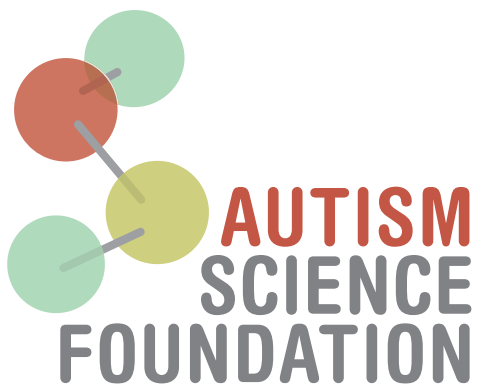# 2019 ANNUAL REPORT

AUTISM SCIENCE FOUNDATION

PRESIDENT'S LETTER

Dear Friends:

It's hard to remember a year with more progress than 2019. We discovered more genes associated with autism and began to understand how they function; we learned more about how girls with autism are different from boys and what this means for treatment plans; we leveraged new technologies to improve diagnosis, reduce treatment waiting lists and monitor and improve behavior; and we dug deep to understand the recurrence risk not only in siblings but in grandchildren. Our investments in science are making a real difference in the day-to-day lives of people with autism.

But the more we learn, the more there is to know. Each answer brings with it new questions and new opportunities. We need to double down on our investment in autism research so that we can truly understand the causes of autism and develop personalized treatment for every individual.

We need your support now more than ever so that we can continue down this path of progress. Thank you for being our partners!

Sincerely,

Alison Singer

CHIEF SCIENCE OFFICER'S LETTER

Dear Friends:

All of us at ASF are committed to ensuring that scientific research will produce answers that are timely and meaningful for families. As you read through our annual report, I hope you will be as excited about the progress we are making as I am. Our goal is always to fund research that will improve the real lives of real people.

In late 2019, we launched a national survey to better understand what would make YOU more likely to participate in research. We can't wait to share the results with you in the coming year. This information will be shared with scientists so that they can improve their research and make the research experience better for our families.

The discoveries and advances we made in 2019 would not be possible without your investments in the Autism Science Foundation. Every dollar and every voice counts, and we are so grateful for your continued partnership and commitment to helping families with ASD.

Sincerely,

Dr. Alycia Halladay

ACCOMPLISHMENTS

In 2019, our tenth year of operation, the Autism Science Foundation:

Expanded our successful Day of Learning program to San Francisco; now in both CA and NY.

Funded almost half a million dollars in grants for predocs, postdocs, undergrads and collaborative consortium activities.

Launched the Next Gen Baby Siblings project to understand autism in the offspring of unaffected sibs.

Produced 50 award-winning weekly science podcasts, which were downloaded 87,000 times.

Recruited 14 patient advocacy organizations to work collaboratively to support a "gene first" approach to research.

Initiated the EXPECT study to improve the experience of families participating in autism research.

Spoke about new autism findings on several major media outlets, including CNN and *The Dr. Oz Show*.

Supported the launch of the National Council for Severe Autism to represent the needs of people with profound autism.

Directed an international study on best practices in employment for people with autism.

FUNDING SCIENCE

In 2019, ASF awarded over half a million dollars in grant support primarily through its pre- and postdoctoral fellowships, research accelerator awards and undergraduate summer research grants. Below are summaries of the projects funded by these awards.

PREDOCTORAL FELLOWSHIPS

Zoe Hawks | Washington University School of Medicine at St. Louis
Mentor: John Pruett, MD, PhD

Testing candidate cerebellar presymptomatic biomarkers for autism
Ms. Hawks will investigate a cerebellum-based biomarker and an eye-tracking biomarker together to see if they may be useful in clinical settings for better identification of ASD as well as for information about the life course of ASD symptoms.

Ileena Mitra | University of California at San Diego
Mentor: Melissa Gymrek, PhD

Interpreting the role of "short tandem repeats" in the genes of people with autism
Researchers at UCSD have recently identified a new type of genetic mutation called "short tandem repeats" in brain tissue associated with neurodevelopmental disorders. Ms. Mitra's project will be the first to study the role of these short tandem repeats in autism spectrum disorder, which will provide families with more accurate information about the potential heritable causes of ASD and the pathways involved.

Serena Tamura | University of California at San Francisco
Mentor: Nadav Ahituv, PhD

Activating the healthy copy of SCN2A as potential treatment for SCN2A haploinsufficiency in autism
Ms. Tamura will investigate the potential utility of gene therapy interventions in an animal model of ASD associated with the SCN2A receptor. People with an SCN2A receptor mutation have a high rate of both ASD and seizures, and if successful, this research could open up avenues to targeted interventions across the spectrum.

