Despite 20 years of experience with thrombolysis of cerebral blood clots with tissue-type plasminogen activator (rt-PA), fifty percent of patients remain disabled for life. A narrow therapeutic time window, insufficient thrombolysis rates, serious side effects, and time-consuming imaging techniques decrease the efficacy of stroke treatment. MAGneTISe aims to develop a new, two-pronged approach by combining the therapy and monitoring of stroke patients with Magnetic Particle Imaging (MPI).

This new imaging technique enables rapid assessment of cerebral perfusion (real-time-MPI), as well as the steering of superparamagnetic iron oxide nanoparticles (SPIO) by magnetic fields (force-MPI). We will develop strategies for continuous bedside cerebral perfusion monitoring, using red blood cells (RBC) as a biomimetic tracer-delivery system for the SPIOs, which otherwise would have been quickly eliminated. This method will enable rapid diagnosis of stroke or bleeding and facilitate faster treatment and better patient outcomes. Using the magnetic fields of the MPI system, we will trap the coupled nanoparticles in the occluded vessel, which will locally increase the amount of active enzyme, resulting in an increased rate of successful revascularization while decreasing systemic side effects.