

James & Esther King Biomedical Research Program

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Ophthalmology
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2011 Program
Technology Transfer Feasibility
(1-year project)

Project Title: Functionalized Magnetic Nanoparticles as a Therapeutic Tool to Improve Axon Regeneration After Stroke

Project Summary: Stroke is a major cause of morbidity and mortality in the United States, and smoking remains a strong risk factor. After a stroke, the blood supply to the central nervous system is interrupted, inducing axon injury and neuronal death. [An axon is a long fiber of a nerve cell that carries outgoing messages.] After a stroke, the axons are severed from their targets and fail to regenerate leading to permanent loss of functions. This failure has been attributed to the presence of axon growth-inhibitory molecules in the neural scar, as well as to lack of sufficient axon growth-promoting molecules. Although there are approaches to neutralize inhibitory signals and add growth-promoting signals, delivery to the lesion site is problematic, limiting effectiveness. Interestingly, axons transport different molecules back and forth using specific cell machinery. In the present study, we are using magnetic nanoparticles to enhance regenerative axon growth after stroke. First, we will coat magnetic nanoparticles with agonist antibodies that both direct them to the injured axon tip using cell transport machinery and also stimulate growth-signaling. Next, we will induce axon elongation using magnetic fields, which may work by mechanical stretch and by sequestering the agonist antibodies at the injury site. We believe that such use of nanotechnology may provide a novel method for delivering treatment to promote nerve regeneration after stroke that may not be achieved by any other current technology.