Brain Functional Imaging with Hyperpolarized $^{129}$Xe MRI
We demonstrate the first use of HP $^{129}$Xe MRI for functional brain imaging of a stimulus evoked pain response in the cerebral cortex of the rat. Our results show that the anatomical specificity of HP $^{129}$Xe functional MRI is comparable to conventional functional MRI (fMRI) methods; the percent increase in HP $^{129}$Xe signal over baseline ($90-140\%$) is much greater than that obtained for conventional BOLD fMRI ($2$ to $8\%$), and functional activity can be determined from a single set of images, demonstrating that single-shot fMRI is possible with this method.

Validation of Hyperpolarized $^{129}$Xe T$_1$ in the Rat Brain
Although T$_1$ values have been reported for human, rat and mouse brain, the values are not consistent for any species and range from $3.6$ to $26$ seconds in the rat brain. In this study, we reconciled discrepant measures of T$_1$ for HP $^{129}$Xe in the rat brain by using two methods which have been corrected for errors introduced by low SNR measurements. The HP $^{129}$Xe T$_1$ in the rat brain was determined to be $15.3\pm1.2$ and $16.2\pm0.9$ sec respectively, which are highly consistent ($0.9$ sec difference), and offer a resolution to the discrepancy.

Imaging Stroke with Hyperpolarized $^{129}$Xe MRI
We show that HP $^{129}$Xe MRI is able to detect with anatomical specificity an area of decreased cerebral blood flow (CBF) induced by middle cerebral artery occlusion (MCAO). These results were compared with a method of determining the areas of critically ischemic tissue, namely, proton ADC mapping. The results demonstrate the feasibility of detecting stroke using HP $^{129}$Xe MRI and suggest that HP $^{129}$Xe MRI may serve as a complementary tool to proton MRI for studying the structure and function of the brain.