20th Anniversary Issue

DISCOVERY

RESEARCH NEWSLETTER FALL 2025

Thompson Center for
Autism & Neurodevelopment
University of Missouri

THOMPSON CENTER
FOR AUTISM & NEURODEVELOPMENTAL DISORDERS

Research Newsletter
Spring 2009

Greetings from the Director

The Thompson Center is proud to present its first research newsletter dedicated to giving you information on the autism research projects currently underway. The goal of this newsletter is to provide feedback on how your participation in research has moved us closer to new discoveries about the causes of and treatments for autism spectrum disorders. This has been a big year for the Thompson Center so we won't report on all our projects on this one page, but we will update you every quarter to keep you in the know.

With appreciation, Janet Farmer, Ph.D., Director of Academic Programs

Spotlight on the Projects

Simons Simplex Collection

The Thompson Center was honored to be asked to join the Simons Foundation Autism Research Program in 2008. The Simons Simplex Collection project is a large national study of 2,000 families that have only one child with autism, called simplex families. These families help researchers gain a greater understanding of the most common and unexplained form of autism in which a child has no other close relatives affected by this condition. The needed assessments and blood collection typically take place over the course of one or two separate visits to the Thompson Center. Families receive a summary report, along with compensation for their time.

Executive Control, Brain Activity, and Autism

The social and communicative challenges faced by individuals with autism are often made worse by additional difficulties with sustaining attention and changing behavior to fit the situation (often termed "executive control"). To better understand these difficulties, Dr. Shawn Christ and others at the Center are conducting a study in which a MRI machine is used to take pictures of the brain while participants perform a task requiring executive control. The pictures will be used to compare brain activity between individuals with and without autism. The study will help identify those brain areas that are important for good executive control and will lead to the development of better interventions for helping persons to overcome executive control difficulties.

Results Update – Thank you for making this happen.

We thank all the children and parents who took time out of their busy lives to participate in the Pupillary Response Study. We have analyzed the results and are currently preparing a paper for publication. The study very convincingly showed that the children with autism had a longer delay between the time the light flashed and the time it took for the pupil to get smaller. The difference is measured in milliseconds, so it is small and it doesn't affect vision. Now we have an objective measure of the autonomic nervous system and brain pathways into a part of the brain called the cerebellum. Understanding how the brain is functioning is a very important first step in designing effective treatments. We have already begun studies to learn more. Thank you from Xiaofei Fan, Gary Yao, Nicole Takahashi, and Judy Miles.

Get to Know Our Researcher

"A look at who is on the other end of the phone & making the research work."

Nicole Takahashi, our project coordinator, is the heart and soul of autism research . Nicole graduated from the University of Missouri in biology and biochemistry and, has been published on subjects ranging from basic characteristics of autism to gene mutations. She has a strong presence in recruitment, coordinating processes, and ensuring the success of research grant projects. Currently, she has a major part in the Simons Collection study and the Autism Treatment Network registry.

Nicole Takahashi

Update

Research Newsletter October 2015

The Power of Knowledge

By Stephen Kanne, Executive Director

Autism research is one of the cornerstones of the mission of the Thompson Center. Better understanding of the genetic and environmental factors in autism lead to better, more effective treatments and supports that improve outcomes for children and adults with autism. Our center has been at the national forefront of autism research since our founding in 2005, having served as a model site in the groundbreaking Simons Simplex Collection genetic research study that collected genetic samples from more than 2,600 families with children with autism. Today, this treasure of genetic information continues to provide the basis of understanding the causes of autism and is helping researchers understand how to treat the many expressions of autism across the spectrum of this complex disorder.

We have continued to partner with the Simons Foundation Autism Research Initiative, participating in the Simons Variations in Individuals Project (VIP) that connects researchers across the country with families who want to contribute their voices about the features of autism and the issues they face. You can read more about VIP on page 2 of this newsletter.

A new landmark study will launch in early 2016: the Simons Foundation's National Autism Cohort project. The Thompson Center has been selected as one of 22 sites across the country to individually recruit 3,000 children and adults with autism spectrum disorder over the next three years – entirely online and from home. The result will be a cohort of 50,000 individuals who contribute medical, behavioral and genetic information to support SFARI's goal to develop better treatments and services to support individuals with autism.

We hope you will consider contributing your family's voice to this incredibly important effort. To express your interest in participating in this project please email our Research Core Administrator Nicole Takahashi at takahashin@missouri.edu.

What's Inside?

