Renal-Targeted Nanomedicine to Treat Acute and Chronic Renal Diseases

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Abstract:
Clinically translational nanomaterials exhibit rationally-designed functionalities with applications including targeted drug delivery with reduced side effects. The Williams Lab is working to design and evaluate the therapeutic efficacy of a kidney-targeted mesoscale nanoparticle (MNP) system that targets the kidneys with 26-fold specificity compared to other organs. Specifically, MNPs localize to the renal proximal tubular epithelium via a novel peritubular transcytosis mechanism. We found that MNPs loaded with the reactive oxygen species scavenger edaravone exhibit significant therapeutic efficacy against acute kidney injury induced by the chemotherapy cisplatin. We also found that MNPs loaded with immune-modulating peptides or DNA oligonucleotides exhibit therapeutic protection against acute kidney injury induced by ischemic injury. Ongoing work in our lab is designing MNPs loaded with nucleic-acid based active cargoes to inhibit inflammation associated with chronic kidney disease. We anticipate this MNP platform has translational relevance for treating or protecting against multiple renal diseases and are working with clinical collaborators to bring this technology to the clinic.