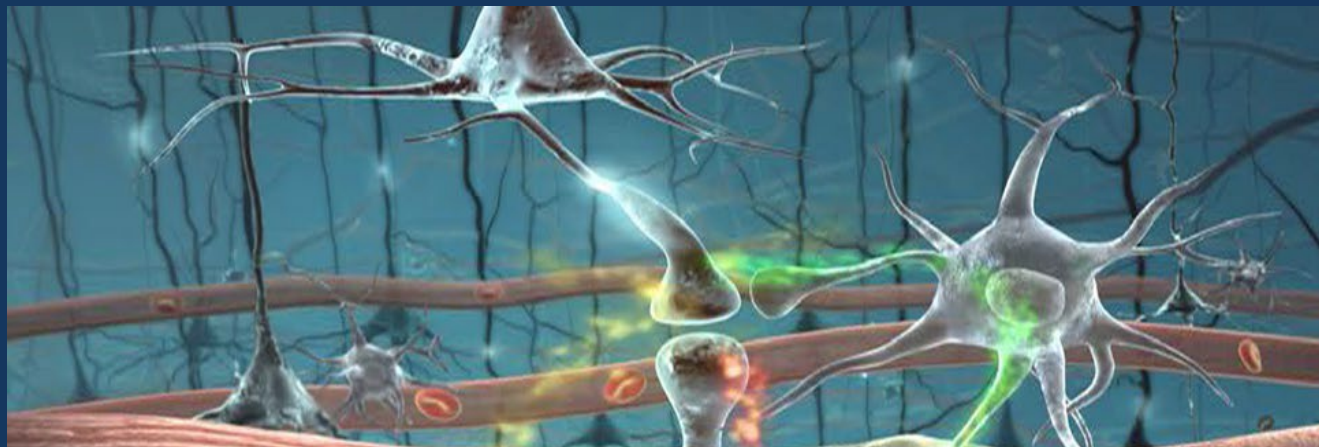




ENDURE

NIH Blueprint for Neuroscience Research



NIH Blueprint Enhancing Neuroscience Diversity through Undergraduate Research Education Experiences (ENDURE) 12th Annual Meeting

November 12, 2022

The NIH Office of the Director and the following NIH Institutes and Centers participate in the NIH Blueprint for Neuroscience Research:

NCCIH

NEI

NIA

NIAAA

NIBIB

NICHD

NIDA

NIDCR

NIEHS

NIMH

NINDS

OBSSR



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ENDURE PROGRAM GOALS

The NIH Blueprint for Neuroscience Research is a collaborative framework between the NIH Office of the Director and 12 NIH Institutes and Centers (ICs) to support research on the nervous system. By pooling resources and expertise, the Blueprint identifies cross-cutting areas of research and confronts challenges too large for any single IC. The NIH Blueprint Program for Enhancing Neuroscience Diversity through Undergraduate Research Education Experiences (BP-ENDURE) aims to raise interest and opportunities in neuroscience research for individuals who are typically underrepresented in the neurosciences. The goal is to provide such individuals with training at the undergraduate level, so that they are prepared to enter and successfully complete neuroscience Ph.D. programs. ENDURE provides undergraduate training through partnerships between research-intensive institutions and institutions with a substantial enrollment of neuroscience majors from diverse groups. This includes individuals from underrepresented racial and ethnic groups, individuals with disabilities, and individuals from economically disadvantaged backgrounds. ENDURE undergraduate training programs support a range of activities to increase student interest and involvement in the neurosciences, including research experiences, core and advanced neuroscience courses, seminars, and journal clubs. In FY10, five ENDURE awards were granted and six awards were granted in FY15. We currently have ten active awards, with six awards made in FY20 and four in FY21.

ENDURE MEETING GOALS

As issued, the funding announcement ([RFA-NS-20-015](#)) cites, “it is a goal of this initiative that the NIH Blueprint Institutes will convene an annual meeting that will bring together BP-ENDURE program directors and participating students.” The purpose of this virtual meeting will be to discuss best practices and provide a forum for student scientific and academic enhancing activities. Students will broaden their networks with other ENDURE participants, T32 or graduate program directors, peer mentors from ENDURE Alumni, and other diverse graduate students.