- Next Generation Genetics
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- Old Tests, New Uses
- Public Health Award
- Join a Study

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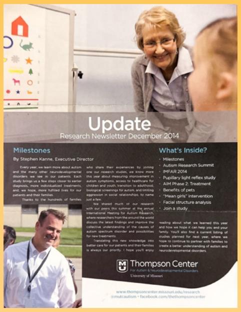
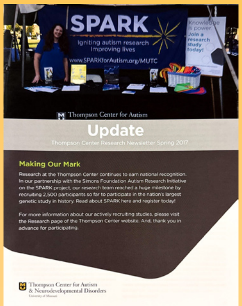




Dr. Judy Miles (right) poses with Thompson Center Research Core staff members at the 2023 Thompson Center Spring Research Symposium

DISCOVERY

Spring 2023 Research Newsletter

Publication by Thompson Center for Autism & Neurodevelopment, University of Missouri

RAYS: Examining the Experiences of Autistic Adolescents & Young Adults

Individuals often begin to drink alcohol during adolescence and early adulthood. But how does this phase of life unfold for autistic teens and young adults compared with their neurotypical peers?

One study at the Thompson Center for Autism & Neurodevelopment at the University of Missouri is focused on investigating the coming of age of autistic teens, particularly in terms of substance use, mental health, and socialization.

This study is an outgrowth of the Rhode Island Consortium for Autism Research and Treatment (RI-CART), which was funded by the Simons Foundation Autism Research Initiative (SFARI) and led by Dr. Stephen Sheinkopf, prior to his role as executive director of the Thompson Center. The RI-CART Adolescent-Young Adult Study (RAYS) is now a collaborative effort between the Thompson Center and Brown University and is funded by the National Institutes of Health (NIH). RAYS launched in 2021 and is jointly directed by Dr. Sheinkopf, Dr. Christina Jackson from Brown University's Center for Alcohol and Addiction Studies, and Dr. Anthony Spirito, an expert in adolescent mental health at Brown University's Department of Psychiatry and Human Behavior.

RAYS is following individuals ages 12-24 years using an accelerated longitudinal design. To do so, each participant is studied for a three-year period. Then, advanced research methods are used to compile the data and derive a pattern of what development trends look like across the full age range. RAYS is conducted 100% online using annual surveys that ask questions about the participant's social environment, mental health, and alcohol and drug use.

The information collected in this study will help researchers begin to understand ways that alcohol use and experiences in autistic young adulthood are similar to or different from that of their typically developing peers, an area that has been the subject of very few studies in the past. Further analysis and data collection could identify additional variables that may be indicators of risk for drug or alcohol abuse or mental health problems, specifically for young adults with autism.

More than 120 autistic teens and young adults have participated in the RAYS project so far, with more than 30% enrolling through the Thompson Center. RAYS will be accepting new study participants through 2024. Eligible adolescents and young adults with a professional autism diagnosis can earn up to $395 for completing the study and their parent or caregiver can earn up to $225. Learn more about getting involved in this study and others at thompsoncenter.missouri.edu/autism-research/join-a-study/.

Spring Research Symposium

The Thompson Center hosted its Spring Research Symposium at the NextGen Precision Health Building in March. Speakers were Drs. Sofia Lizarraga (Brown University) and Evdokia Anagnostou (University of Toronto). A special presentation honored Dr. Judy Miles for her many years of dedication to autism research and programming in Missouri.

A graduate student asks Dr. Anagnostou (right) a question after her presentation

CELEBRATING 20 YEARS OF REMARKABLE RESEARCH

Since its founding in 2005, the Thompson Center has been at the forefront of innovative neurodevelopment research and discovery. With the interdisciplinary strength and structure of the Thompson Center, these innovations are effectively implemented in our clinical spaces, delivering positive outcomes for patients. As we look forward to another 20 years of discovery, we wait with eager anticipation for the new Thompson Center facility, which will provide state-of-the-art equipment and spaces designed for research and implementation.

2008-2011

SIMONS SIMPLEX COLLECTION CREATED TO ANALYZE GENETIC ROOTS OF AUTISM

One of the earliest and most ambitious research projects of the Thompson Center began just three years after its founding. In 2008, the Thompson Center was asked to join the Simons Foundation Autism Research Initiative (SFARI). Funded by the Simons Foundation, SFARI became the progenitor of the Simons Simplex Collection and SPARK, the largest autism study to date, with more than 150,000 autistic participants. Today, SPARK recognizes the Thompson Center as a national leader in providing clinical data.

The Simons Simplex Collection project began as a large national study of 2,000 families with only one child with autism (known as simplex families). The goal of the project was to gain a greater understanding of the various causes of autism, especially the most common and unexplained form of autism, in which an autistic individual has no other close relatives affected by the condition. Researchers also hoped this collection would provide direction on how to develop more effective subgroup-specific therapies, depending on how homogeneous ASD subgroups are defined. The combination of clinical information and DNA samples collected from simplex families provided data that researchers used to investigate which genetic changes occur in which autism subtypes.

