



Albert Einstein College of Medicine

Graduate Programs in the Biomedical Sciences

PRE-APPLICATION: Google PhD Program 2025

ELIGIBILITY:

- Full-time graduate students of all backgrounds pursuing a PhD. The Fellowships are awarded to students who represent the future of research in the fields listed on [this page](#).
- Students who have completed graduate coursework in their PhD by the academic award year when the Fellowship begins.
- Students must remain enrolled full-time in the PhD program for the duration of the Fellowship.
- Google employees, and their spouses, children, and members of their household are not eligible.
- Students already supported by a comparable industry award are not eligible. Government or non-profit organization funding is exempt.
- Past awardees from the PhD Fellowship program are not eligible to apply again.

Requirements for Pre-Application Review:

- Applicant's CV with links to website and publications (if available)
- Research / dissertation proposal (**maximum 500 words**). Please include references (not limited).
- Student essay response (**350-word limit**) to: Describe the desired impact your research will make on the field and society, and why this is important to you. Include any personal, educational and/or professional experiences that have motivated your research interests.
- Student essay response (**350-word limit**) to: Describe an example of your leadership experience in which you have positively influenced others, helped resolve disputes, or contributed to group efforts over time. (A leadership role can mean more than just a title...).

Date: 2025-05-01 **Banner ID:** 810446601

Student Name: Megan Darrell

Entered the PhD Program (eg. Fall 09): Spring 2024

Student Email: megan.darrell@einsteinmed.edu

Department: Neuroscience

Thesis Mentor: Sophie Molholm

Summary of Current Status:

Course Requirements:	Completed <input checked="" type="checkbox"/>	Not Completed <input type="checkbox"/>
Qualifying Examinations:	Passed <input type="checkbox"/>	To Be Taken <input checked="" type="checkbox"/>
Publications:	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Manuscript in prep:	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>

PRE-APPLICATION: Google PhD Fellowship Program 2025**Student Name:** Megan Darrell **Banner ID:** 810446601**Thesis Mentor:** Sophie Molholm**DESCRIPTION OF RESEARCH/DISSERTATION PROPOSAL. PLEASE INCLUDE REFERENCES
(500 word-limit)**

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by social impairments and restricted, repetitive behaviors [1] that arises from altered brain development [2, 3]. Neuro-oscillatory activity—which reflects synchronized neural activity within and between cortical regions [4]—is ubiquitously reported to be atypical in ASD [5-7], offering a potential assay of disrupted information processing and network connectivity [8]. However, findings are i) often challenging to compare across studies due to differences in methodology and participant characteristics, and ii) typically limited to between-group comparisons, which fail to account for neurophysiological differences underlying heterogeneity within the ASD population. Critically, this heterogeneity likely reflects differing neurobiological mechanisms of ASD that are responsive to different treatments.

To address these limitations, we curated a rich clinical dataset comprising high-density EEG data from 136 individuals and eight paradigms—probing brain function under a range of sensory, motor, and cognitive domains—alongside rigorous clinical assessments. Access to such data provides a rare, invaluable opportunity to systematically evaluate neuro-oscillatory activity across multiple sensory modalities within a single cohort. This large, heterogeneous sample includes autistic children (n=66), age- and IQ-matched typically developing peers (n=41), and unaffected siblings of individuals with ASD (n=29), drawn from the Bronx—a highly diverse and historically underrepresented population in biomedical research.

Prior EEG studies in autism typically fail to deploy tools that evaluate ASD at the individual-level—risking oversimplification of phenotypic variation that is core to autism. In addition to traditional analysis methods, we propose integration of novel machine learning approaches, which enables a) rigorous evaluation of the strength of neural biomarkers associated with ASD and b) identification of meaningful subgroups within ASD to begin disentangling clinical and behavioral heterogeneity.