ANNUAL MEETING ORGANIZING COMMITTEE

Dr. Anahid Ebrahimi (NIH/NINDS)

Dr. Michelle Jones-London (NIH/NINDS)

Dr. Jenny Kim (NIH/NINDS)

Dr. Marguerite Matthews (NIH/NINDS)

Dr. Lauren Ullrich (NIH/NINDS)

For more information about BP-ENDURE and the program sites over our 11-year history, visit

<https://neuroscienceblueprint.nih.gov/endure-undergraduate-education>

Join [An ENDUREing Network](#) on LinkedIn groups [An ENDUREing Network](#)

To learn more about the [NIH Blueprint for Neuroscience Research](#) and [NIH BRAIN Initiative Diversity and Scientific Excellence](#), visit <https://neuroscienceblueprint.nih.gov/about/diversity-and-scientific-excellence>

Follow [NINDS Office of Programs to Enhance Neuroscience Workforce Diversity](#) on Twitter [@NINDSDiversity](#)

AGENDA

Marriott Marquis San Diego
San Diego Ballroom A/B
Saturday, November 12, 2022

Pacific Time

- 7:00 – 7:30 am Registration
- 7:30 – 7:40 am Introduction and ENDURE Meeting Goals
[Dr. Michelle Jones-London](#), Chief, Office of Programs to Enhance Neuroscience Workforce Diversity (OPEN), National Institute of Neurological Disorders and Stroke (NINDS)
- 7:40 – 8:00 am NIH Blueprint Welcome
[Dr. Michael Chiang](#), Director, National Eye Institute
[Dr. Joshua Gordon](#), Director, National Institute of Mental Health
[Dr. Walter Koroshetz](#), Director, National Institute of Neurological Disorders and Stroke
- 8:00 – 8:30 am Keynote Address
[Dr. Felicia Jefferson](#), Associate Professor of Biology, Fort Valley State University
- Q&A
- 8:30 – 9:30 am Panel on Pathways and Perspectives on Advancing Your Career
Moderator by [Dr. Marguerite Matthews](#), Program Director, OPEN, NINDS
- What should a student expect out of graduate training programs? What are effective strategies to navigate some of the challenges of research training? What are the qualities of a good mentor? What makes your career in neuroscience fulfilling?*
- Each panelist will share their scientific background, their experiences being underrepresented in neuroscience, and lessons learned navigating their career.
- Panelists:
- ❖ [Yesenia Garcia-Sifuentes](#), ENDURE alum and Ph.D. student, Emory University
 - ❖ [Dr. Cellas Hayes](#), recent Ph.D. graduate, University of Mississippi; incoming postdoctoral fellow, Stanford University
 - ❖ [Dr. Stephanie Noble](#), BRAIN K99 postdoctoral scholar, Yale University
 - ❖ [Dr. Cory White](#), D-SPAN K00 postdoctoral scholar, Johns Hopkins University
- 9:30 – 11:30 am Graduate Program Recruitment and Networking Fair

SPEAKER BIOGRAPHIES



Michael F. Chiang, M.D.

Director

National Eye Institute

Pronouns: He/him

Dr. Chiang is Director of the National Eye Institute. By background, he is a pediatric ophthalmologist and is also board-certified in clinical informatics. His research focuses on the interface of biomedical informatics and clinical ophthalmology in areas such as retinopathy of prematurity (ROP), telehealth, artificial intelligence, electronic health records, data science, and genotype-phenotype correlation. He is an Adjunct Investigator at the National Library of Medicine, and his group has published over 250 peer-reviewed papers and developed an assistive artificial intelligence system for ROP that received Breakthrough Status from the U.S. Food and Drug Administration.

Dr. Chiang began at NIH in November 2020. He serves as Co-Chair of a trans-NIH working group for high value data asset sustainability, Chair of a trans-NIH clinical trials infrastructure working group, Co-Chair of a trans-NIH medical imaging working group, Co-Chair of the NIH AIM-AHEAD advisory committee, and Co-Chair of the NIH Common Fund Bridge2AI program. He is a member of the NIH Scientific Data Council. Before coming to NIH, he received a BS in Electrical Engineering and Biology from Stanford University, an M.D. from Harvard Medical School and the Harvard-MIT Division of Health Sciences and Technology, and an MA in Biomedical Informatics from Columbia University. He completed residency and pediatric ophthalmology fellowship training at the Johns Hopkins Wilmer Eye Institute. Between 2001-2010, he worked at Columbia University, where he was Anne S. Cohen Associate Professor of Ophthalmology & Biomedical Informatics, director of medical student education in ophthalmology, and director of the introductory graduate student course in biomedical informatics. From 2010-2020, he worked at Oregon Health & Science University (OHSU), where he was Knowles Professor of Ophthalmology & Medical Informatics and Clinical Epidemiology, and Associate Director of the Casey Eye Institute. He co-directed an NIH-funded T32 training program in visual science for graduate students and research fellows, as well as an NIH-funded K12 clinician-scientist program at OHSU.