First peeks at the data indicated that small changes in DNA, called copy number variants, are implicated in 20% to 30% of autistic individuals. Thompson Center researchers found two other innovative uses for the Simons Simplex Collection data: (1) to study risk factors for aggression and impediments to building friendly relationships in autistic individuals; and (2) to analyze physical characteristics among autistic individuals that indicated some alteration in early embryological development.[1]

Several years later, Dr. Judith Miles, Thompson Center geneticist and researcher, continued this invaluable work by partnering with Dr. Chi-Ren Shyu, director of the MU Institute for Data Science and Informatics, and Dr. Stephen Kanne, former executive director of the Thompson Center. Dr. Shyu used the data from the Simons Simplex Collection study to investigate correlations between genetic data and symptom information. The researchers aimed to uncover how certain genetic mutations and chromosomal variations are linked to the presence and severity of symptoms associated with autism. By identifying tentative subtypes of autism based on groups of symptoms linked to genetic variations, the group sought to lay out the foundation for treatments tailored to those subtypes, resulting in a greater improvement in symptoms for those individuals.

On a national level, the Simons Simplex Collection transformed autism research, enabling scientists to conduct research that was only possible with such extensive, reliable data. As a result, many scientists started shifting their focus toward autism. Now, hundreds of projects reference the analyses of the Simons Simplex Collection.[1,2]

1 Miles, J. H. (2011). Autism Spectrum Disorders—A Genetics Review. *Genetics in Medicine, 13*(4), 278-294. https://doi.org/10.1097/GIM.0b013e3181ff67ba

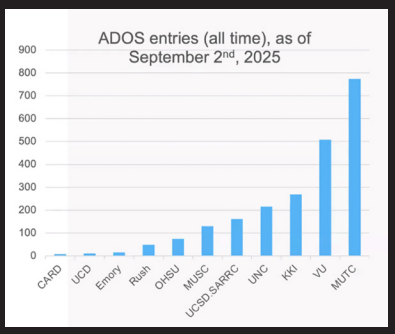
2 Fischbach, G. D. (2010). The Simons Simplex Collection: A Resource for Identification of Autism Genetic Risk Factors. *Neuron, 68*(2), 192-195. https://doi.org/10.1016/j.neuron.2010.10.006

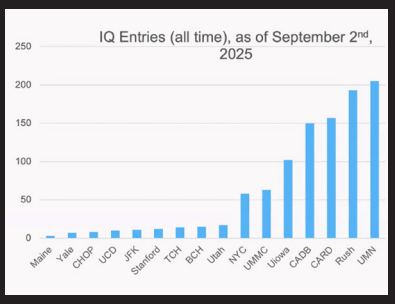
LONG-TIME PARTNERS OF THE LARGEST AUTISM RESEARCH STUDY

The Thompson Center has been a clinical site for SPARK, the largest autism research study to date, since it began in 2016. With over 150,000 autistic participants, SPARK is an online autism study that empowers researchers to make new discoveries to advance our understanding of autism. SPARK is sponsored by the Simons Foundation Autism Research Initiative (SFARI), which the Thompson Center has been proud to support since 2008.

The Thompson Center is one of 31 autism centers and research institutions that SPARK has partnered with nationwide. The research team is proud to share that the Thompson Center has recently been recognized nationally by SPARK for the incredible amount of clinical data our team provides to the study.

The top graph displays total number of ADOS scores submitted to the collection since SPARK's beginning. The Thompson Center is the highest performing site (labeled as MUTC), illustrating our continued commitment to national research. The lower graph shows IQ scores submitted to the collection since SPARK's beginning. Again, the Thompson Center was the highest performer. In fact, the Thompson Center was excluded from this graph because the number of entries submitted was significantly higher than the number of entries submitted by other sites, which caused the Thompson Center's number to skew the y-axis. The Thompson Center is very proud to be a leader in the SPARK community and values its continued partnership with this crucial study.





NEW TASK FORCE HIGHLIGHTS THE STRENGTH OF NEURODIVERSE MINDS AT MIZZOU

BY DR. CONNIE BROOKS, EXECUTIVE DIRECTOR

Since the formation of the Thompson Center in 2005, researchers have collaborated with leaders and experts from academic units across Mizzou to unlock innovative new solutions for our families. A prime example includes the Thompson Center's collaboration with the College of Engineering to develop the pupillary light reflex screening tool. Similarly, within the last decade, the Thompson Center collaborated with the MU Institute for Data Science and Informatics to discover new correlations between genetic data and symptom information from the Simons Simplex Collection. 20 years later, a new task force of interdisciplinary collaborators promises to bring universal outcomes that allow every student, faculty, and staff member at Mizzou to thrive.

On October 3, the MU College of Engineering hosted guest speaker Dr. Keivan Stassun, nationally renowned astrophysicist and Director of the Frist Center for Autism & Innovation at the Vanderbilt Kennedy Center. During his presentation, Dr. Stassun illustrated a groundbreaking initiative that Mizzou was already proud to be a part of — a large effort among several universities to create programs that support neurodiversity in higher education.

Following recent approval from Provost Martens, the MU Neurodiversity Task Force was formed to evaluate and enhance Mizzou's ability to support neurodiverse students, faculty, and staff. The task force is composed of a panel of interdisciplinary leaders across the university, including the Thompson Center, the Center for Teaching and Learning, the Disability Center, MU Extension, the College of Engineering, and several other MU academic units. Most importantly, the task force addresses our primary concern by including the voices of neurodivergent individuals and prioritizing input from their lived experiences to shape future strategies.

