

Title: Cell Labeling and Tracking

Abstract

MRI is experiencing a rapid expansion in methods and materials designed to visualize specific cell populations *in vivo*. Cell tracking enables the exploration of sophisticated biological processes *in vivo* at the whole organism level and enables monitoring of new generations of cellular therapeutics. These capabilities are facilitated by the development of new imaging probes that label cells in culture prior to transfer into the body, target specific cell types *in situ*, or alter a cell's proteome to facilitate MRI detection. We will also discuss cell tracking approaches that are suitable for clinical translation.

Specific topics discussed will include, for example:

- Suitable imaging probes for intracellular labeling
 - Metal-ion based small molecules and nanoparticles
 - Perfluorocarbon emulsions
 - DNA-based imaging reporters
 - Probes for multimodal detection
 - Theranostics probes
- *Ex vivo* versus *in situ* cell labeling
- Intracellular probe delivery
- Cell type-dependent labeling considerations
- Probe cytotoxicity considerations
- MRI hardware considerations for cell tracking
- Pulse sequence design for cell tracking
- Sensitivity limitations
- Preclinical studies
 - Immune cells
 - Inflammatory macrophages
 - Stem cells
- Clinical cell tracking feasibility
- Patient safety considerations
- Regulatory environment for MRI cell tracking
- Clinical ¹⁹F cell tracking using perfluorocarbon emulsions

Background references:

Ahrens, E.T., Bulte, J.W.M. (2013) Tracking immune cells *in vivo* using MRI. *Nat. Rev. Immunol.* 13: 755-763
<http://www.ncbi.nlm.nih.gov/pubmed/24013185>

Ahrens, E.T., Zhong, J. (2013) *In vivo* MRI cell tracking using perfluorocarbon probes and fluorine-19 detection. *NMR Biomed.* 26(7): 860-871
<http://www.ncbi.nlm.nih.gov/pubmed/23606473>