Project Title: Will interactive acoustic experience optimize rapid auditory processing and prelinguistic acoustic mapping critical to later language in infants at familial risk for autism?

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Compromised language abilities and auditory processing deficits are ubiquitous in individuals with Autism Spectrum Disorder (ASD). Due to its high heritability, younger siblings of children diagnosed with ASD are at high-risk for the disorder and thus around 20% will also develop ASD, often showing language delays as early as 12 months of age. Moreover, within the subset of siblings not subsequently diagnosed with ASD, 10-38% will later meet diagnostic criteria for language delay.

The aim of this research is to support early language development in infants at high-risk for ASD in order to improve later language outcomes. During typical development, the infant brain constructs a precise representation or “map” of native language sounds which then allows the child to process incoming speech quickly and efficiently. To create accurate maps, infants must be able to discriminate fast, successive changes in auditory sounds occurring in the ten of milliseconds range. The neural mechanisms sub-serving language acquisition in ASD are still poorly understood. However, as language delays emerge very early in infants at familial risk for ASD there is a high probability that prelinguistic processing abilities are compromised in those infants. Since the critical foundations of phonemic mapping are established well before spoken language emerges, efforts oriented to improving language outcomes in siblings of children with ASD should begin in early infancy.

The Infancy Studies Laboratory at the Center for Molecular and Behavioral Neuroscience at Rutgers, Newark, has developed a 6-week acoustic training protocol to target key linguistic precursors over the period when the foundations of language are being established. This intervention protocol is based on an interactive acoustic experience using spectrotemporally-modulated non-speech stimuli, operant conditioning, and infant-control algorithms to adaptively drive brain plasticity, provide support for prelinguistic acoustic mapping, facilitate discrimination abilities, and enhance infant auditory processing speed and attention. Starting at 4 months of age, infants engage in this baby-friendly interactive protocol that encourages them to discriminate between brief, successive sounds that become increasingly faster and more complex. The training protocol to be used has proved successful in enhancing processing speed and attention in typically developing infants at the same ages and offers the promise of ameliorating or perhaps even preventing the disrupted language acquisition seen in ASD.

To examine effectiveness of the interactive training protocol, pre- and post-intervention responses will be compared among (1) trained infants at high-risk for ASD, (2) a group of typically developing infants previously trained, and (3) a group of age-matched untrained naïve controls. Electrophysiological measures including EEG, Event Related Potentials (ERPs) and assessment of changing oscillatory dynamics as well as standardized language and cognitive assessments will allow us to determine whether neural and behavioral changes in acoustic discrimination skills and fine-tuning of phonemic mapping were induced in the group of infants at high-risk for ASD.