THE ELISON LAB

for developmental brain and behavior research

Jed Elison, Ph.D.
Director of the E-Lab

Dr. Jed Elison is the Irving B. Harris Professor of Child Development at the Institute of Child Development and in the Department of Pediatrics at the University of Minnesota.

We had a great 2023 and we are thrilled to share some of our successes and convey some of the ways that YOUR CONTRIBUTION is advancing our understanding of early childhood brain and behavioral development! This year was somewhat sentimental and eye-opening, as 2023 marked 10 years at the University of Minnesota and 20 years of working in child development research for me. I couldn't be happier to take stock of what we've accomplished and how we're positioned to positively influence the lives of children in the future!

We continue to strive for new discoveries, new knowledge, and new understanding and we also remain committed to improving the health and well-being of children and their families. We couldn't do what we do if not for your generous contribution of time and effort participating in our studies. For that we are deeply indebted and humbled. In this newsletter, we will tell you about some of the projects our lab has been working on and we will also provide you with information about how to get involved with our current research studies. If you have questions, please feel free to reach us at elab@umn.edu or jtelison@umn.edu.

Get in touch!

612-301-6639

elab@umn.edu

2025 E River Pkwy
Minneapolis, MN

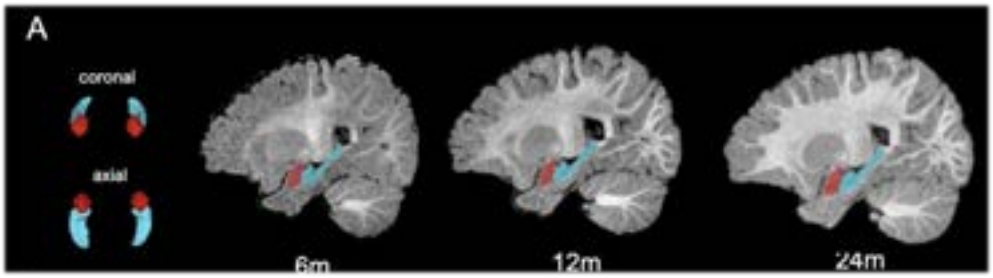
INSIDE THIS ISSUE:

