Microscopic MRI

Spatial resolution is limited by
- T2 decay
- Diffusion
- Susceptibility artifacts
- SNR
- FOV (gradient strength)
Microscopic MRI

Signal recovery
- Increase B0
- Optimizing RF coil
- 3D imaging
- Fast imaging

Bottom line: 2µm resolution at 14.1 T (geranium leaf stem)
Microscopic MRI of nervous system

Cell lineage tracing using MRI contrast enhancement agent by microinjection

Agent should have good signal
Physiologically inert
be membrane impermeable

DTPA-Gd bound to dextran
Microscopic MRI of nervous system

MRI of frog embryo

Histology  overlay  MRI
Mapping two cell lines
X laevis tadpole
Mouse neonate
In vivo and in utero!
Manganese Enhanced MRI (MEMRI)
Mapping Prefrontal Circuits In Vivo with Manganese-Enhanced Magnetic Resonance Imaging in Monkeys

Janine M. Simmons,¹ Ziad S. Saad,² Martin J. Lizak,³ Michael Ortiz,¹ Alan P. Koretsky,³ and Barry J. Richmond¹
¹Laboratory of Neuropsychology and ²Scientific and Statistical Computing Core, National Institute of Mental Health, and ³NMR Imaging Research Facility, National Institute of Neurological Disorders and Stroke, National Institutes of Health, Department of Health and Human Services, Bethesda, Maryland 20892-4415