We propose a two-pronged analytic approach that combines supervised and unsupervised learning. First, we will apply support vector machine and regression algorithms [9] to predict both discrete (diagnostic group) and continuous (clinical or behavioral) outcomes from neural markers of interest, allowing us to quantify the strength of the relationship between neural activity and phenotype. We will also implement a complementary unsupervised approach (k-means clustering; [10]) to identify data-driven sub-groups based on neural features. Clusters will be compared on continuous measures of behavior and ASD symptom severity to assess how neural profiles relate to variations in clinical presentation. Importantly, inclusion of multiple tasks spanning diverse sensory and cognitive domains allows us to examine how neural signatures map onto distinct clinical features.

To date, the field has struggled to identify robust neural biomarkers of ASD, which are critical to improve diagnostic precision and develop personalized interventions [11-13]. Here, we propose a comprehensive, comparative approach that utilizes novel computational methodologies to elucidate patterns of neuro-oscillatory atypicality in ASD, both at the group- and individual-level. Furthermore, inclusion of unaffected siblings of individuals with ASD allows us to investigate whether observed neural markers reflect heritable mechanisms contributing to ASD risk, or whether they instead represent consequences of overt disease expression [14]—thereby addressing a critical challenge in the search for biomarkers and mechanisms in autism.

1. Association, A.P., *Diagnostic and statistical manual of mental disorders*. 5 ed. 2013.
2. Courchesne, E., *Brain development in autism: early overgrowth followed by premature arrest of growth*. *Ment Retard Dev Disabil Res Rev*, 2004. **10**(2): p. 106-11.
3. Lord, C., et al., *Autism spectrum disorder*. *Lancet*, 2018. **392**(10146): p. 508-520.
4. Lakatos, P., et al., *An oscillatory hierarchy controlling neuronal excitability and stimulus processing in the auditory cortex*. *J Neurophysiol*, 2005. **94**(3): p. 1904-11.
5. Beker, S., J.J. Foxe, and S. Molholm, *Oscillatory entrainment mechanisms and anticipatory predictive processes in children with autism spectrum disorder*. *J Neurophysiol*, 2021. **126**(5): p. 1783-1798.
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7. Murphy, J.W., et al., *Susceptibility to distraction in autism spectrum disorder: probing the integrity of oscillatory alpha-band suppression mechanisms*. *Autism Res*, 2014. **7**(4): p. 442-58.
8. Uhlhaas, P.J. and W. Singer, *Neuronal dynamics and neuropsychiatric disorders: toward a translational paradigm for dysfunctional large-scale networks*. *Neuron*, 2012. **75**(6): p. 963-80.
9. Cortes C., V.V., *Support-vector networks*. *Mach Learn*, 1995. **20**: p. 273-297.
10. Steinley, D., *K-means clustering: a half-century synthesis*. *Br J Math Stat Psychol*, 2006. **59**(Pt 1): p. 1-34.
11. Murza, K.A., et al., *Joint attention interventions for children with autism spectrum disorder: a systematic review and meta-analysis*. *Int J Lang Commun Disord*, 2016. **51**(3): p. 236-51.
12. Ozkan, E., et al., *Joint Attention-Based Occupational Therapy Intervention in Preschoolers With Autism Spectrum Disorder: A Randomized Controlled Trial*. *Am J Occup Ther*, 2023. **77**(2).
13. Spaniol, M.M., et al., *Attention training in children with autism spectrum disorder improves academic performance: A double-blind pilot application of the computerized progressive attentional training program*. *Autism Res*, 2021. **14**(8): p. 1769-1776.
14. Pohl, A., et al., *Behavioral predictors of autism recurrence are genetically independent and influence social reciprocity: evidence that polygenic ASD risk is mediated by separable elements of developmental liability*. *Transl Psychiatry*, 2019. **9**(1): p. 202.