By fostering inclusive learning and workplace cultures, the task force aims to unlock the strengths of neurodiverse minds, remove barriers to participation, and position Mizzou as a national leader in innovation, access, and opportunity. The Thompson Center is proud to take part in this initiative, and we celebrate these essential efforts to uplift the voices of neurodivergent individuals. Using the interdisciplinary strength of academic units and organizations across Mizzou, we will continue to develop life-changing initiatives for our families and create a community that recognizes the strength in our neurodiversity.

2008-2020

COLLABORATORS ACROSS MIZZOU BRING LIGHT TO AUTISM DIAGNOSES BY STUDYING THE PUPILLARY LIGHT REFLEX

By creating specially designed eye-tracking and motion-sensing devices, researchers from the Thompson Center and the MU College of Engineering hoped to shed light on predisposition to autism at younger ages, helping families find support when therapy is most beneficial.

The Pupillary Light Reflex Study aimed to determine if eye reflexes to light could be used to help diagnose children with autism. Dr. Judith Miles (Thompson Center geneticist), Dr. Gang Yao (professor of biological engineering), and several colleagues studied children with and without an autism diagnosis by flashing a light at their eyes and analyzing the reaction of their pupils.

Initial findings showed that children with autism had a longer delay (about 40 milliseconds) between the time the light flashed and the time it took for their pupils to get smaller, and their pupils didn't constrict quite as much. These measurements demonstrated activity related to speed impulses traveling through the midbrain and the interaction of the sympathetic and parasympathetic neurons of the brain. These initial findings were published in the *Journal of Autism and Developmental Disorders,* providing an objective measure of nerve impulse transmission and brain pathways into the cerebellum.

Supported by the National Institutes of Health, the researchers planned to confirm these observations by studying a greater number of participants with and without an autism diagnosis, matched for age, gender, and IQ. These differences, if confirmed, could be used as biomarkers to study brain function and develop treatments for the management of symptoms associated with autism. Since the pupillary light reflex is under the control of the autonomic nervous system, the researchers also

investigated other autonomic nervous system signs in the participants, including heart rate variability and response to fevers.

Because young children tend to have trouble sitting still for the test, Dr. Yao and Randima Dinalankara developed a new device that incorporates eye-tracking and motion-sensing capabilities. The new device remotely located a participant's pupils and tested constriction from across the exam room, where the child might be sitting on their parent's lap. This device created new possibilities for testing toddlers and infants who might benefit from early diagnosis and early intervention therapies.

Dr. Yao advanced this study by creating a clever device that could be incorporated into a bassinet to record the pupillary light reflex as a screen for autism in infants. Using the data collected from this device, Dr. Yao hoped that children who have a delay in this reflex would be followed more closely with developmental care to ensure support is received as early as possible.

In a longitudinal study published in 2020, Thompson Center researchers validated atypical pupillary light reflex parameters seen in previous studies of older children with autism, and also observed these parameters in younger children aged 6-24 months. The researchers concluded that the pupils of children with a higher risk of autism (based on family history) were larger at both the resting state and the time of maximal constriction (on average). They also noticed distinct patterns in pupillary light reflex latency in a participant who was later diagnosed with autism. The researchers noted that additional studies in a large population are necessary to further evaluate these observations, and suggested an assessment of the effect of developmental age in additional to chronological age.[3]

2009-2015

RESEARCHERS USE 3D IMAGING TO STUDY BRAIN AND FACIAL STRUCTURES

Long before 3D printers and 4D modeling were conversations around the water cooler, researchers at the Thompson Center and MU's College of Engineering used 3D photographs of face and brain structures to identify specific developmental precursors to autism.

Researchers Judith Miles and Nicole Takahashi of the Thompson Center and Ye Duan and Tayo Obafemi-Ajayi of the MU College of Engineering used a 3D camera to photograph the faces of 42 male autistic participants and measure differences in their facial structures, such as the distance between their eyes. The 3DMD camera made a "map" that helped calculate even very small differences in distances between facial features that aren't recognizable to the naked eye.

Using robust clustering analyses, they found 12 distances that separated the participants into three distinctive subgroups. The researchers then analyzed the autism symptoms of each subgroup. They found that one subgroup had symptoms of severe autism and early regression, one subgroup exhibited milder symptoms, and the last subgroup was more diverse, with symptoms that overlapped with typically developing controls. By identifying biological markers that predict autism severity and regression, the researchers aimed to identify gene changes specific to each subgroup.

In a study published in 2015, the researchers gathered facial surface measurements in 62 eight- to twelve-year-old male autistic children using comprehensive cluster analysis techniques. The results showed that facial morphology differed significantly between groups of male autistic children and matched controls, and that subsets with distinctive facial morphology could be identified.

The researchers asserted that facial structure, based on 31 geodesic facial distances, should be considered a potentially useful biomarker to separate out a biologically discrete and homogeneous ASD subset for further study. These biomarkers could help clinicians anticipate necessary support and intervention levels and tailor specific treatment options to subgroups of patients.

