DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

**Department of Materials Science and Engineering,**

**PhD Thesis Proposal**

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# Development of Biomaterials for Cancer Immunotherapy

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## Abstract

Nanoparticles (NPs) are a promising modality in cancer therapy due to their enhanced penetration and retention (EPR) effects. Recently the research on the immune systems has enabled scientists to pursue ways of turning our own immune cells against tumors. Here we propose two nanoparticle-based therapeutic strategies for anticancer immunotherapy. One is the co-delivery of anticancer drug (doxorubicin, DOX) and inhibitor of Transforming Growth Factor-beta (TGF-β), via long circulating NPs coupled with extracellular matrix degrading enzyme. The other one is cancer cell membrane-coated particles in injectable 3D scaffolds of nanoparticle-network for efficiently inducing tumor-specific cytotoxic T-lymphocyte (CTL) activation and proliferation.

DOX has been found to be immunogenic and can induce an effective antitumor immune response. TGF-β is essential for maintaining an immunosuppressive environment to protect an established tumor from the host immune response and probably also the reason for failure of anticancer vaccines. It is expected that the immunogenic capability of DOX will be unveiled by a simultaneous treatment of TGF-β inhibitor in anticancer immunotherapy. Recently, a long circulating nanocarrier coupled with extracellular matrix degrading enzyme has been developed in our lab and showed superior accumulation in 4T1 mouse cancer models. We propose to use this platform for the co-delivery of TGF-β inhibitor and DOX and study the efficacy of immunotherapy.

3D scaffolds subcutaneously implanted have been developed to induce CTL activation and proliferation. The vaccine scaffold was able to elicit tumor-specific CTL response that delayed or even prevented melanoma tumor growth in mice. We propose to create a novel injectable porous scaffold to induce the activation and proliferation of tumor-specific CD8+ T cell in situ.