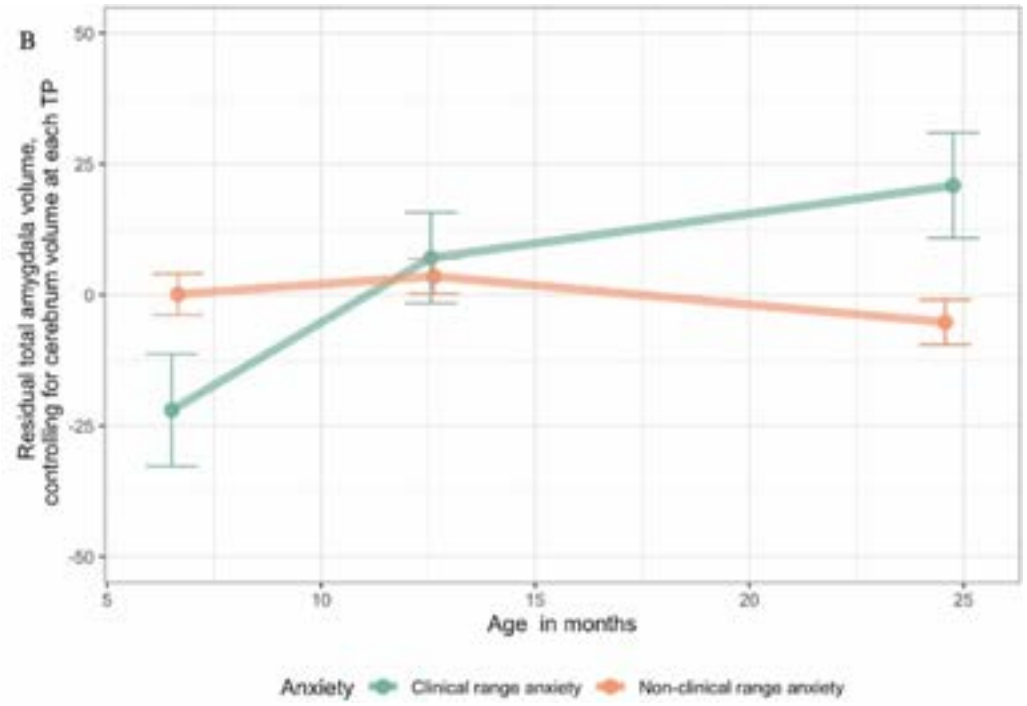
IBIS Study

Amygdala growth and anxiety

By Dr. Casey Burrows

E-Lab researchers Casey Burrows (faculty in pediatrics) and Carolyn Lasch (former graduate student) published new findings looking at the association between early amygdala growth and later anxiety symptoms in the IBIS sample. The amygdala is involved in emotion processing and has been shown to be larger in children with anxiety and autism. We used the IBIS-school age sample, which includes children at high- and low-familial likelihood for autism: the high-likelihood (HL) participants all had an older sibling with autism, and the low-likelihood (LL) participants all had an older sibling who was not autistic. We used MRI scans from 6 to 24 months to measure amygdala volume change in early childhood, as well as autism and anxiety symptoms at school age (7-11 years). We found that early amygdala growth was associated with school-age anxiety, more so than the presence of autism. This research helps us understand how early development can "set the stage" for later anxiety and points us toward new ways of identifying kids at most risk for anxiety later on.





IBIS Study

Early temperament, restricted/repetitive behaviors, and later internalizing problems in school-age children

By Dante Rogers and Dr. Chimei Lee

Children with autism spectrum disorders (ASD) have an increased likelihood of experiencing mental health challenges, with anxiety being one of the most prevalent internalizing problems among autistic individuals. Both autism and anxiety are shown to be associated with distinct early temperament profiles and share similar behavioral presentations. Among infants with both elevated and typical likelihood of ASD, early fearful temperament is specifically associated with subsequent restricted and repetitive behaviors.

Moreover, recent studies have also found connections between repetitive behaviors (such as ritualistic and sameness behaviors) and internalizing behaviors among typically developing toddlers. Recent research led by Dr. Chimei Lee within the Elison Lab suggests that certain repetitive behaviors may mediate the relationship between fearful temperament and internalizing problems in infancy and toddlerhood; however, there remain gaps in our understanding of how dimensions of early temperament, anxiety symptoms, and restrictive and repetitive behaviors relate to one another later in development.

Using longitudinal data from the IBIS network, we were able to examine the relationship between early temperament (at 24 months), repetitive behaviors (at either 24 or 36 months), and internalizing behaviors (at 7-10 years old) among school-age children with elevated and typical likelihood of ASD.

Results suggest that early temperament of fearfulness was not significantly associated with school-age internalizing problems among participants, whereas measures of effortful control (inhibition control and attention shifting) were. Similarly, we found that specific repetitive behaviors were shown to mediate the relationships between early temperament (particularly among subscales related to effortful control) and school-age internalizing problems. These findings may indicate that the role of specific temperament traits varies over time as children develop cognitively, emotionally, and socially. We hope to further explore the long-term interplay of repetitive behaviors and school-age psychopathology among elevated- and typical-likelihood ASD populations.

IBIS Study

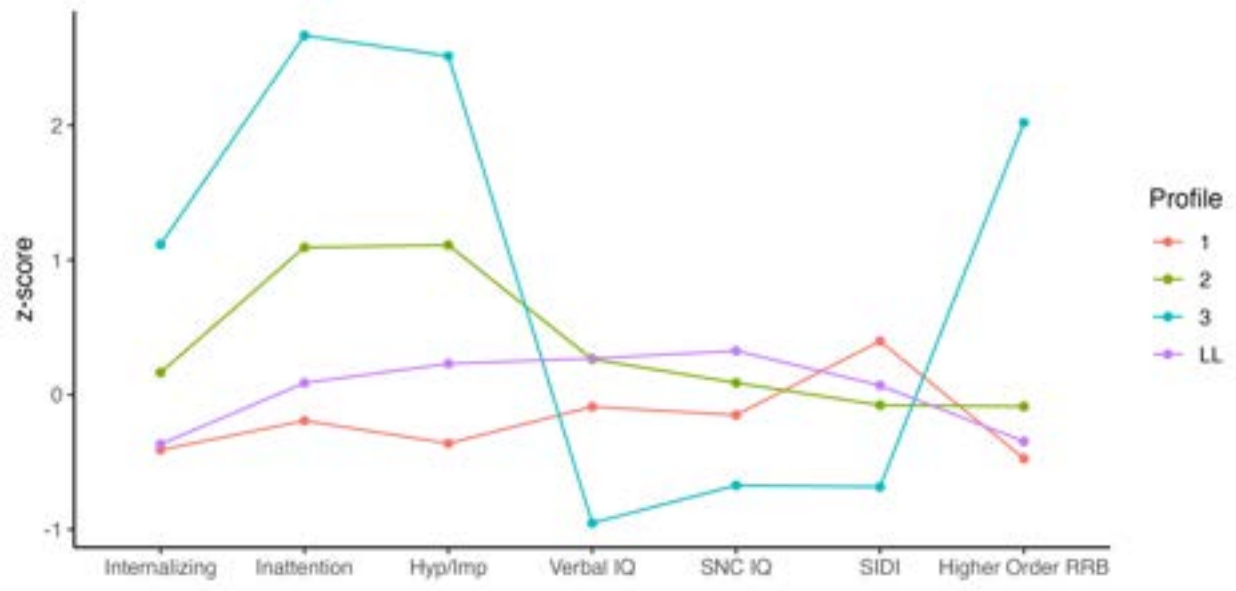
Behavioral profiles of children at higher likelihood for autism spectrum disorder

