Nanofiber based bone repair device for management of orthopaedic infections

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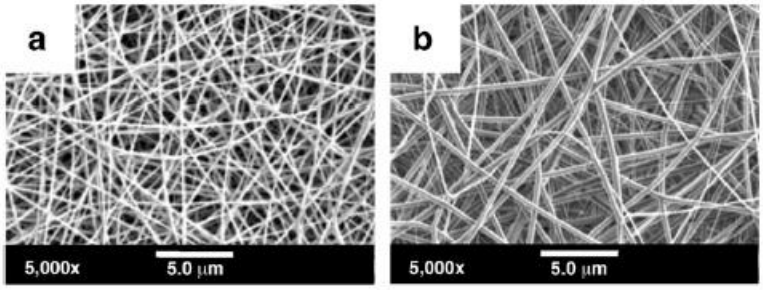
This project proposes to develop an innovative bone repair device for limb salvage in patients afflicted with traumatic bone injury. This nanofiber based device will incorporate antimicrobial properties along with biomimetic, osteoinductive and osteoconductive components. It is envisioned that this construct will be resorbed within the biological system following its function leaving behind healed natural bone. Serving a triple function of a bone graft, infection management and growth promoters, this device will aid elimination of repeat surgery for removal of antibiotic beads and contribute immensely to acceleration of bone healing following trauma. This device will comprise of a nanofiber mat electrospun from polylactide co-glycolide and functionalized with vancomycin and/or tobramycin. Additionally bone morphogenetic protein-2 and osteogenic precursor cells will be incorporated.

Examples of electrospun nanofibers are shown in the scanning electron microscopy (SEM) images shown below. Note that the diameter and length of the fibers work together to establish an open network with a characteristic porosity.



In this project, antibiotic agents vancomycin and tobramycin will be incorporated into the fibers during spinning. The analytical goal is to determine the rate at which antibiotics are released from these devices when placed in "body-mimicking" solution of saline and incubated at 37^{o}C. Antibiotic assays will be performed using a Waters Ultra Performance Liquid Chromatography-Mass Spectrometry (LC-MS-MS) instrument. This technique has the triple advantage of highly efficient chromatographic separation, highly selective mass spectrometric detection using the technique of multiple reaction monitoring (MRM), and the lowest detection limits available due to the triple quadrupole design.