PRE-APPLICATION: Google PhD Fellowship Program 2025**Student Name:** Megan Darrell**Banner ID:** 810446601**Thesis Mentor:** Sophie Molholm**DESCRIBE THE DESIRED IMPACT YOUR RESEARCH WILL MAKE ON THE FIELD AND SOCIETY, AND WHY THIS IS IMPORTANT TO YOU (350 word-limit)**

Entering college, I was torn between studying neuroscience—captivated by the brain’s unparalleled complexity—and bioinformatics, an innovative field that required logical rigor and creativity. As I delved deeper into research, I quickly realized the two disciplines exist not in competition, but in parallel—and that the most meaningful advances in healthcare would come from integrating them.

In my first research role, I helped develop a convolutional neural network to non-invasively measure naturalistic gait in neurological disease models, and was immediately captured by the ability of AI-driven tools to reveal profound insights into brain function and behavior. Eager to explore the power of bioinformatics to drive medical discovery, I’ve since applied novel AI methodologies to rigorously analyze data across a wide range of clinical domains—from identifying transcriptomic subtypes in a rare pediatric autoimmune condition at the NIH, to my most recent work, which has uncovered critical healthcare disparities in large clinical trials. These prior experiences have been the driving force behind my current research, as they reveal the immense potential of novel informatics approaches to extract meaningful insights from complex health data—insights that would remain hidden using traditional analyses.

Currently, my work centers on autism spectrum disorder (ASD)—a condition characterized by significant clinical and biological heterogeneity, which poses profound challenges for both diagnosis and treatment. In my proposal, we leverage a large, diverse dataset from children in the Bronx—a population historically excluded from research—that integrates rigorous clinical assessments and EEG from eight behavioral paradigms. Instead of relying on traditional analysis methods—which risk oversimplifying the complex neural and behavioral heterogeneity in ASD—we propose an innovative alternative: cluster-based identification of neural subgroups within ASD.

This methodology—applied to a uniquely rich clinical dataset—offers a rare and powerful opportunity to identify functional neural mechanisms that drive phenotypic variation in ASD, a challenge that has long hindered progress in the field. Above all, I am deeply motivated by the hope that this work moves us closer to personalized, effective care for individuals with autism—while demonstrating how data-driven methods can reveal insights into the brain’s complexity.



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DESCRIBE AN EXAMPLE OF YOUR LEADERSHIP EXPERIENCE (350 word-limit)

Leadership found me before I acquired the words to define it. As the eldest daughter in a home that buzzed with chaos and responsibility, I took on the role of mentor, teacher, mediator, confidante, and caretaker. I learned quickly that true leadership relied not on authority, but on consistency, confidence, and reliability. These early experiences laid the foundation for how I would lead in every chapter of my life.

The role of “big sister” followed me into my professional life, profoundly influencing my passion for teaching and mentorship. What began as early-morning math lessons with my brother at the kitchen table evolved into tutoring underserved youth and, now, educating young scientists and medical students. While the content has changed, the heart of mentorship remains the same, and I draw daily on the instincts and patience I first cultivated with my siblings.

I also came to understand early on that leadership is not a solo act. At home, I wasn’t leading alone; I was part of a family where cooperation and compromise were essential. That same interdependence drew me to team sports—soccer, basketball, softball—spaces that cultivate support, collaboration, and togetherness. Competing at national and collegiate levels taught me the quiet strength of reliability—showing up for teammates in both triumph and adversity. Whether comforting a younger sister through college homesickness or coaching an injured teammate from the sidelines, I learned that leadership often lives in small moments of solidarity. Recently, I founded a soccer-and-science afterschool program in the Bronx to offer children in my community access to those same lessons—discipline, confidence, and the value of teamwork. It’s a full-circle return to where my leadership journey began: not in a title or position, but in being present.

Truthfully, my earliest lessons in leadership were learned at home, which laid the groundwork for the collaborative, dependable leadership style I bring to my professional life today. As a physician-scientist in training, I carry these lessons with me—leading with care, competence, and the belief that small acts of support can transform someone’s life.