By Ekom Eyoh

As part of the Infant Brain Imaging Study, we collected school age outcomes data related to autistic features, ADHD features, mood disturbances, and IQ for children at high and low familial likelihood for developing autism. Using these outcomes, we derived three clinically meaningful profile groups within the high-likelihood children.

One profile had low autism, ADHD, and mood symptoms, average IQ scores, and looked more like the low likelihood children. Another group had low autism and low mood symptoms, average IQ, but elevated ADHD symptoms. Finally, the third group had high scores across autistic and ADHD features as well as mood disturbances and lower IQ. Children in this last group were more likely to be diagnosed with autism than those in other groups. We also found that school-age children with more ADHD, autistic, and mood features may have more trouble functioning independently within their various contexts and may require more supports regardless of diagnostic status. There were also sex differences in diagnosis, such that males were more likely than females to have an autism diagnosis.

Additionally, we looked at brain features related to these profiles. We found that girls in the second profile (ADHD-like) had larger amygdalae than those in the third profile. The amygdala is a brain region involved in emotion processing and regulation. The girls with larger amygdalae had lower mood disturbances and were less inattentive than those with smaller amygdala. It was also found that boys with autism had smaller caudates than those without autism. The caudate has been associated in ADHD characteristics and the boys with ASD did have higher inattention and hyperactivity impulsivity levels.



What do babies see? Eye tracking as tool for understanding infant attention

By Dr. Caitlin Sisk

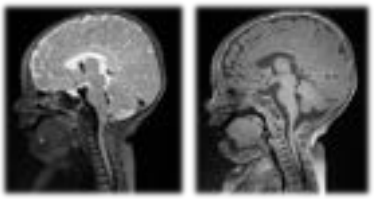
Infants cannot tell us with words what they are thinking or what they are interested in, but they may be able to tell us with their eyes. We are interested in seeing how what a child looks at relates to a child's age and cognitive development. If we want to learn from their eye movements though, we need to make sure that we are doing a good job tracking those eye movements.

When we look at infant and toddler eye-tracking data, we want to know both how accurate our measurements are and how precise they are. One way that we looked at accuracy was using a calibration task, where the only thing on the screen in front of the child was a single dot. We assume that when they were looking at the screen, they spent most of that time looking at that dot, since it was the only interesting thing to focus on. Based on this assumption, we measured accuracy as the distance between the detected location of their longest eye fixation and the location of that dot. Accuracy was overall high, and it improved with age. If our eye tracking is not only accurate but also precise, we would expect eye movements that are happening around the same time to also be around the same place. To measure this, we looked at the distance between detected locations of eye movements that were close together in time. In a task where we show children a video of women dancing and smiling, we found overall high precision that did not change much with age.

These findings give us confidence that our eye tracking is consistent and accurate. They also let us know that in some cases, changes in accuracy with age might influence our results. This can help us interpret eye tracking findings that change with age, so we can accurately characterize the relationships between cognitive development and eye movements in our ongoing research.

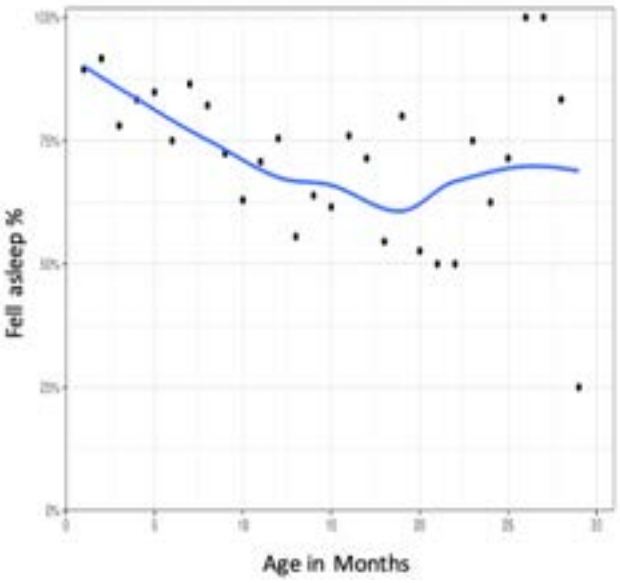
Natural sleep MRI scans: How well do they work?