Follow Dr. Chiang on Twitter [@NEIDirector](https://twitter.com/NEIDirector).



Joshua Gordon, M.D., Ph.D.
Director
National Institute of Mental Health
Pronouns: He/him

Dr. Gordon, M.D., Ph.D. is Director of the National Institute of Mental Health (NIMH), the lead federal agency for research on mental disorders. He oversees an extensive research portfolio of basic and clinical research that seeks to transform the understanding and treatment of mental illnesses, paving the way for prevention, recovery, and cure.

Dr. Gordon pursued a combined M.D.-Ph.D. degree at the University of California, San Francisco. Medical school coursework in psychiatry and neuroscience convinced him that the greatest need, and greatest promise, for biomedical science was in these areas.

Dr. Gordon's research focuses on the analysis of neural activity in mice carrying mutations of relevance to psychiatric disease. His lab studied genetic models of these diseases from an integrative neuroscience perspective, focused on understanding how a given disease mutation leads to a behavioral phenotype across multiple levels of analysis. To this end, he employs a range of systems neuroscience techniques, including in vivo imaging, anesthetized and awake behavioral recordings, and optogenetics, which is the use of light to control neural activity. His research has direct relevance to schizophrenia, anxiety disorders, and depression.

Dr. Gordon's work has been recognized by several prestigious awards, including the Brain and Behavior Research Foundation – NARSAD Young Investigator Award, the Rising Star Award from the International Mental Health Research Organization, the A.E. Bennett Research Award from the Society of Biological Psychiatry, and the Daniel H. Efron Research Award from the American College of Neuropsychopharmacology.

Follow Dr. Gordon on Twitter [@NIMHDirector](https://twitter.com/NIMHDirector).



Walter Koroshetz, M.D.
Director
National Institute of Neurological Disorders and Stroke
Pronouns: He/him

Dr. Koroshetz serves as Director of the National Institute of Neurological Disorders and Stroke. He joined NINDS in 2007 as Deputy Director and has held leadership roles in a number of NIH and NINDS programs including co-leading the NIH's BRAIN Initiative, the NIH

RECOVER Initiative in the study of Post-Acute Sequelae of COVID-19, NIH Blueprint for Neuroscience, the NIH Post-Acute Sequelae of Covid-19 Initiative, the Traumatic Brain Injury Center collaboration between the NIH intramural and the Uniformed Health Services University, the Helping to End Addiction Long Term (HEAL) Initiative. He co-leads a number of NIH Common Fund's programs including the Undiagnosed Disease Network, the Acute to Chronic Pain Transition programs, Somatic Gene Editing program, Transformational ALS research program, and he was instrumental in founding the NIH Office of Emergency Care Research.

Before joining NINDS, Dr. Koroshetz served as Vice Chair of the neurology service and Director of stroke and neurointensive care services at Massachusetts General Hospital (MGH). He was a professor of Neurology at Harvard Medical School (HMS) and led neurology resident training at MGH between 1990 and 2007. Over that same period, he co-directed the HMS Neurobiology of Disease Course with Drs. Edward Kravitz and Robert H Brown.

Follow Dr. Koroshetz on Twitter [@NINDSDirector](#).



Felicia Jefferson, Ph.D.

Associate Professor, Department of Biology

Director, NeuBEs (Neuroscience, Bioengineering and Sleep) Laboratories

Fort Valley State University

Pronouns: She/her

Dr. Felicia Jefferson holds a B.S. in Biotechnology and German Language from Rochester Institute of Technology, an M.S. in Molecular Genetics and Biochemistry from Georgia State University and a Ph.D. in Neuroscience and Biomedical Science from Morehouse School of Medicine. Dr. Jefferson has served as a Biology and Environmental Science faculty member for nine years. She is a tenured Associate Professor within the University System of Georgia who recently served on two National Academies of Science, Engineering and Medicine panels and presented to the National Science Board. She was also commissioned as the lead author for a publication from the National Academies of Science, Engineering, and Medicine (NASEM). She serves as an appointed delegate to National CDEI under the American Society for Engineering Education (ASEE)'s Board of Directors and to the Artificial Intelligence in Sleep Medicine Committee under the American Association of Sleep Medicine. A recent publication funded by the National Science Foundation and published in the journal *Frontiers in Computer Science* by Jefferson is the most viewed peer-reviewed original research paper in the journal. She also has recent publications using Artificial Intelligence in Biology, CRISPR-Cas9 technology, remodeling the CREST Model, and investigating cognitive decline in *Drosophila* and patients. At her university, Dr. Jefferson has served as PI on seven grants, five federally funded garnering full overhead. She also has served as co-PI on other STEM-based grants. Funds from these grants advance scientific research, train students in STEM and fund students to participate in conferences and other training opportunities. Dr. Jefferson's achievements have earned her the GOLD (Graduate of the Last Decade) award in 2021 from Morehouse School of Medicine.



