Is white matter in infancy related to music aptitude abilities in preschool?

Jennifer Zuk[1,2], Michael Figuccio[1], Joseph Sanfilippo[1], Jade Dunstan[1], Clarisa Carruthers[1], Nicolas Langer[1], Xi Yu[1], Ellen Grant[1], Nadine Gaab[1,2,3]

[1]Laboratories of Cognitive Neuroscience, Boston Children's Hospital, Boston MA, [2]Division of Medical Sciences, Harvard University, Boston MA, [3]Harvard Graduate School of Education, Cambridge MA

A growing body of evidence has identified structural brain alterations in musically trained relative to untrained individuals, with enhanced properties of white matter in several language-related tracts. In addition, longitudinal studies have shown training-induced structural plasticity following musical training, particularly in the corpus callosum. However, it remains unclear whether there may be neural predispositions for success with musical training. This raises an intriguing question of the extent to which these observed training differences in brain structure may be influenced by variability in brain structure in early childhood. To address this unknown in the literature, the present study investigated whether early brain structure relates to subsequent music aptitude skills by tracking properties of white matter connectivity in infancy with behavioral outcomes in preschool. This study draws from an ongoing longitudinal investigation of children with and without familial risk for language-based learning difficulties. Initially, structural MRI and DTI were successfully acquired with infants (ages 4-18 months) using a natural sleep technique. Automated Fiber Quantification was employed to estimate white matter properties. Infants were then longitudinally enrolled and completed a follow-up MRI and behavioral assessment in preschool, which included evaluation of music aptitude and language skills. Longitudinal analyses were employed to examine the extent to which properties of language-related white matter tracts in infancy may be predictive of subsequent music aptitude skills in preschool while accounting for age and nonverbal IQ. Preliminary findings establish significant positive relationships between several language-related white matter tracts in infancy and music aptitude abilities in preschool, especially the corpus callosum. Effects were found to remain significant even after accounting for language abilities. This research has the potential to uncover white matter properties that may serve as a scaffold upon which ongoing experience in development can build.