use of medical devices is increasing, so do the chances of infection; leading to poor device performance, implant failure and, in severe cases, patient death. With new strains of bacteria developing multidrug resistance, i.e. MRSA, accurate and early diagnosis, are becoming pressing issues. Currently used diagnostic procedures for implant-associated infections comprise of a combination of hematological, clinical and imaging features. Though it is possible to reach successful late-stage infection diagnosis by coupling these diagnostic imaging modalities, in many of the cases, needle aspirations with microbiological analysis of the aspirated fluid may still be required and currently, it is the gold standard to diagnose medical device associated infections. To alleviate this problem, the next generation of medical devices should be embedded with sensors to detect, in real-time and in a high resolution manner, ensuing implant failure. The goal of this project is to create an implantable sensor capable of detecting small amounts of infectious agents, inflammation, and/or cell growth on the implant surfaces and communicate with the clinicians with a small implantable transmitter. In this research, we used carbon nanotubes (CNTs) grown on anodized nanotubular titanium surfaces to detect cellular growth. The electrically active CNTs can measure the impedance of the cells that adhere onto the medical device surfaces and, thus, identify if minute amounts of bacteria (or other cell types) have attached. In the studies, it was successfully differentiated surface adherent *Staphylococcus aureus* from surface adherent osteoblasts and further assessed osteoblast cellular functions, i.e. calcium deposition, on CNTs *in vitro*.

Biography

Thomas Webster, PhD, is the Professor and Chair of the Chemical Engineering Department in Northeastern University. The primary focus of his research is the design, synthesis, and evaluation of nanomaterials for various medical applications. This includes self-assembled chemistries, nanoparticles, nanotubes, and nanostructured surfaces for a diverse range of tissues, i.e. bone, cartilage, skin, neural, bladder and cardiovascular. Prof. Webster has started 9 companies.

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