Yesenia Garcia-Sifuentes
Graduate Student
Emory University
Pronouns: They/them

Yesenia Garcia-Sifuentes is a Latinx, first-generation, nonbinary scientist and advocate for diversity. They are a Ph.D. candidate in the Emory University Neuroscience Graduate Program. Their research uses behavioral approaches to understand how social experiences influence reward-related decision-making and how these processes may be disrupted by early life adversity. In addition, they have conducted research on the reporting and misreporting of sex differences in the biological sciences resulting in a first-author publication. Yesenia graduated from Vassar College with a B.A. in neuroscience and a minor in English with a concentration in race and ethnicity. They earned the BP-ENDURE fellowship and spent two summers characterizing neural and behavioral alterations following cannabinoid withdrawal at Washington University in St. Louis. Yesenia is an alum of the Summer Program in Neuroscience, Excellence, and Success at the Marine Biological Laboratory in Woods Hole, MA. Recently, Yesenia was awarded the 2022 Howard Hughes Medical Institute Gilliam Fellowship for Advanced Study. Yesenia's overarching goal is to build inclusive communities and empower and support fellow students in STEM who have been historically excluded, marginalized, and oppressed.

Follow Yesenia on Twitter [@yeseniatweets](https://twitter.com/yeseniatweets).



Cellas Hayes, Ph.D.
Postdoctoral Scholar, Neurology & Neurological Sciences
Stanford University
Pronouns: He/him

Cellas is a first-generation college graduate who also recently received his Ph.D. from the University of Mississippi School of Pharmacy Department of Biomolecular Sciences. Cellas also received his bachelor's degree from his graduate alma mater in May 2019 in Biology. In addition to his graduate training, Cellas was a Southern Regional Education Board Scholar and a Smith Scholar at the Graduate Training Educational Center at the University of Mississippi Medical Center and a Neuroscience Scholars Program Associate/Fellow. As an undergraduate researcher in the Ashpole Laboratory, Cellas' research focused on understanding how neuroendocrine modulation specifically insulin-like growth factor-1 (IGF-1) altered learning and memory while his doctoral thesis focused on elucidating whether neurons or astrocytes were responsible for the neuroprotection of IGF-1 against ischemic stroke. Cellas' most noteworthy accomplishment during graduate school was being the first black trainee and the first trainee in 37 years at the University of Mississippi to receive a NIH F31. Cellas will soon be joining Stanford University as postdoctoral scholar in the Mormino Laboratory. Cellas' future research will use imaging modalities to understand how topographic changes in markers of vascular disease and Alzheimer's disease (tau PET) predict cognitive decline and gray matter atrophy in aging. Long term, he hopes to become an independent academic scientist at an R1 level institution using both clinical and preclinical techniques to understand the pathophysiological processes of neurodegenerative diseases.

Follow Cellas on Twitter [@c3llas](https://twitter.com/c3llas).



Stephanie Noble, Ph.D.

Postdoctoral Associate, Radiology & Biomedical Imaging

Yale University

Pronouns: She/her

Dr. Stephanie Noble is a postdoctoral associate in Radiology and Biomedical Imaging at Yale University where she is working on improving reproducibility of fMRI statistical methods for mapping the human brain, under the mentorship of Dr. Dustin Scheinost. Her research interests lie at the intersection of human neuroscience, statistics, and computational methods. Before starting her postdoc, she completed her undergraduate training in Chemical Engineering at Princeton University, co-founded neuroscience startup goBlue Labs LLC, worked as a technical consultant at Source Signal Imaging (now part of Cortech Solutions), and completed her Ph.D. in the Interdepartmental Neuroscience Program at Yale advised by Dr. Todd Constable. Her work has addressed open questions regarding reliability of fMRI maps and power of fMRI-specific inferential procedures. Throughout her careers in academia and industry, Dr. Noble has been supported by a number of awards, including the NSF GRFP, NIH DSPAN F99/K00, and NIH BRAIN K99/R00. Complementing her research, Dr. Noble has been an active advocate for open science practices and elevating underrepresented scientists, including fellow Latinas, in STEM.

