

Combating Antibiotic Resistant Bacteria Using Tissue Adhesive Hydrogel with Cell-Membrane Coated Nanotherapeutics

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As strains of bacteria have evolved to acquire resistance against antibiotics, they have also developed mechanisms to evade the body's natural immune system. To combat these problems, a thermosensitive hydrogel containing cell membrane coated, drug loaded nanoparticles was engineered to provide localized and controlled delivery of drugs, targeting both the bacteria themselves and the external toxins secreted by them. This platform can deliver high concentrations of antibiotics directly to the infection source. Thus, it has the ability to eradicate antibiotic resistant bacteria, otherwise known as superbugs, without posing a threat to the patient. The nanotherapeutics in this project consist of a polymeric nanoparticle core encapsulating a high concentration of antibiotics, which are then cloaked with a red-blood cell (RBC) membrane. The RBC membrane will soak up the various toxins secreted by the bacteria, which will facilitate immune system recovery from toxin onslaught. Thus, these nanoparticles will achieve two main purposes: they will aggregate and eliminate the bacteria, and will also alleviate the effect of secretory toxins on natural cells. The thermosensitive, tissue-adhesive hydrogel will provide a platform for localized and controlled delivery of the drug loaded nanoparticles. The hydrogel is in a liquid state at any temperature below 37 C, but forms and retains a gel structure at 37 C (body temperature). This allows for syringe loading and injection. Tests were run to quantify the properties of different hydrogel formulations, the release rate of the RBC-coated nanoparticles from the hydrogel platform, and the effectiveness of the drug delivery system in eradicating the bacteria.

Awards Won:

Third Award of \$1,000