New materials for treating and imaging inflammatory diseases

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Overview of Presentation

Inflammatory diseases cause millions of deaths each year and new strategies for treating and diagnosing inflammatory diseases are greatly needed. In this presentation two new materials will be presented, which are designed to enhance the treatment and diagnosis of inflammatory diseases, termed the polyketals and the peroxalate nanoparticles. The polyketals are acid sensitive polymers that degrade into neutral compounds and generate minimal inflammatory responses in vivo. Polyketal microparticles can enhance the treatment of inflammatory diseases by targeting therapeutics to macrophages and by acting as controlled release reservoirs. In this presentation I will present our recent in vivo data demonstrating that polyketal microparticles loaded with p38 inhibitors can improve cardiac function following a myocardial infarction, and also that polyketal microparticles loaded with siRNA targeting TNF-α can rescue mice from acute liver failure.

The second class of materials that will be presented are a new family of hydrogen peroxide sensing contrast agents, termed the peroxalate nanoparticles. The overproduction of hydrogen peroxide is implicated in the development of numerous inflammatory diseases and there is currently great interest in developing contrast agents that can image hydrogen peroxide, in vivo. In this presentation, we demonstrate that nanoparticles formulated from peroxalate esters and fluorescent dyes can image hydrogen peroxide in vivo with high specificity and sensitivity. The peroxalate nanoparticles have several attractive properties for in vivo imaging, such as tunable wavelength emission (460-630 nm), nanomolar sensitivity for hydrogen peroxide and excellent specificity for hydrogen peroxide over other reactive oxygen species. The peroxalate nanoparticles were capable of imaging hydrogen peroxide in the peritoneal cavity of mice, during an LPS-induced inflammatory response.