Lisa Yankowitz | University of Pennsylvania
Mentor: Robert Schultz, PhD

Analyzing baby talk to better understand brain development in autism
Ms. Yankowitz will utilize the infant siblings study design to better understand how very early differences in vocalizations in infancy are linked to brain development and language in toddlerhood. This will help better identify those with an ASD diagnosis vs. those with language delay.

POSTDOCTORAL FELLOWSHIPS

Emily Warren, PhD | Brown University
Mentor: Eric Morrow, MD, PhD

Molecular mechanisms of 17q12 deletion syndrome: Developing a novel mouse model of polygenic ASD
Dr. Warren will use an animal model to determine which genes on an area of chromosome 17 are associated with neurodevelopmental disorders and abnormalities, as well as abnormalities in other organ systems, to understand which genes can be targeted for better autism therapies.

UNDERGRADUATE SUMMER RESEARCH GRANTS

ASF is the only autism organization to offer summer grants to undergraduate researchers, encouraging the best and brightest students to launch a career in autism science.

Nathan Bliss | Baylor College of Medicine
Mentor: Hsiao-Tuan Chao, MD, PhD

A class of genes called teneurins has been shown to play a role in neuron development and neurodevelopmental disorders. Nathan and Dr. Chao will isolate the function of this class of genes in a fruit fly to determine its influence on cognitive behaviors and brain function. This will allow for better understanding of the role of this gene in autism spectrum disorder.

Kristen Enriquez | Yale University
Mentor: Ellen Hoffman, PhD

TBR1 is an autism risk gene on chromosome 2 that has only recently been identified. It is critical for proper wiring of brain regions associated with autism, like the amygdala and the cortex. Using CRISPR technology, Ms. Enriquez and Dr. Hoffman will use zebrafish to manipulate the expression of the TBR1 gene, which is associated with brain wiring in autism-relevant brain regions. The study design allows about 100 zebrafish to be screened at a time, making it an efficient model to screen for potential pharmaceutical interventions.

Emma McQueen | University of North Carolina at Chapel Hill
Mentor: Clare Harrop, PhD

Ms. McQueen and Dr. Harrop will use advanced techniques to study brain activity during behavioral tasks to test the ability to switch between tasks, which is an issue in ADHD as well as autism. The goal of this project is to develop better biomarkers of these co-occurring conditions, which will lead to better diagnoses of the disorders together and separately.

Nicholas Page | University of California, Los Angeles
Mentor: Daniel Geschwind, MD, PhD & Michael Gandal, MD, PhD

Under the direction of Drs. Geschwind and Gandal, Mr. Page will examine the different patterns of gene expression in males and females following the environmental exposure of maternal infection and identify genes that are normally expressed together.These genetic expression patterns combined with environmental influences will help explain the sex difference in ASD diagnosis.

ACCELERATOR AWARD

The accelerator grant mechanism is designed to rapidly fund novel findings, provide resources to build on an existing project or explore unexpected opportunities.

Veronica Fleury, PhD
Florida State University

Targeting low resource autism preschoolers to improve literacy

Dr. Fleury will build on her Department of Education-funded project, which delivers literacy intervention to improve reading and vocabulary in preschoolers with autism. However, this DoE-funded project currently does not include a diverse community, as it lacks children from low-income areas. ASF accelerator funding will enable an additional 20 children, specifically from Title 1 low resource schools, to be included in the study.
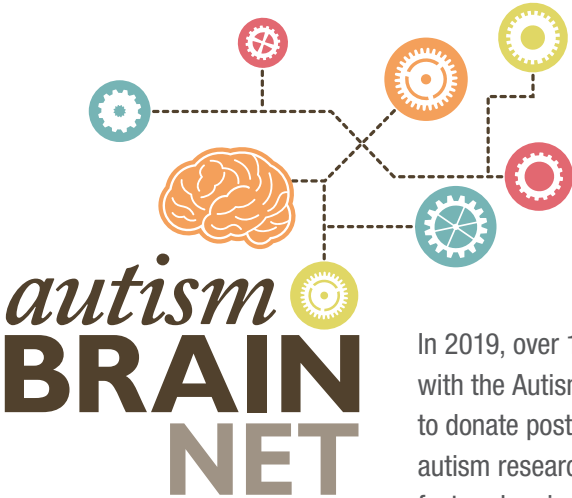
In 2019, over 1,500 new people registered with the Autism BrainNet and agreed to donate postmortem brain tissue for autism research. This growing resource fostered major discoveries in understanding the symptoms and features of autism, identifying biological treatment targets and determining changes in the brain on a cellular level throughout the lifespan.