Follow Stephanie on Twitter [@sNeuroble](https://twitter.com/sNeuroble).



Cory White, Ph.D.

Postdoctoral Fellow, Molecular and Comparative Pathobiology

Johns Hopkins University

Pronouns: He/him

Cory White, Ph.D. is a NIH Blueprint D-SPAN postdoctoral research fellow at Johns Hopkins University School of Medicine in the laboratory of Dionna W. Williams, Ph.D. studying the metabolic consequences of HIV in the brain using multiple animal models of infection in the Department of Molecular and Comparative Pathobiology at Johns Hopkins University School of Medicine. Before joining the Williams lab, Cory earned his Ph.D. in the Biochemistry, Cellular & Molecular Biology Graduate Program also at Hopkins and his B.S. summa cum laude from Mercer University. Cory is invested in initiatives that mentor, support, and advocate for historically excluded scientists. Currently serving as a mentor for the Hopkins Post-baccalaureate Research Education Program, a volunteer in the Hopkins HBCU Mentoring Program and near peer mentor and resource to junior scientists at Hopkins and beyond. Cory has also benefitted tremendously from communities and resources that have poured into his scientific and professional development through experiences in NSF Research Experiences for Undergraduates (REUs), the Society for Neuroscience's Neuroscience Scholars Program (NSP), the Diversity Specialized Predoctoral to Postdoctoral Advancement in Neuroscience Award (D-SPAN), and the Broadening the Representation of Academic Investigators in NeuroScience (BRAINS) Program.

Follow Cory on Twitter [@coryjwhite](https://twitter.com/coryjwhite).

ENDURE PROGRAM INFORMATION

BP-ENDURE AT HUNTER & NYU

HUNTER COLLEGE – CITY UNIVERSITY OF NEW YORK (CUNY)

<http://www.bpendure.org/>

Partner Institutions: New York University, Brown University, University of Michigan, Vanderbilt University, Yale University

Principal Investigator: Dr. Nesha Burghardt | Hunter College CUNY

Principal Investigator: Dr. Glenn Schafe | Hunter College CUNY

Principal Investigator: Dr. Chiye Aoki | New York University

Advisor: Dr. Margarita Kaplow | New York University

Program Coordinator: Kizzy Vazquez | Hunter College CUNY

Description: The overall goal of BP-ENDURE at Hunter College and NYU is to develop and refine the neuroscience training program at Hunter that will encourage and prepare students from diverse backgrounds to enter and succeed in neuroscience Ph.D. programs. To achieve this goal, Hunter College has developed a research-educational partnership with five outstanding T32- awarded universities: New York University, Brown, the University of Michigan, Vanderbilt, and Yale. This partnership will expose 12-14 BP-ENDURE students from Hunter College and NYU each year to a research-intensive curriculum and an environment of excellence and active research. Moreover, because of the diversity of the proposed mentors, students will be exposed to a broad spectrum of researchers, including basic neuroscientists interested in central nervous system (CNS) issues and more applied neuroscientists from the areas of clinical and cognitive neuroscience.

BRIDGE TO PH.D. IN NEUROSCIENCES PROGRAM

MICHIGAN STATE UNIVERSITY

<https://translationalscience.msu.edu/prospective-trainees/endure/index.html>

Partner Institutions: Ana G. Méndez University, Arizona University, North Carolina Central University, Northern New Mexico College, Pontifical Catholic University Puerto Rico, St. Mary's University (San Antonio, Texas), University of Puerto Rico-Arecibo, University of Puerto Rico-Cayey, University of Puerto Rico-Humacao, University of Puerto Rico-Ponce

Principal Investigator: Dr. Irving Vega | Michigan State University

Co-Investigator: Dr. Gina Leininger | Michigan State University

Program Coordinator: Fabiola Sotomayor-Reinat | Michigan State University

Description: The Bridge to Ph.D. in Neurosciences Program (BPNP) was created with the objective of increasing the number of underrepresented Ph.Ds. trained in the neurosciences; specifically, to facilitate

the entry of students into the Ph.D. program in Neuroscience at MSU and enhance the likelihood of their success. Students who have completed two summers of research are eligible to complete the fall semester of their senior undergraduate year at MSU. During the fall semester, the selected students take 9 credits of undergraduate courses in the neuroscience area, further develop the research project they began during the prior summer and receive one-on-one mentoring to develop competitive applications for graduate school.