The researchers testified to the feasibility of this autism biomarker for delineating homogeneous populations, noting that 3D facial imaging can be acquired with commercially available 3D systems already present in many university-based tertiary care hospitals.[4,5,6]

3 Fan, X., Miles, J.H., & Takahashi, N. et al (2009). Abnormal Transient Pupillary Light Reflex in Individuals with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders, 39*, 1499–1508. https://doi.org/10.1007/s10803-009-0767-7

4 Miles, J.H., Takahashi, N., Hong, J., Munden, N., Flournoy, N., Braddock, S.R., Martin, R.A., Bocian, M.E., Spence, M.A., Hillman, R.E., & Farmer, J.E. (2008). Development and Validation of a Measure of Dysmorphology: Useful for Autism Subgroup Classification. *American Journal of Medical Genetics, 146A*(9), 1101-1116. https://doi.org/10.1002/ajmg.a.32244

5 Aldridge, K., George, I.D., Cole, K.K., Austin, J.R., Takahashi, N.T., Duan, Y., & Miles, J.H. (2011). Facial Phenotypes in Subgroups of Prepubertal Boys with Autism Spectrum Disorders are Correlated with Clinical Phenotypes. *Molecular Autism, 2*(15), 1-12. https://doi.org/10.1186/2040-2392-2-15

6 Obafemi-Ajayi, T., Miles, J.H., Takahashi, N.T., Qi, W., Aldridge, K., Zhang, M., Xin, S.Q., He, Y., & Duan, Y. (2015). Facial Structure Analysis Separates Autism Spectrum Disorders into Meaningful Clinical Subgroups. *Journal of Autism and Developmental Disorders, 45*(5), 1302-1317. https://doi.org/10.1007/s10803-014-2290-8

2013-2018

AUTISM IMPACT MEASURE DETERMINES WHICH TREATMENTS ARE MOST EFFECTIVE

When Thompson Center researcher Dr. Micah Mazurek was awarded a $3.8 million grant — the Thompson Center's first N01 grant — from the National Institutes of Health in 2013, she sought to develop a measure that would help clinicians determine whether their treatments for autism symptoms are effective.

Working with former Thompson Center executive director Dr. Stephen Kanne, Dr. Mazurek developed the Autism Impact Measure (AIM) to assess improvement in the frequency and impact of core symptoms associated with autism. The AIM became an innovative measure in the field of autism research, comprising an easily administered parent report that utilized a 2-week recall period and a 5-point response format. Unlike previously existing measures, the AIM was designed to track incremental change over shorter periods of time. It also allows clinicians to target and track symptoms that had the greatest influence on patient functioning.

Dr. Mazurek evaluated the AIM's effectiveness by examining the measure's construct validity and sensitivity to change after treatment. In collaboration with multiple sites nationwide, data were collected before, during, and after three different well-established treatments for symptoms associated with autism: medication-based treatment, behavior therapy-based treatment, and curriculum-based treatment.[7]

As a culmination of their grant, Dr. Mazurek and Dr. Kanne conducted a final study, which found that the AIM could accurately indicate whether a patient's core symptoms were improving, declining, or maintaining the status quo based on the treatment they were receiving.[8]

A reflection from Dr. Stephen Kanne:

"Dr. Mazurek and I developed the AIM many years ago after recognizing the lack of reliable tools to measure incremental change in core autism symptoms following an intervention. At the time, we were adapting a well-known treatment approach. Since then, and after extensive psychometric work, the AIM has evolved into one of the strongest measures available for determining whether an intervention is effective in clinical trials. We are continuing to improve the tool and add new components, such as a self-report measure."

7 Kanne, S.M., Mazurek, M.O., Sikora, D., Bellando, J., Branum-Martin, L., Handen, B., Katz, T., Freedman, B., Powell, M.P., Warren, Z. (2014). The Autism Impact Measure (AIM): Initial Development of a New Tool for Treatment Outcome Measurement. Journal of Autism and Developmental Disorders, 44, 168-179. https://doi.org/10.1007/s10803-013-1862-3

8 Mazurek, M.O., Carlson, C., Baker-Ericzén, M., Butter, E., Norris, M., Kanne, S. (2020). Construct Validity of the Autism Impact Measure (AIM). Journal of Autism and Developmental Disorders, 50, 2307-2319. https://doi.org/10.1007/s10803-018-3462-8

2016-PRESENT

INVESTIGATING THE ROLE OF PROPRANOLOL IN IMPROVING SOCIAL FUNCTIONS, ANXIETY, AND GASTROINTESTINAL SYMPTOMS IN AUTISTIC INDIVIDUALS

BY DR. DAVID BEVERSDORF, NEUROLOGIST & PROFESSOR

For nearly a decade, I've had the pleasure of working with Dr. Shawn Christ, Dr. Stephen Kanne, Dr. Bradley Ferguson, Dr. Rachel Zamzow, and several other remarkable colleagues to investigate the role of propranolol — a medication commonly used for high blood pressure, irregular heartbeats, migraine, tremor, and other conditions — in possibly providing several positive outcomes for autistic individuals, including improving some social functions, regulating the stress response, and remedying gastrointestinal symptoms.

