KC Jacobson

Herz Global Impact Award

Ph.D. Student, Bioengineering in ChBE

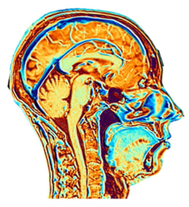
Third Year ARCS Scholar

Georgia Tech

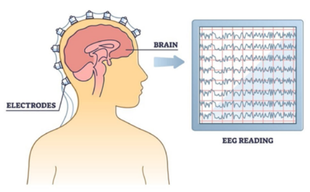
Quantifying neural & perceptual impairments in autism spectrum disorder (ASD) model mice

While the 1 in 36 children diagnosed with autism spectrum disorder (ASD) in the US have a range of traits and severity, sensitivity to sensory stimuli is relatively common across the disorder. My project leverages state of the art technology to record brain activity from mice genetically engineered with a human risk-factor of ASD as they perform a sensory task in order to directly link sensory impairments to single neuron deficits.

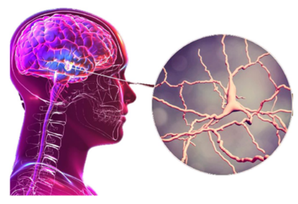
Autism spectrum disorder (ASD) affects 1/36 people[1], but finding the cause is still elusive.



No large brain malformations[2]



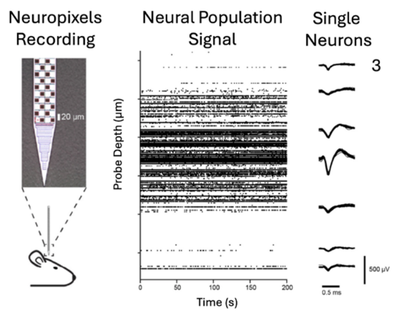
No consistent functional changes found in EEG or fMRI[2]



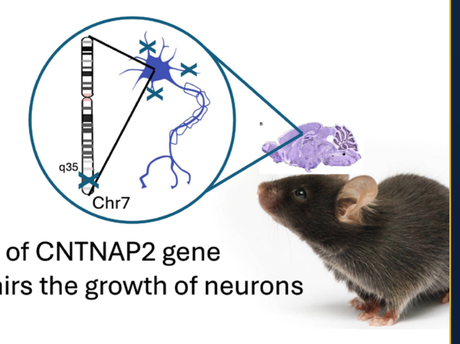
However, post-mortem studies have shown microscopic defects in individual neurons[2]

How can we measure microscopic neural differences in a live brain?

State of the art electrodes for in-vivo cellular recordings



Genetic engineering to recreate human ASD risk factor genes in mice

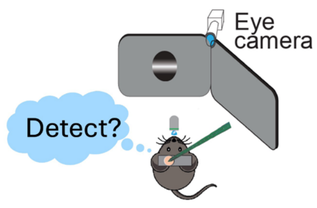


Loss of CNTNAP2 gene impairs the growth of neurons

How do we link neural activity to behavior in an animal model?

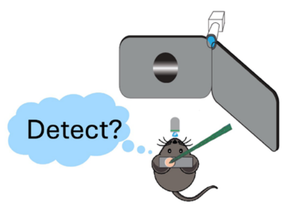
- ~90% of people with autism experience hyper- or hypo-sensitivity to sensory stimuli[1]
- The visual processing system is highly conserved across mammals

→ Train our ASD model mice in a visual detection task to test sensitivity to stimuli at a range of contrasts, and directly link behavior to simultaneous neural recordings

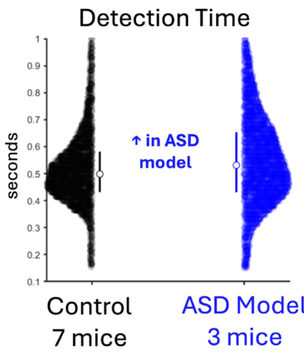


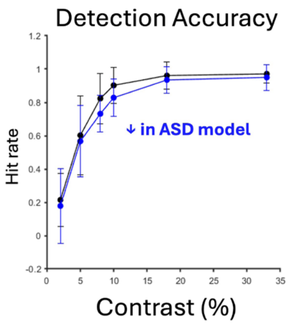
Lick	Hit	False Alarm
Not Lick	Miss	Correct Reject

Validation of Model: ASD model mice exhibit decreased performance in our behavioral task.

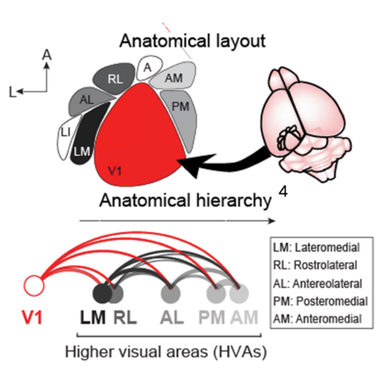


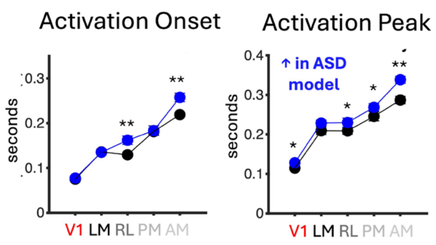
ASD Model Mice
Wildtype Control



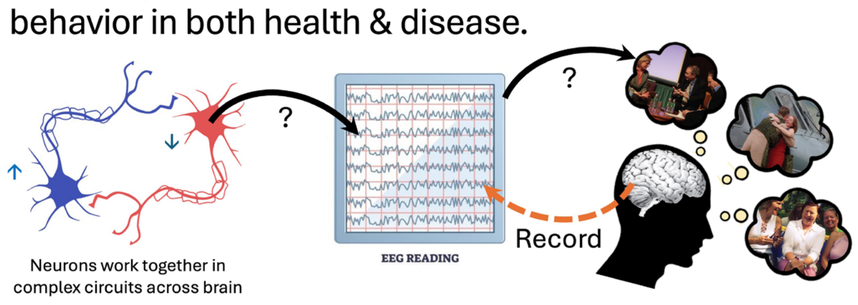


Increased detection time linked to delayed timing of neuron activation across visual brain areas.





Goal/Future Steps: Understand how single neurons come together to form brain-wide activity to create behavior in both health & disease.



Neurons work together in complex circuits across brain

Long term goal: Finding measurable, brain-wide signatures of ASD to improve quantitative diagnostics

Scholar Awards Celebration

November 13, 2024

ARCS Scholar Awards Celebration — ARCS Foundation Atlanta

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