BROOKLYN NEURAL NETS (NEUROSCIENCE EDUCATION AND TRAINING FOR SCIENTISTS)

BROOKLYN COLLEGE – CITY UNIVERSITY OF NEW YORK (CUNY)

<https://brooklyn.cuny.edu/bnets>

Partner Institutions: Medgar Evers College (MEC) and State University of New York (SUNY) Downstate Medical Center

Principal Investigator: Dr. Louise Hainline | Brooklyn College CUNY

Co-Investigator: Dr. Paul Forlano | Brooklyn College CUNY

Co-Investigator: Dr. Mark Stewart | SUNY Downstate Medical Center

Associate: Dr. Mohsin Patwary | Medgar Evers College

Description: Our program, Brooklyn Neural NETS (Neuroscience Education and Training for Scientists) or B-NETS, prepares well-qualified underrepresented (UR) juniors and seniors to enter careers in the neurosciences that require Ph.D. or M.D./Ph.D. degrees. B-NETS Fellows will increase the diversity of researchers in neuroscience and contribute research findings to address chronic neurological conditions that occur more frequently in minority and low-income populations, including the catchment area of the participating institutions where our students live and study. Working as a consortium and exploiting prior successful cross-institution collaborations, B-NETS is providing our Fellows with academic and research experiences to foster the development of strong research skills as well as the motivation to pursue careers in the broad field of the Neurosciences. The proposed B-NETS program will meet the goal of developing neuroscience research education programs by creating a full neuroscience major at BC and an expanded neuroscience curriculum at MEC. The senior administration of all three B-NETS partner institutions has prioritized STEM diversity programs and increasing faculty diversity and fully supports the B- NETS program.

INSPIRING DIVERSITY TO EXPLORE THE BRAIN IN THE 21ST CENTURY: THE NIH/NINDS-LSUHSC-NO, UNDERGRADUATE DIVERSITY IN NEUROSCIENCE RESEARCH EXPERIENCES

LOUISIANA STATE UNIVERSITY HEALTH SCIENCES CENTER NEW ORLEANS (LSUHSC-NO)

<https://www.medschool.lsuhschool.edu/odce/endure/>

Partnering Institutions: Dillard University, Louisiana State University and A&M College, Loyola University New Orleans, Southeastern University of Louisiana, Southern University at New Orleans, Tulane University, University of New Orleans, Xavier University of Louisiana

Principal Investigator: Dr. Allison Augustus-Wallace | LSUHSC-NO

Co-Investigator: Scott Edwards | LSUHSC-NO

Co-Investigator: Hamilton Farris | LSUHSC-NO

Co-Investigator: Patricia Molina | LSUHSC-NO

Co-Investigator: Fern Tsien | LSUHSC-NO

Program Coordinator: Melissa Prestwood | LSUHSC-NO

Description: Inspiring Diversity to Explore the Mind in the 21st Century: The NIH/NINDS-LSUHSC-NO, Undergraduate Diversity in Neuroscience Research Experiences Program is a one year, non-residential/commutator undergraduate summer academic enrichment program, which will provide students from partnered-institutions the opportunity to perform research and experience graduate education under the egis of neurosciences. This program leverages multi-university partnerships to provide structured mentored research experiences in neuroscience to undergraduate students from underrepresented/underserved populations in Louisiana. This is accomplished through summer and year-round mentor and mentee training in science, critical thinking, professional, and career skills. The program will increase the number of diverse applicants prepared for independent research, graduate school, and, ultimately, careers in neuroscience, helping to address population disparities in neurological diseases.

THE MID-ATLANTIC NEUROSCIENCE DIVERSITY SCHOLARS (MINDS) Program

TEMPLE UNIVERSITY

<https://sites.temple.edu/minds/>

Partner Institutions: Drexel University; Lincoln University of Pennsylvania; University of Maryland, College Park; University of Maryland School of Medicine

Principal Investigator: Dr. Ingrid R. Olson | Temple University

Subcontract Principal Investigator: Dr. Matthew Roesch | University of Maryland, College Park

