Cell Membrane-Coated Nanodevice for Anti-Virulence Therapy Against Antibiotic Resistant Bacteria

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With the growing issue of antibiotic resistant bacteria, anti-virulence therapies have emerged as an attractive and effective treatment regimen against pathogenic proliferation, which do not induce resistance in the bacteria as antibiotics do. Removing the secretory toxins of these bacteria facilitates immune clearance of the pathogen, without interference by drug molecules. In this work, a cell membrane coated nanodevice is 3D bioprinted using polyethylene glycol (PEG) hydrogel as the supporting platform, along with the red blood cell membrane coated nanoparticles (RBC-NPs) encapsulated in the hydrogel as the detoxification mechanism. This nanodevice is engineered with inner channels to enhance directional blood flow. RBC-NPs are prepared through self assembly methods and incorporated into the liquid PEG solution. Upon polymerization through 3D bioprinting, a cylindrical shaped nanodevice with embedded RBC-NPs is printed with multiple through channels. To enhance the detoxification efficiency, different shapes (i.e. circle, star, triangle) of the channel are fabricated. The nanodevice displays nanoparticle retention and broad spectrum toxin absorption abilities, is both time and cost efficient, and allows for patient specific shapes, sizes, and designs. The personalization of treatment discourages immunosuppression, and the detoxification ability facilitates immune clearance of antibiotic resistant bacteria without the usage of antibiotics. These innovations will lead to a paradigm shift in designing non-antibiotic strategies for combating antibiotic resistant bacteria.

Awards Won:

First Award of $5,000