The Baby Siblings Research Consortium (BSRC) is a global team of 43 researchers focused on discovering early signs and symptoms of ASD (as early as 6 months of age!). This includes two consortium-wide papers that explain the importance of early motor interventions for later autism symptoms and examine cognitive impairment in families with one vs. more than one child with ASD in the family. Their findings have been critical in our quest for earlier diagnosis and intervention. This year we will work toward expanding the BSRC to include a cohort of grandchildren so that the offspring of unaffected baby siblings can be tracked from birth. We also want to understand early autism signs in these "Next Gen Sibs."

EXPECT
Experience of People Enrolled in Clinical Trials

In 2019, we launched a national survey called EXPECT (Experience of People Enrolled in Clinical Trials) to help us better understand how we can improve the research experience for autism families. We look forward to sharing the results with you in 2020.

Autism Sisters PROJECT

Our Autism Sisters Project is making tremendous progress! This year, scientists funded by ASF conducted the largest genetic analysis of both males and females with autism from around the world in an effort to better understand the Female Protective Effect (FPE).

In a landmark publication in the journal *Cell*, the scientists showed that females with ASD have a higher load of rare genetic variants associated with ASD compared to males with ASD, despite their symptom severity being about the same.

We are collecting DNA from sisters of people with autism because it may help us understand why some girls are protected from autism.

Cell

Article

Large-Scale Exome Sequencing Study Implicates Both Developmental and Functional Changes in the Neurobiology of Autism

Graphical Abstract
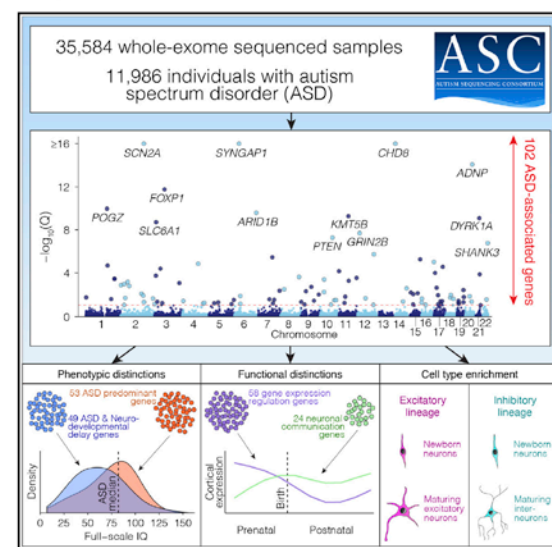
Authors
F. Kyle Satterstrom, Jack A. Kosmicki, Jiebiao Wang, ..., Kathryn Roeder, Mark J. Daly, Joseph D. Buxbaum

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In Brief
Large-scale sequencing of patients with autism allows identification of over 100 putative ASD-associated genes, the majority of which are neuronally expressed, and investigation of distinct genetic influences on ASD compared with other neurodevelopmental disorders.

This study also helped identify the function of these genes and how they influence ASD, and confirmed that the FPE reduces the probability of a diagnosis in females. The next phase of this important project will better identify which of these genes are most responsible so that we can start to develop new interventions targeting these genes.

WALL STREET RIDES FAR
FOR AUTISM RESEARCH

Our fifth annual Ride FAR (For Autism Research) drew huge crowds and raised over $450,000 to fund ASF's scientific initiatives. Riders enjoyed bicycling through beautiful fall foliage in Westchester County, and walkers loved our scenic 5K trail walk. Join us for our sixth Ride FAR on October 3, 2020.
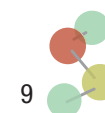
Our 6th annual TED-style autism conference featured researchers from across the country for a full day of learning. Over 350 parents, teachers, students, scientists and people with autism participated. Our next Day of Learning East will be held on September 22, 2020.

In 2019, we took our successful Day of Learning program on the road, bringing leading autism scientists from across the country to San Francisco for a sold-out series of presentations designed for families, entrepreneurs and other stakeholders. Our next West Coast Day of Learning will be held on October 15, 2020.

Paul Morris and Tommy Bak in New York.

Former NIMH Director Dr. Tom Insel gave the keynote in San Francisco.

Dr. Lisa Croen and Dr. Alycia Halladay in San Francisco.

Autism Society of America Vice Chair Lori Ireland poses a question in NYC.

Wall Street Rides FAR co-chairs Bryan and Melissa Harkins received the annual Caryn Schwartzman Spirit Award.

San Francisco speakers helped Silicon Valley entrepreneurs understand the types of products autism families need.

Michelle Gorenstein and Danielle Halpern, MD, from the Seaver Center at Mount Sinai School of Medicine.

AUTISM SCIENCE FOUNDATION

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