Recruitment and Retention Coordinator: Dr. Lisa Briand | Temple University

Community Engagement Coordinator: Dr. Vishnu Murty | Temple University

Community Engagement Coordinator: Heather Lewis-Weber | Temple University

Program Coordinator: Alenah Yi | Temple University

Description: The Mid-Atlantic Neuroscience Diversity Scholars (MiNDS) program aims to bolster the number of underrepresented minority (URM) students within the neuroscience academic pipeline and build a foundation for URM students to succeed in graduate school and beyond. Our two-year program brings together scholars from Temple University, Lincoln University, and University of Maryland, College Park beginning the summer prior to scholars' junior year. The program provides scholars with the tools necessary to persist in academia by focusing on 6 elements: integrated research experiences during the academic year, immersive summer research experiences at R1 universities, opportunities to build presentation skills at local and national meetings, coursework to build technical excellence in neuroscience, professional skills training and mentoring to facilitate transition into neuroscience graduate programs, and outreach activities to foster community and build teaching skills.

NEUROSCIENCE RESEARCH OPPORTUNITIES TO INCREASE DIVERSITY

(Neuro- ID)

UNIVERSITY OF PUERTO RICO-RÍO PIEDRAS

<http://neuroid.uprrp.edu/>

Partner Institutions: Inter American University of Puerto Rico at Bayamón, Metropolitan University, Sacred Heart University of Puerto Rico

Principal Investigator: Dr. Jose García-Arrarás | University of Puerto Rico-Río Piedras

Principal Investigator: Dr. Carmen S. Maldonado-Vlaar | University of Puerto Rico-Río Piedras

Administrative Assistant: Marimar Velázquez-Vargas | University of Puerto Rico-Río Piedras

Description: NeuroID is a program designed to increase diversity in neuroscience by providing opportunities to undergraduate students interested in this area and enhance their scientific knowledge, research capability, and social responsibility.

NEVADA ENDURE

UNIVERSITY OF NEVADA RENO

<https://www.unr.edu/science/student-resources/nevada-endure-program>

Partner Institutions: Stanford University, Truckee Meadows Community College (TMCC), University of California Berkeley, University of California Davis, University of Michigan

Principal Investigator: Dr. Mariann Weierich | University of Nevada, Reno

Co-Investigator: Dr. Marian Berryhill | University of Nevada, Reno

Co-Investigator: Dr. Dennis Mathew | University of Nevada, Reno

Program Coordinator: Lauren Levi | University of Nevada, Reno

Description: The Nevada ENDURE Program is a two-year intensive neuroscience research training program. The University of Nevada, Reno (UNR) partners with Truckee Meadows Community College to recruit talented sophomores from backgrounds that are underrepresented in neuroscience. Nevada ENDURE trainees begin the program in the summer before the junior year, during which they are paid to work full-time for 10 weeks in a neuroscience research lab at one of our summer partner institutions: UC Berkeley, UC Davis, the University of Michigan, or Stanford University. During the summer before the senior year, trainees similarly conduct research at a second summer partner institution. During the junior and senior academic years, trainees are paid to work 15 hours per week in a UNR neuroscience research lab and they also attend a weekly seminar that provides additional training in topics including professional development, research ethics, and preparing research for presentation. Trainees also attend and present at research conferences including the annual Society for Neuroscience meeting.

SUMMER TRANSFER AHEAD INTO RESEARCH TRAINING IN NEUROSCIENCE (STARTneuro)

UNIVERSITY OF CALIFORNIA SAN DIEGO

<https://startneuro.ucsd.edu/>

Partner Institutions: City College of San Francisco, Cuyamaca Community College, De Anza Community College, Grossmont Community College, Imperial Valley College, MiraCosta College, Pasadena City College, San Diego Miramar College, Saddleback Community College, Solano Community College, Southwestern College

Principal Investigator: Dr. Ashley L. Juavinett | University of California San Diego

Principal Investigator: Dr. Brenda Bloodgood | University of California San Diego

Co-investigator: Dr. David Artis | University of California San Diego

Co-investigator: Dr. Terry Gaasterland | University of California San Diego

Co-investigator: Dr. Stanley Lo | University of California San Diego

Co-investigator: Dr. Eduardo Macagno | University of California San Diego

Program Coordinator: Jason Avalos | University of California San Diego

Description: STARTneuro trains and mentors diverse transfer students as they enter neuroscience research with the goal of preparing them to apply for Ph.D. programs. Our program begins with a 10-week summer research training program to ramp students up on key neuroscience techniques and facilitates lab placements with faculty mentors during the school year. During the academic year, students will meet regularly with program faculty, be shepherded into laboratory internships, and be mentored in applying for a research scholarship the following summer. STARTneuro also provides professional development workshops for mentors, including graduate students, postdoctoral

scholars, research staff, and faculty, to work with transfer students in their labs.