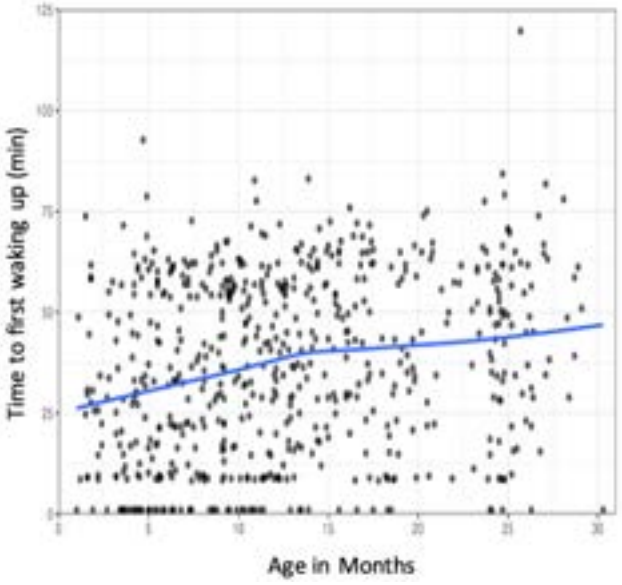
By Dr. Sooyeon Sung



"Is it really possible to MRI scan sleeping babies?" "What is your actual success rate?" We are often asked these questions by (mostly first-time visiting) parents. Yes, it is possible, and the success rate is high. Despite the unfamiliar environment and loud noise, about 4 out of 5 babies fall asleep, letting us collect data, resulting in an 83.5% success rate over 733 scan visits.

Does the success rate change by age? Yes and no. As you might expect, younger babies were more likely to fall asleep, but older babies stayed asleep longer once they fell asleep (see figures). Across all ages, babies slept about 35 minutes on average in the MRI scanner before they woke up. There were also interesting questions like "Do babies with older siblings sleep better?" We examined a comprehensive list of factors, including the number of siblings, temperament, sleep behavior, etc. One factor that had an impact was whether babies slept alone at home. Babies sleeping alone in their bed at home were more likely to sleep in the MRI scanner. However, it comes as a surprise that many other factors did not significantly influence the likelihood of scan success. Is it good news? Maybe. Any babies could fall asleep at scans, to put it in another way. Finally, we appreciate all families for their dedication to late-night scans. Whether babies fall asleep or not, we learn from every scan session which improves our environment and skills.





ACC Study

Early development in agenesis of the corpus callosum (ACC)

By Dr. Lauren Haisley

Agenesis of the corpus callosum (ACC) is a condition in which the part of the brain that connects the left and right hemispheres is fully or partially missing. It affects about 1 in 4000 live births. Our ACC Infant Study seeks better ways to help children grow to their full potential by studying mental and behavioral development in infants with ACC. We have enrolled 169 families from across the world who have completed a large set of questionnaires at 6-36 months. We have also had the privilege of seeing 41 of these families in-person at the Masonic Institute for the Developing Brain.

We are currently preparing to submit our first papers for publication from this project! My paper looks at adaptive functioning, or an individual's ability to independently complete specific tasks required by his/her environment, from 6 to 24 months. We measure adaptive functioning with a standard parent interview that asks parents what their child does independently across four main areas: communication, daily living skills (e.g., feeding, dressing, toileting), social skills and motor skills. Based on our interviews, children with ACC show some delays in motor skills from 6-24 months, while delays in communication and daily living skills seem to emerge over time. Importantly, parents reported that their children with ACC tend to show a real strength in their socialization skills during these early years. We also compared kids with ACC to kids with autism spectrum disorder (ASD) and kids with genetic conditions (Down Syndrome, Fragile X). Our group with ACC tended to perform similarly to the ASD group, except in social skills where the ACC group had higher scores. The ACC group also had higher adaptive functioning scores than kids with known genetic conditions by 24 months. We hope to share these findings with parents, as well as with providers who see children with ACC. The findings have direct implications for treatment recommendations (e.g., early intervention, speech therapy, occupational therapy), as well as what strengths to harness!