Propranolol was first reported to improve the language and sociability skills of autistic individuals in the 1980s, but the reporting trial was not randomized or controlled, and there was little follow-up research on the medication in relation to autism. Notably, propranolol has been widely used off-label to treat performance and public speaking anxiety.

Social Functions with Propranolol Treatment

In 2016, our research team began studying the role of propranolol treatment by first examining its potential to improve social skills and working memory in autistic individuals. Once the initial studies were completed, a larger clinical trial would confirm or deny the presumptions of the initial studies, establish the effects of regular doses, and suggest who would most likely benefit from propranolol treatment.

Our former student, Dr. Rachel Zamzow, led an initial single-dose challenge study designed to examine social skills. 20 autistic participants were given either a 40-milligram dose of propranolol or a placebo pill. Half of the participants took propranolol on the first visit, and the other half took the placebo on the first visit. On the second visit, they repeated the assessment with the opposite drug. After an hour had passed, our researchers held a structured conversation with the participants and scored their performance according to six social skills necessary to maintain a conversation: staying on topic, sharing information, reciprocity or shared conversation, transitions or interruptions, nonverbal communication, and maintaining eye contact.

We found that the total communication scores were significantly greater among participants when they took propranolol compared to the participants when they took the placebo. Though more research was required to study the effects of propranolol after more than one dose, the preliminary results showed a potential benefit of the medication to improve conversational and nonverbal skills of autistic individuals.

This initial social skills study, "Effects of Propranolol on Conversational Reciprocity in Autism Spectrum Disorder: A Pilot, Double-blind, Single-dose Psychopharmacological Challenge Study," was published in *Psychopharmacology* in 2016.[9]

Working Memory with Propranolol Treatment

A similar study in 2012 examined the effects of propranolol administration on impaired higher-order executive skills often seen in autistic individuals. Led by Dr. Shawn Christ, professor of psychological sciences at MU's clinical neuropsychology lab, and his student at that time, Dr. Kim Bodner, our researchers studied a sample of 14 high-functioning autistic adults and a demographically-matched comparison group of 13 typically developing participants. After administering a single dose of propranolol and a placebo among the participants, we used a test called the AX continuous performance test (AX-CPT) to assess working memory and inhibitory control.

We found that the autistic group who received propranolol performed significantly higher than the autistic group who received the placebo, suggesting that administration of propranolol improved aspects of the autistic participants' working memory.

Our findings hinted that norepinephrine may have a role in some cognitive impairments commonly associated with autism, but more research is needed to fully understand whether this role is mainly causal or compensatory.

These findings were published in the article "Noradrenergic Moderation of Working Memory Impairments in Adults with Autism Spectrum Disorder" in the *Journal of the International Neuropsychological Society* in 2012.[10]

Larger Clinical Trial to Establish Parameters for Clinical Treatment and Effects on Social Functions and Anxiety

Aiming to establish more concrete effects for propranolol treatment in a more clinical setting, our next step involved studying propranolol in a larger clinical trial to establish the effects of regular doses and determine who would most likely benefit from the medication. We also planned to examine possible relationships between autism symptoms and how well someone responds to propranolol.

THOMPSON CENTER RESEARCH BRINGS INNOVATIVE OUTCOMES TO CLINICS

BY DR. KERRI NOWELL, HEALTH PROFESSIONS DIRECTOR AND DR. STEPHEN KANNE, NEUROPSYCHOLOGIST & PROFESSOR

The Thompson Center has continued to be a source of innovation and hope thanks to the countless families who have participated in our studies over the years. Our team of clinical providers includes researchers who use their direct clinical experiences to inform research questions that are meaningful to families. For example, our clinician researchers have used our central database to improve timely access to diagnostic evaluations and better understand co-occurring diagnoses, such as anxiety. Another unique attribute of the Thompson Center — and one of our favorites — is its multidisciplinary structure, which allows for new discoveries from our research team to be transferred to positive outcomes within our clinics. For example, the clinical trials conducted by our research team have clear direct clinical implications for the patients seen by our medical team.

Dr. David Beversdorf's propranolol studies are crucial not only for universal knowledge of the medication's potential benefits for individuals with autism, but they also have direct treatment implications for our patients at the Thompson Center. Similarly, Thompson Center researchers have published four articles about the Special Interest Survey, a tool the team developed to better understand interests in autistic people. Information from that survey and can lead to a better understanding of strengths and treatment recommendations, and has been positively received by the autistic community, clinicians, and other researchers. Another unique example is Dr. Stephen Sheinkopf's work on cry data in young children, which has implications for early identification and faster treatment.

Translating this new knowledge into better care for our families is always our priority. We're proud to share that the Thompson Center is one of the leading contributors to SPARK, the nation's largest autism research community. SPARK provides ongoing, widespread support for our genetic understanding of autism, as well as a wide range of clinical phenotyping and treatment studies.

