



High Magnetic Field MRI Evidences Pathways for Metabolic Brain Waste Clearance

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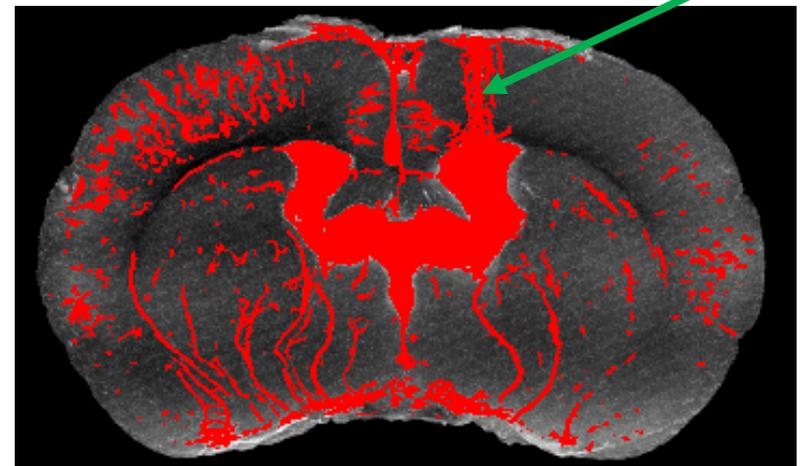
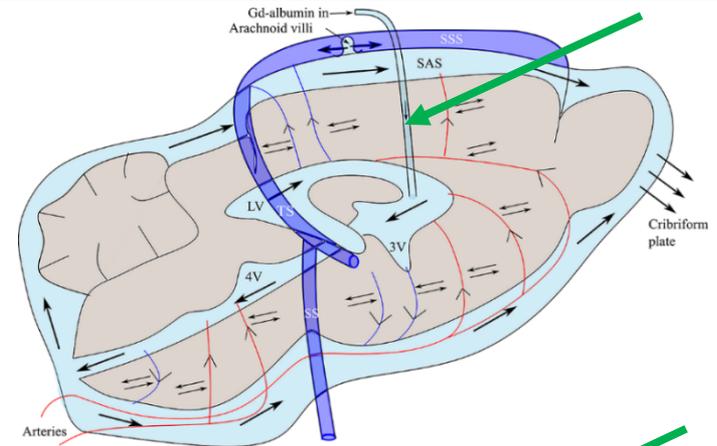
The brain is the only part of the body without a lymphatic system to clear metabolic waste. Recent evidence suggests brain clearance of waste may be accomplished in the annular spaces around cerebral blood vessels, called perivascular spaces (PVS), through which cerebrospinal fluid (CSF) is transported.

In this work, MagLab users reconstructed the PVS network in the whole rat brain using the MagLab's 17.6T, 89mm bore MRI system to measure contrast enhanced three-dimensional images of the PVS with a resolution that is two orders of magnitude higher than previously reported.

An MR visible tracer (Gd-albumin) was infused *in vivo* into the CSF-filled lateral ventricle followed by *ex vivo* high-resolution MR imaging (Figure 1). Tracer distribution patterns were reconstructed using a tube-following algorithm, since the PVS surround the blood vessels. This results in a more complete visualization of the PVS network in the brain (bright regions in the bottom image) to elucidate both PVS uptake and clearance pathways. PVS connections were highlighted repeatedly across several brains, and new PVS connections between ventricles and different parts of the functional tissue of the brain were revealed. This suggests a role for the ventricles as a source or sink for metabolites in the brain.

Facilities and instrumentation used: AMRIS Facility & 17.6 T, 89 mm bore MRI system.

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(Top) Cartoon of side view and (bottom) actual MRI cross-section of the mouse brain, showing injection site for the contrast agent (**green arrows**) and circulation pathways in the brain. MRI at 17.6T shows that the Gd-Albumin contrast agent (**red in bottom image**) circulates through the ventricles and perivascular spaces of the brain.