ACC Study

Early temperament in ACC

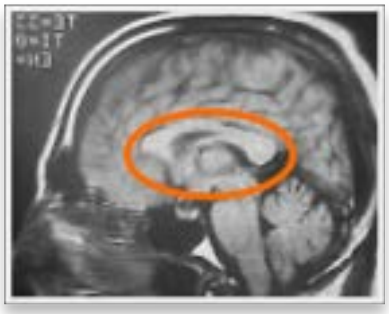
By Jasmin Turner, MS

The corpus callosum, a bundle of fiber connecting the left and right hemispheres of the brain, plays a pivotal role in the development of behavioral and cognitive skills during the initial two years of life. Research indicates that abnormalities in its structure are linked to various neurodevelopmental disorders, including autism spectrum disorder (ASD).

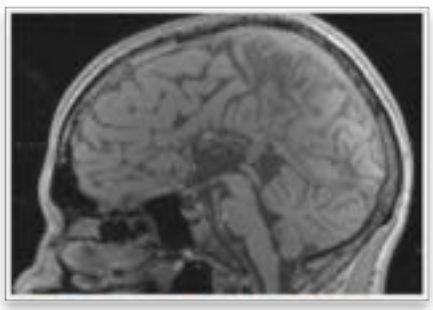
Furthermore, structural abnormalities in the corpus callosum have been identified in genetic conditions associated with an increased risk of ASD, such as Down syndrome (DS) and Fragile X (FX). Despite the higher incidence of ASD in infants with ACC, DS, and FX compared to the general population, there is limited knowledge regarding the similarities and differences in their early developmental trajectories. Studying these infants in the early years of life offers a valuable approach to understanding the early features and developmental trajectories associated with ASD.

In our study, we examined the early expression of temperament by comparing emotional expression across the first year of life among those with isolated ACC, monogenic disorders (DS, FX), or a high familial likelihood of ASD (without an ASD diagnosis [HL-] and with a diagnosis [HL+]), as well as low-likelihood control participants (LL-).

Overall, infants with ACC, Down Syndrome and Fragile X demonstrated reduced emotional expression. Infants with a diagnosis of ASD showed similar patterns of positive emotionality to the monogenic disorders, but higher rates of negative emotionality. These findings highlight the importance of interhemispheric connections in facilitating emotional expression in the first year of life. Notably, similarities between infants with ACC and infants at elevated familial risk of ASD suggest that disrupted callosal connectivity may specifically contribute to reductions in positive emotionality.



"Normal" Brain



Complete ACC

'Partial' ACC

Brain associations with language learning

The BCP

By Trevor Day

In 2023, we recruited six families who had worked with the E-Lab previously on the Baby Connectome Project (BCP). In that project, we scanned babies between birth and five years. For this project, we wanted to extend our understanding of their brain development, now that those children are three years older. These families participated in three to six MRI scans in spring, summer, and fall of 2023. Now, for these six children, we already have MRI scans over their first six years of life, which is a rare and unique dataset.

My research interests are in language acquisition, and so the children participated in an in-scanner language task modeled after a task originally published in German. That task looked at potential processing differences between "easy" and more complex sentences, for example:

1. *Where is the small beetle, who carried the big fox?*
2. *Where is the big fox, who was carried by the small beetle?*

There is an idea that, when faced with a difficult-to-understand sentence, children rely on cues from the meaning of the words if they don't understand the syntax completely. We hope to replicate the original study's findings about changes in the brain when children fully learn the syntax (here, the passive voice).

As of writing, we successfully acquired language data at 15/18 visits, and some data from the other three. We also acquired a type of scan known as "resting state," while the children watched movies in the scanner. More minutes is better, and two rock-star participants were able to hold still enough for 146 and 186 minutes respectively over their visit sequences. This will be an incredibly valuable resource, especially when combined with their BCP data. I am very thankful to the families for their time!

The BCP

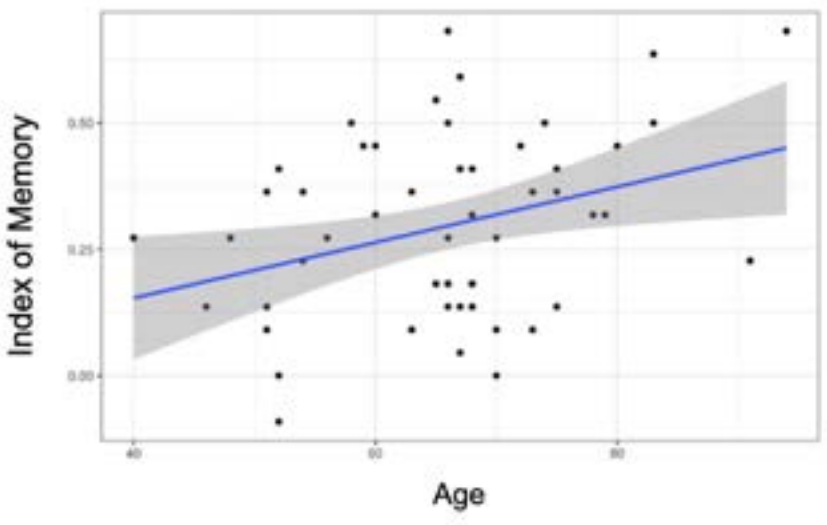
Baby Connectome Project: School age memory games

