MEG study of Cortical Coherence in Autism

Tal Kenet, PhD[1], **Elena Orekhova, PhD**[2], **Nandita Shetty, MSc**[1], **Adrian KC Lee, PhD**[3], **Mark Vangel, PhD**[4], **Martha R. Herbert, MD, PhD**[1] and **Dara Manoach, PhD**[3],
(1)Neurology, Massachusetts General Hospital / Harvard Medical School, Boston, MA 02129, (2)Institute of Neuroscience and Physiology, Sahlgrenska Academy, Gothenburg University, Gothenburg, Sweden, (3)Psychiatry, Massachusetts General Hospital / Harvard Medical School, Boston, MA 02129, (4)Radiology, Massachusetts General Hospital / Harvard Medical School, Boston, MA 02129

Background: Recently, a significant body of evidence has accumulated in support of the cortical hypo-connectivity hypothesis of autism; the hypothesis states that individuals with autism have weaker than normal long range cortical functional connectivity, which may contribute to the cognitive abnormalities underlying autism. The majority of the studies investigating this thesis are fMRI based. While those studies have enriched the field significantly, they are limited by the low temporal resolution of fMRI, which prohibits fine temporal resolution analysis of functional connectivity.

Objectives: Our goal was to further our understanding of the nature of hypo-connectivity in autism, and specifically its correlation with (1) specific frequency bands, (2) task demands, and (3) distance between the cortical regions.

Methods: We studied 8 high functioning adults with autism and 8 age and gender matched healthy controls (6 of 8 were also verbal IQ matched) using whole head Magnetoencephalography (MEG). We looked at three conditions – fixation with i) no immediate associated task ('fixation'), and in preparation for ii) a saccade or iii) an antisaccade task. For each subject and condition, we analyzed 64 seconds of concatenated data for coherence in the delta, theta and alpha frequency bands.

Results: Significant coherence reduction in autism was observed during 'fixation' and antisaccade preparation ($p<0.02$), but not during prosaccade preparation, in the delta band. A tendency for coherence reduction was also found in theta band during antisaccade preparation ($p<.07$), and in the alpha band ($p<.07$) during 'fixation'. The observed differences tended to be more pronounced for longer distances, ensuring this is not a volume conductance effect. The regions driving the differences were mostly posterior (mainly occipital).

Conclusions: These observations support the hypothesis of weaker long-range cortical functional connectivity in autism. Our thus far preliminary findings indicate that weaker functional connectivity seems to be band, task, and region dependent.