Utilization of MRI of the Brain by neonatal intensive care unit (NICU) physicians has increased substantially in recent years. At St. Louis Children’s Hospital, we have seen 200% growth in MRI of the Brain from the NICU over the last 5 years. This increase has been fueled by development of best practices, skilled transport teams and technological advances that allow for safe scanning of ever smaller and sicker newborns. These advances present the MR community with opportunities to make a difference in the lives of the children we image. As a first step, we can examine the effects of prematurity on brain development and maturation. In parallel, we can investigate which NICU practices promote healthy brain maturation. For neonates who suffer perinatal insults, MR plays an important role in characterization of brain injury in the newborn. Moving forward, we must seek to understand how the abnormalities we detect on MR serve as predictors of patient outcome through longitudinal studies which measure neurocognitive performance well into school age. We also must seek to understand the role that MR can play in the triage of the at-risk newborn for neuroprotective strategies and/or in the assessment of therapeutic efficacy of clinical interventions.

While the MR research community is making great progress in advancing the understanding of the neonatal brain, many challenges remain. Many of our advanced techniques (e.g., DTI, ASL, BOLD, MRSI) have limited spatial resolution. The challenge of imaging extremely small structures with contrast properties that change dramatically as the brain matures should keep investigators busy for years to come. The image to the right illustrates that cortical thickness is less than 2 mm in preterm newborns, less than half the adult value. Progress will come with advances in RF coil design and gradient performance as we have come to expect. MR pulse sequence innovations are needed to simultaneously limit the impact of patient motion, push the limits of resolution and maintain reasonable imaging times for these most fragile patients.