By Sally Stoyell

Henry the Puppet

This past year, we had many families come for a school-age follow-up of the Baby Connectome Study. Thank you to all of you who participated! This visit allowed us to start to understand how the development of the brain and different behaviors at very young ages might correlate with your child's cognitive abilities as they start to enter school. One of the specific abilities that we measured, among many, is the ability to remember specific objects and events. To measure memory, children played two different games. In one game, they watched videos of a girl "Abby" and a puppet "Henry" teaching them cool new facts - did you know that a group of rhinos is called a "crash"?? About a week later, we asked kids to recall the answers to these facts and asked them who taught them the fact - the girl or the puppet? Kids often did very well on this and even after a week, they remember a lot of the fun facts!

Children also played a game called the "inside-outside" game where they categorized objects as "inside objects" or "outside objects". By doing so, they memorized a lot of these objects, and were able to tell us if new pictures were "exactly the same", "kind of the same", or "completely different" from the "inside-outside" game pictures. Older kids were a lot better at remembering details than younger kids, and were much better at remembering which objects were only "kind of the same" as previous objects.



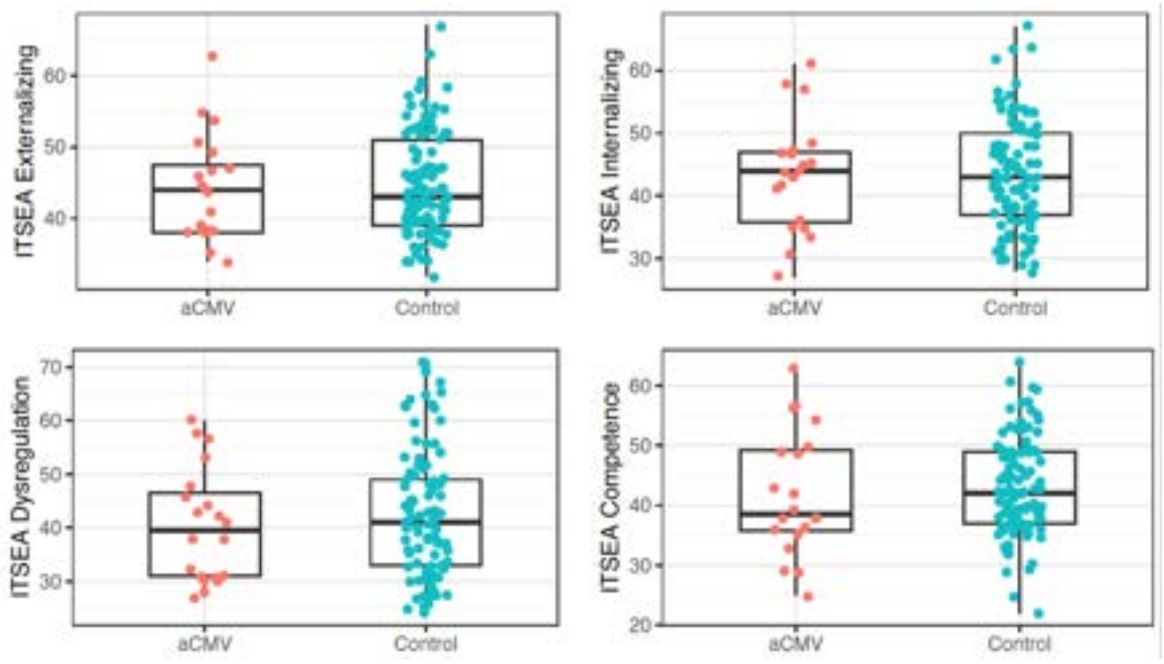
We're excited to use this information about memory to look at how brain development in these children might be able to predict how well they did on these new memory games!

Development with asymptomatic congenital cytomegalovirus

By Sally Stoyell

One of the most common viral infections that can be passed from a mother to an infant is an infection called congenital cytomegalovirus. Ninety percent of infants who test positive for this infection at birth don't show any symptoms. Infants who do develop symptoms from this infection though, can show severe hearing loss and neurological disability. Despite the prevalence of this infection, we don't yet understand the long-term consequences of an infant who tests positive for cytomegalovirus at birth, but doesn't show any symptoms. Does this asymptomatic infection have any long-lasting implications as a child grows up? To answer this question, infants born in the Twin Cities were tested for cytomegalovirus, and those who tested positive but didn't show any symptoms were recruited for a follow-up study.

