An investigation of congenital agenesis of the corpus callosum
Alexis Delgado1,2, Jason S. Nomi3, Bryce Dirks3 & Lucina Q. Uddin3
1REU, Department of Computer Science, University of Miami, Coral Gables, FL, USA; 2Avila University, Kansas City, MO, USA; 3Department of Psychology, University of Miami, Coral Gables, FL, USA.

Introduction
• Individuals with congenital agenesis of the corpus callosum present the unique opportunity to study the way connections of the brain respond to a major developmental disruption.
• Previous research in a patient who has undergone commissurotomy to alleviate intractable epilepsy demonstrated that increased structural integrity in subcortical pathways may facilitate inter-hemispheric communication after white matter fibers of the corpus callosum are surgically severed.
• We hypothesized that similar to what was observed in the commissurotomy patient, white matter pathways in a child with callosal agenesis would show increased integrity of subcortical pathways as a compensatory mechanism.

Methods
• Neuroimaging data (MRI) were examined for a 12-year-old child with congenital agenesis of the corpus callosum and ten age-matched control subjects.
• Diffusion weighted imaging data were preprocessed to correct for motion, eddy current and EPI distortion.
• The fractional anisotropy (FA) of inter- and intra-hemispheric white matter pathways was measured and compared.
• Major white matter tracts were identified using region-of-interest (ROI) localization.

<table>
<thead>
<tr>
<th>Tract</th>
<th>Function</th>
<th>Location of ROI(s) and ROA(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arcuate Fasciculus</td>
<td>Connects Broca’s and Wernicke’s areas</td>
<td>ROI 1, ROI 2, ROI 3, ROA</td>
</tr>
<tr>
<td>Uncinate Fasciculus</td>
<td>Connects parts of the limbic system to the frontal lobe</td>
<td>ROI 1, ROI 2, ROI 3, ROA</td>
</tr>
<tr>
<td>Middle Cerebellar Peduncle</td>
<td>Cross-hemispheric</td>
<td>ROI 1, ROI 2, ROI 3, ROA</td>
</tr>
</tbody>
</table>

Results
Congenital Agenesis of Corpus Callosum

<table>
<thead>
<tr>
<th>Arcuate Fasciculus (AF)</th>
<th>Uncinate Fasciculus (UF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td>Right</td>
</tr>
</tbody>
</table>

Below, structural scans show clear white matter paucity, which is resulting in ex-vacuo ventricular dilatation. This malformation is a result of callosal agenesis.

Typical age matched peers

Discussion
• Despite organizational differences in important white matter structures, the overall FA in white matter structures in the callosal agenesis patient are not significantly different from typically developing peers.
• These findings suggest that the developing brain of the patient with agenesis does not use a subcortical interhemispheric pathway to compensate for the lack of interhemispheric white matter pathways, as previously demonstrated in an adult commissurotomy patient.
• Our results contribute to a better understanding of the brain’s plasticity, particularly with respect to inter-hemispheric white matter pathways.

Acknowledgments
Thank you Dr. Rosenburg for coordinating this REU opportunity. Thank you to Dr. Jason Nomi and Dr. Lucina Uddin for welcoming me this summer and for the mentorship throughout this project. This material is based on work supported by NSF CNS-1659144 to AD and R01MH107549 to LQU.

References