When our families participate in our research studies, they help us gain a better understanding of neurodevelopment and find potential treatments for all families. We would like to share our immense gratitude for your participation in our research over the last 20 years, and we invite you to stay involved as we announce new opportunities for research!

Our larger clinical trial involved 69 participants with autism (age 7-24 years) who were randomized to a 12-week course of propranolol or a placebo, with blinded assessments before taking the medication, at 6 weeks, and at 12 weeks. This study, "Randomized Controlled Trial of Propranolol on Social Communication and Anxiety in Children and Young Adults with Autism Spectrum Disorder," was published in *Psychopharmacology* in 2024.[11]

While we concluded that propranolol did not impact social interaction measures or language, there were indications of a beneficial effect for anxiety. This potential benefit will need confirmation in a larger multicenter trial. This larger trial needs to monitor markers or characteristics to identify participants who are most likely to respond to propranolol for anxiety.

The published clinical trial was completed entirely at the Thompson Center. Recruitment on this scale would only be possible with the remarkable infrastructure of the Research Core, led by Nicole Takahashi. With the Research Core, we can effectively ensure that our patients are aware of studies ongoing at the Thompson Center, and they can also effectively coordinate and implement the numerous details required to carry out such studies.

Impact of Stress on Gastrointestinal Disorders

Acknowledging that gastrointestinal (GI) symptoms have been linked with the autonomic nervous system and the endocrine response to stress in some autistic individuals, our research team — led by Thompson Center researcher Dr. Bradley Ferguson and I — conducted a study examining the effects of stress on GI disorders in children and adolescents with autism. Our results suggested that children and adolescents with autism and GI problems may have a heightened response to stress compared to those with autism alone. Specifically, we found that autistic individuals with GI problems showed increased stress when resting and in response to mild sensory stressors, such as placing their hands in cold water.

Seeking to take these results even further, we investigated whether the increased stress response in autistic individuals with GI problems also triggered an immune system reaction throughout the body.

In a secondary phase of the study involving multiple research sites, small sensors were attached to participants' fingers and chest to monitor their heart rate and the amount of sweat on their skin. Mild stressors were given to participants, and saliva and blood samples were taken.

While we did not detect a relationship between gastrointestinal symptoms and inflammatory markers in this sample, there was a significant relationship between the cortisol stress response and gastrointestinal symptoms, particularly among those reporting a history of regressive autism.

In 2016, our findings were published in *Autism Research*: "Psychophysiological Associations with Gastrointestinal Symptomatology in Autism Spectrum Disorder"[12] and in *Brain, Behavior, and Immunity*: "Associations Between Cytokines, Endocrine Stress Response, and Gastrointestinal Symptoms in Autism Spectrum Disorder."[13]

Gastrointestinal Treatment with Propranolol and Heart-Rate Variability as a Treatment Response Biomarker

Hoping to discover a potential treatment for GI symptoms, Bradley Ferguson and I recently led a pilot trial that examined the effects of propranolol on GI symptoms in autistic individuals, as well as heart rate variability as a potential treatment response biomarker. We sought to determine whether baseline (resting) heart rate variability (a biomarker that is sensitive to the stress response) predicted the response to propranolol in decreasing GI symptoms.

For this study, 37 autistic individuals participated in a 12-week open-label trial of propranolol. The Gastrointestinal Severity Index and heart rate variability were collected before taking propranolol and at the end of the 12-week trial period.

We found that higher heart rate variability was associated with the greatest reduction in gastrointestinal symptoms for autistic adolescents and young adults (15-24 years old). However, changes in heart rate variability and gastrointestinal scores were not significantly correlated for young children (7-14 years old).

These results suggest that autistic adolescents and young adults with higher heart rate variability (indicating greater parasympathetic tone) may respond better to propranolol and show the greatest reduction in gastrointestinal symptoms, but larger, randomized, double-blinded, and placebo-controlled trials of propranolol for gastrointestinal symptoms in autistic individuals are needed to draw stronger conclusions.

This study, "Pilot Trial on the Effects of Propranolol on Gastrointestinal Symptoms in Autism Spectrum Disorder and Heart Rate Variability as a Treatment Response Biomarker," was published in the *Journal of Child and Adolescent Psychopharmacology* in 2025.[14]

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REFLECTIONS FROM RESEARCHERS WHO PAVED THE WAY

Many renowned researchers have contributed to the Thompson Center's remarkable growth over the last 20 years. Below are quotes from several researchers who have been with us for over a decade and continue their incredible work at the Thompson Center today.

NICOLE TAKAHASHI

Research Core Director

Being part of the research team since our founding in 2005 has been an extremely gratifying experience. In just 20 years, we've made great strides and celebrated several remarkable discoveries. I am incredibly grateful to have been a part of this organization and will always be proud of the work we accomplished with visionary researchers such as Judith Miles. Her incomparable passion for our patients and commitment to success led the Thompson Center to what it is today.