These children completed behavioral testing and were compared to children who hadn't tested positive for cytomegalovirus. At 12 months old, we found that kids who had an asymptomatic cytomegalovirus diagnosis scored just as well as control children on the behavioral and developmental measures we tested. This so far is reassuring news to parents of children with an asymptomatic congenital cytomegalovirus infection, but there is still more work to be done! These kids are currently being followed out to even older ages to see if any differences appear as kids get older.



CURRENTLY RECRUITING!

Phenoscreening Study

Thank you to all our families who have participated in our Population Phenoscreening Study, or what many of you may know as the Early Childhood Study! This study aims to improve the early detection of autism through a population-based screening approach.

To date, over 2,000 families have enrolled in the study, with more than 3,600 online survey batteries being completed. We have also completed over 160 in-person visits and 270 remote parent interviews! We have closed enrollment for the study and are planning on wrapping up data collection by the end of the summer. Our team has just started analyzing the data we have collected and will begin presenting our work at conferences and writing papers soon. We want to thank you again for your time and contributions to our research. With your help we are working to improve early detection and developmental outcomes for many children who are diagnosed with autism spectrum disorder.

In addition, **we are also currently recruiting for our Infant Phenoscreening Study**. Infants between the ages of 5 and 7 months living in the Twin Cities area are eligible to enroll. For more information, please reach out to earlychildstudy@umn.edu

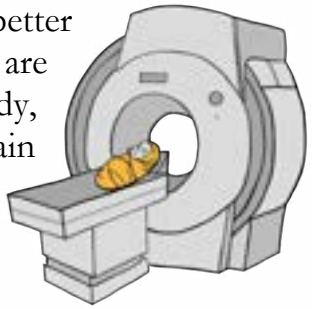
IBIS Study

One of the goals of our research in the E-Lab is to improve early detection of autism spectrum disorder (ASD). In Minnesota, the ASD prevalence rate is higher with about 1 in 36 children diagnosed with ASD. Of that, research suggests that 1 in 5 siblings of children with autism will develop ASD themselves. While the average age of diagnosis is 4 years old, children can start showing early signs of ASD as young as 6 months old. Moreover, families who have one child with ASD have an increased likelihood of having another child with ASD. Early detection of autism and access to early intervention services is crucial to improving long-term outcomes for these children. *(continued on next page)*

The E-Lab is a proud member of the IBIS (Infant Brain Imaging Study) Network. The IBIS Network is a consortium of researchers across North America that use a combination of behavioral testing, parent interviews, MRI brain imaging, and EEG to uncover important clues about infant development that can aid in early detection of ASD. Previous research by the IBIS network on infants with older siblings with autism found that MRI brain scans of infants as early as 6 months old can accurately predict later ASD diagnoses.

The IBIS-EP research study is currently recruiting! We're looking for families who have a child with autism and a new baby who is 6 months or younger. If you or someone you know is interested in participating in the study, please contact us at ibis@umn.edu or visit our website at www.ibis-network.org.

Baby Brain Development Study



This goal of our Baby Brain Development Study is to gain a better understanding of what variations in early brain development are involved with differences in children's behavior. Through this study, we can start to understand how different parts of the brain communicate with each other and how this organization impacts children's behavior, for example their response to sounds from the environment.

We are currently recruiting! Parents of 0-3 month-old infants may be eligible to enroll in this study. Parents who are currently pregnant can also reach out to the study team if they are interested in participating once their child reaches the appropriate age. As our aim is to take a very precise look at early brain development, we are inviting families to participate in a series of 4 MRI brain scans with their child. Participating children's MRI brain scans will occur in the evenings while they are naturally sleeping.

If you or someone you know are interested in learning more about this study, please email our team at babymri@umn.edu.

CELEBRATIONS IN THE E-LAB!

Welcoming new members to our team!

In the past year, we've welcomed four new members to our team — Angelina Jones, Sammy Lee, Hannah Lundblad, and Dante Rogers!

Angelina Jones
ICD Graduate Student

Sammy Lee
Study Coordinator

Hannah Lundblad
Study Coordinator

Dante Rogers
Research Staff

Welcome to Dr. Meghan Swanson!

