MR Phase Contrast and Susceptibility Weighted Imaging of the Rodent Brain

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We are currently working on developing methods to enhance contrast between brain tissue structures by exploiting the phase MR signal at high-field strength. Magnetic heterogeneity of brain tissue is caused by the venous vascular system (paramagnetic blood deoxyhemoglobin), by different tissue iron concentrations and tissue myelin content. These heterogeneities are the origin of phase contrast and susceptibility weighted imaging (SWI) since they induce an offset in the resonance frequency that can be detected in the signal phase. In this study SWI was employed to improve contrast between several regions of different magnetic susceptibilities by combining magnitude and phase information. This method gives a comprehensive insight of the venous rat brain vascular system as shown in (A). Phase contrast images revealed, often more clearly than the corresponding magnitude images, the laminar structure of the rat cortex (B-b), and the cortical layers of the living mouse cerebellum, resolution 30×30×200 µm3, scan time ~12 min (C-b).

Figure 2: A. MR venography of the rat brain; B. Magnitude (a) and high-pass phase image of the rat brain (b) revealing five cortical layers of alternating brightness; C. Magnitude (a) and high-pass filtered phase images (b) depicting the cortical layers of the living mouse cerebellum.