



2007

Materials Council Seminar Series

Georgia Institute of Technology

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Endowed Eminent Scholar in Imaging
Coulter Department of Biomedical Engineering
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“Alternative Approaches for Magnetic Resonance Imaging With Magnetic Nanoparticles”

Tuesday, September 4, 2007
Classroom 299 – Love Building
3:00-4:00PM

ABSTRACT

Magnetic nanoparticles are widely used as a contrast agent in MRI. Presently, imaging with magnetic nanoparticles is mostly based on T_2^*/T_2 contrast, which is not ideal because it results in a decrease of MR signal (negative contrast) and undesirable signal loss and exaggeration of spatial extent. A number of approaches have been developed to produce the so-called positive contrast but they are based on macroscopic magnetic field changes. We developed an alternative approach that is not related to T_2^*/T_2 contrast and sensitive to the microscopic field disturbances induced by the magnetic nanoparticles. The technique is based on saturating spins near the particles and exploits an effect that can be controlled on the scale of T_1 and is sensitive to diffusion. The technique was demonstrated to be sensitive to the magnetic nanoparticles. In addition, an empirical model was also been developed to account for the dependence of the contrast on the diffusion.

Molecular imaging with magnetic nanoparticles are presently done with cell labeling with exogenous particles or delivering of biologically conjugated particles; these approaches suffer from dilution in vivo and cannot be readily used to monitor in vivo gene expression. To avoid this problem, we have developed an MRI reporter gene using a gene native to magnetotactic bacteria. Expression of this gene in mammalian cells led to the production of magnetic nanoparticles and hence the MRI contrast.

Gene expression in vivo also lead to significant MR contrast. This approach is expected to be used in MRI as GFP is used in optical imaging.

BIOGRAPHY

Xiaoping Hu obtained his Ph.D. in medical physics, focusing on MRI, from the University of Chicago in 1988. After post-doctoral training, he worked at the University of Minnesota as Assistant Professor (1990-1994), Associate Professor (1994-1998) and Full Professor (1998-2002). In January 2002, he moved to Emory University/Georgia Institute of Technology to become Professor of Biomedical Engineering, Georgia Research Alliance Endowed Eminent Scholar in Biomedical Imaging, and Director of the Biomedical Imaging Technology Center. His research interest lies in the development and biomedical application of magnetic resonance imaging/spectroscopy. To date, Dr. Hu has authored or co-authored 134 peer-reviewed journal articles and given 100+ invited talks and numerous conference presentations and holds 4 MRI patents. He is currently a deputy editor of Magnetic Resonance in Medicine. He has been an Associate Editor of IEEE Transactions on Medical Imaging since 1994. Dr. Hu is a fellow of the International Society for Magnetic Resonance in Medicine in 2004.

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