DR. DAVID BEVERSDORF

Neurologist & Professor; William and Nancy Thompson Endowed Chair in Radiology

I have been proud to be part of many research studies that have taken place at the Thompson Center over the years. One of the most rewarding aspects of our work is to see our research have positive implications for the families in our clinics and for families across the world. Our studies receive widespread support and recruitment, which is only possible thanks to the remarkable infrastructure of our Research Core, led by Nicole Takahashi. With our Research Core, we can effectively ensure that our patients are aware of ongoing studies that may benefit them and other families with similar needs. The Thompson Center is a hub of innovative autism research, and I am thrilled to be part of this incredible team.

DR. STEPHEN SHEINKOPF

Former Thompson Center Executive Director; Professor of Pediatrics

The Thompson Center is a remarkable place to be a clinical researcher. It is a unique hub that brings together collaborators — clinicians, educators, and researchers — from a variety of backgrounds who can make discoveries that improve the lives of the children and families we serve. I joined the Thompson Center team in 2021 and immediately recognized the amazing foundation that has been built here. We have a wonderful physical space that is coupled with a collaborative and caring culture. As we move to an amazing new building, we are poised to achieve even more. I am proud to be a part of this wonderful center and our amazing team.

DR. STEPHEN KANNE

Former Thompson Center Executive Director; Neuropsychologist & Professor

I've had the honor and pleasure of being part of the Thompson Center since we first opened our doors, driven by a vision to unite several MU departments into a multidisciplinary center. Diverse departments, including Medicine, Health Psychology, Speech & Language, Occupational Therapy, and Education, each contributed remarkable leaders such as Judy Miles, Janine Stichter, and Leanne Lowery, who together created something far greater than the sum of its parts.

With a strong commitment to high-quality clinical care, grounded in research, we built a place unlike anything else in the Midwest. Watching it grow from our original space to our current building, then expanding next door, and now preparing to move into an incredible new complex, has been an adventure beyond anything I imagined. I'm deeply proud to have been part of that journey.

So many families depend on us, and countless autism providers across the country look to us for leadership. It's essential that we continue our mission to serve the individuals and families in our community with excellence and compassion.

DISCOVERIES IN PROGRESS

EARLY YEARS STUDY

Researchers at the Thompson Center are currently engaged in the Early Years Study to learn more about early development in infancy. The Thompson Center, in collaboration with Women & Infants Hospital in Rhode Island, have enrolled over 2,000 families and recorded babies' cries and developmental milestones in the first year of life. Initial findings from the study include differences in infant behavior (e.g. sleep behaviors) and milestones that seem to relate to early autism indicators at 12 months.

BIOMARKER STUDY

The Thompson Center is currently recruiting for an autism biomarker study with the goal of learning more about autism by identifying subgroups of patients with autism based on biomarkers. Biomarkers are also known as "biological signs" that can be linked to a condition and how it progresses. This study will better characterize subpopulations of autism spectrum disorder (ASD) and potentially identify/confirm a molecular signature specific to each subpopulation. By exploring medical history, clinical signs and co-occurring conditions from a broad group of subjects with ASD, researchers hope to identify other subgroups of individuals with ASD eligible for precision medicine and their associated biomarkers. The Thompson Center research core has enrolled more than 60 participants into the biomarker study and will be recruiting through spring of 2026.

CLINICAL DRUG TRIAL FOR SOCIAL COMMUNICATION

The Thompson Center research core recently completed enrollment for a clinical drug trial to evaluate the potential of an investigational medication to improve autism symptoms that affect social communication. Approximately 150 adult and adolescent subjects with ASD have been enrolled in the trial across 41 sites worldwide. Currently, there are only two pharmacological therapies approved by the FDA to treat ASD, but these drugs are indicated for treatment of the irritability symptoms associated with ASD and are ineffective in treating the core social deficits of ASD. Treatment of the core social deficits in ASD patients is largely based on expensive behavioral therapies that are often inaccessible and are typically focused only on very young children. Thus, there is a critical public health need to develop novel, efficacious treatments for ASD that address the core social symptoms.

OUR STORY NEEDS YOU – JOIN A STUDY!

CALL THE RESEARCH CORE AT 573-303-8405

EMAIL TCRESEARCH@MISSOURI.EDU

SCAN THE QR CODE TO LEARN MORE

EXPANDING THE EXTRAORDINARY

The Thompson Center for Autism & Neurodevelopment and the Thompson Foundation are pleased to announce the Grand Opening of the new Thompson Center facility, which will increase the number of specialists and annual visits by more than two-fold to meet the demand for clinical services. To accelerate diverse and evidence-based research by our renowned faculty, the new facility will feature state-of-the-art facilities for research, training, and clinical care, including a new Intensive Outpatient Program (the first of its kind in Missouri), an adaptive playground, an indoor therapy gym, group therapy rooms, a life skills room, and a training café that serves visitors.

JOIN US FOR OUR GRAND OPENING

MAY 8, 2026

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