Abstract for the Fourth International Symposium on the Fetal Brain

Pregnancy, Stress, and Depression: Impact on the Developing Fetal Brain

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Abstract Title:

Mapping the neonatal microbiome-gut-brain axis: Use of data driven approaches to MR imaging to study relationships between early brain development and the microbiome.

Background:

Advanced MR imaging offers novel insights into the gut-brain axis. Recent studies have examined links between gut microbiota, brain connectivity, and/or infant behavior. Using a candidate region of interest approach gut microbial diversity has been associated with

functional connectivity between the amygdala and thalamus. To determine the feasibility of using data driven approaches, this proof of principle study was undertaken to study relationships between the neonatal microbiome and early whole brain development.

Objective:

To investigate the use of a data driven approach to neonatal MRI measures of functional connectivity and metabolism.

Study Design/Methods:

Healthy preterm neonates (*N* = 17 fcMRI; *N* = 12 MRS) were scanned at (36 ± 3 weeks and 40 ± 6 weeks post conceptual age, respectively) to obtain measures of functional connectivity (fcMRI) and metabolism (MRS).

We analyzed the relationship between whole brain BOLD signal and microbiome diversity with PLS for mixed data types (MiMoPLS). We then examined the relationship between metabolite levels and diversity using a similar approach, PLS Correspondence Analysis (PLS-CA). The PLS analyses examine shared covariance between brain measures and abundance, giving microbiome abundance associated networks of brain activation (resp. metabolite levels).

Results:

MiMoPLS found brain functional connectivity networks that included activations in regions in the basal ganglia most strongly associated with citrobacter, coprobacillus, and peptostreptococcus count levels. PLS-CA found associations between brain metabolites and bacteria counts, specifically between MM14 and pluralibacter and bacterioides.

Conclusion:

Data driven approaches tailored to the data-types seen in fcMRI, MRS, and the microbiota provide promising approaches to mapping the gut-brain axis and the symbiotic relationship between gut health and early brain development.