Meghan Swanson, Ph.D.
Associate Professor
Department of Pediatrics

We recently welcomed long-time friend and collaborator, Dr. Meghan Swanson, to the Masonic Institute for the Developing Brain here at the University of Minnesota. She will be continuing her research program investigating the neurobiology of communication development and early language learning in addition to partnering with our team on a number of projects, including the Infant Brain Imaging Study (IBIS).

Sooyeon Sung completes dissertation defense

In March of 2023, E-Lab member Sooyeon Sung successfully defended her dissertation. Her work focuses on psychometrics and temperament in infancy. Congratulations, Dr. Sung!

Carolyn Lasch completes dissertation defense

In May of 2023, E-Lab member Carolyn Lasch successfully defended her dissertation, which focused on maternal anxiety, infant attention, and amygdala development in early life. Congratulations, Dr. Lasch!

Dr. Casey Burrows achievements highlight

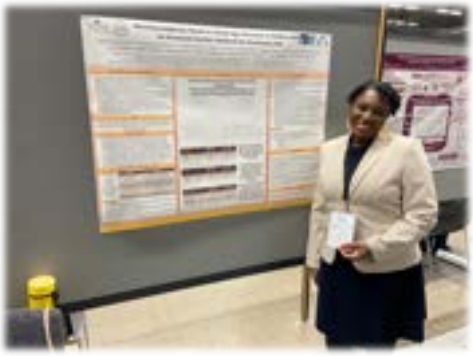
Dr. Casey Burrows received well-deserved acknowledgments for her work dedicated to understanding the sex-based differences in autism diagnoses. Currently, the diagnosis ratio for autism spectrum disorder between males and females is 4:1. Her recent publication found that when measurement bias is removed, there is a 1:1 ratio of males to females with autism spectrum disorder-related impairment. This exciting finding was highlighted by the Interagency Autism Coordinating Committee as one of the top 20 advances in autism research of 2022.

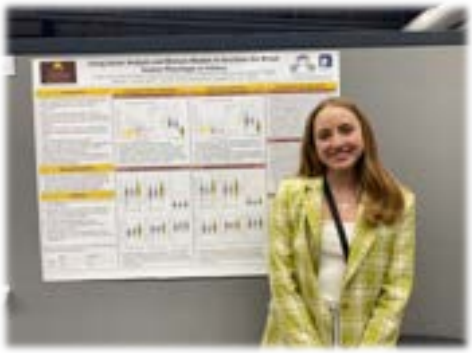
Additionally, Dr. Burrows has been selected to receive funding through a K23 grant to further pursue this line of research, and she will be launching a study this spring which will be investigating early detection of autism in girls, with the hope of improving care and support for females with autism spectrum disorder.

Conference Feature

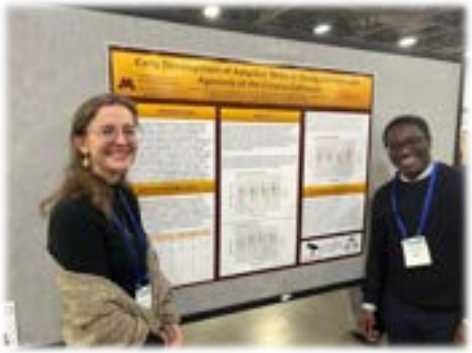
Members of our lab travelled across the country and around the world to present research at academic and professional conferences in 2023, including:

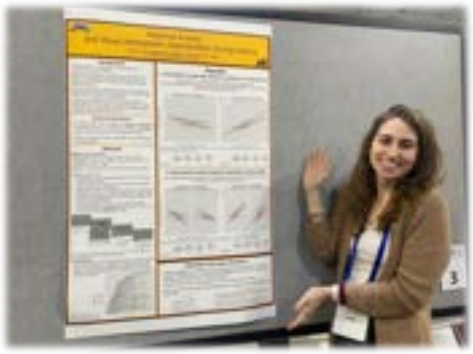
- International Neuropsychological Society 2023 Meeting | San Diego, CA
- 2023 International Neuropsychological Society Taiwan Meeting | Taipei, Taiwan
- Society for Research in Child Development 2023 Meeting | Salt Lake City, UT
- International Society for Autism Research 2023 Meeting | Stockholm Sweden
- Flux: The Society for Developmental Cognitive Neuroscience 2023 Meeting | Santa Rosa, CA
- Society for Neuroscience 2023 Meeting | Washington D.C.
- Infant Brain Imaging Study Network Meeting | Chicago, IL





The ACC Infant Study Team presented a Symposium at the International Neuropsychological Society's 2023 Annual Meeting





SNAPSHOTS FROM 2023

E-Lab at the Saint Paul Saint's Game

Celebrating Dr. Lasch's Dissertation Defense

The E-Lab team exploring Stockholm, Sweden