UNIVERSITY OF WASHINGTON ENDURE

UNIVERSITY OF WASHINGTON

<http://depts.washington.edu/endure/>

Partner Institutions: Puget Sound Community Colleges

Principal Investigator: Dr. Horacio O. de la Iglesia | University of Washington

Co-Investigator: Dr. Eric H. Chudler | University of Washington

Program Manager: Jessica Huszar | University of Washington

Description: The goal of UW ENDURE is to mentor and train undergraduates who belong to underrepresented minorities in the sciences to transition into successful graduate careers in neuroscience. Our ENDURE program specifically targets undergraduates in community colleges within the Puget Sound regions. Participants are part of a full-time summer research experience and year-round training in quantitative and computational skills, basic principles of neuroscience, writing and oral communication courses and workshops, and network activities intended to increase their sense of identity with academic STEM environments and guide them towards a successful application to a competitive neuroscience graduate program.

WUSTL ENDURE

WASHINGTON UNIVERSITY IN ST. LOUIS

<http://endure.wustl.edu/>

Partner Institutions: Harris-Stowe State University, St. Louis University, University of Missouri-St. Louis

Principal Investigator: Dr. Erik Herzog | Washington University in St. Louis

Program Coordinator: Lori Corzine | Washington University in St. Louis

Description: The Washington University in St. Louis (WUSTL) ENDURE undergraduate research program prepares undergraduates from diverse backgrounds for neuroscience Ph.D. programs. We combine outstanding research training, a rigorous curriculum, and an empowering support system so participants thrive on their path to graduate school and beyond. With support from the NIH Blueprint ENDURE initiative and Washington University, accepted students are funded for up to two years and trips to the annual Society for Neuroscience meeting. Overall, the program embeds students in a network of neuroscientists and enhances the success of trainees towards our goal of increasing diversity in neuroscience.

ENDURE SCHOLAR PROFILES

Dina Abdalla

Pronouns: She/Her

Email: abdalla.d@wustl.edu

Home Institution: Washington University in St. Louis

Undergraduate Major and Graduation Date: Cognitive Neuroscience, 2024

Science Interests: My scientific interests include investigating the roles in which natural restorative biological systems, like sleep, can help reverse neurological diseases, like Alzheimer's disease. Using the brain's own capacity to remove excess toxicity can be crucial to understanding how to combat neuropathologies.

Career Goals: I am interested in pursuing either a M.D./Ph.D. in neuroscience, or an M.D./M.P.H. Either way, I am interested in continuing research in the future as a physician. I am interested in exploring psychiatry and cognitive neuroscience topics as a physician scientist.

Laila Abdalla

Email: Lailaabdalla185@gmail.com

Home Institution: University of Washington

Undergraduate Major and Graduation Date: Pre-science, 2024

Science Interests: I am interested in the control and dynamics of movement in biology.

Career Goals: I hope to graduate from a graduate program in Neuroscience.

Khalid Abrera

Pronouns: He/Him

Email: Khalid1@uw.edu

Home Institution: University of Washington

Undergraduate Major and Graduation Date: Biology; Physiology and Neuroscience, 2024

Home Institution Mentors: Dr. Raaj Gowrishankar, Dr. Michael Bruchas

Science Interests: I am interested in studying the neuroanatomical and physiological mechanisms of neuropsychiatric disorders. Many of these disorders are simply from the dysfunction of dopamine signals which also leads to Parkinson's and other movement disorders. With the background knowledge of that, I am interested in research that allows us as scientists to improve the effectiveness of treatment as well as recognizing these disorders prematurely.

Career Goals: In the future, I plan to matriculate into a M.D.-Ph.D. program specifically getting my Ph.D. in neuroscience. This will allow me to continue to conduct scientific research and apply the critical thinking skills into a translational setting. On the M.D. side, I would like to specialize into being

a cardiothoracic surgeon, as I always gravitated towards the side of the field as heart disease is the leading cause of death. I wish in the future to combine the benchwork and research from the Ph.D. with the M.D. to combat a way to fight heart disease.

Alexander Acevedo

Pronouns: He/Him

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Home Institution: University of Puerto Rico-Río Piedras

Undergraduate Major and Graduation Date: Biology, May 2023

Home Institution Mentor: Dr. Carmen Maldonado-Vlaar

Science Interests: Neurobiology of addiction, anxiety, depression, and other disorders

Career Goals: M.D./Ph.D.

Oumayma Agdali

Pronouns: She/Her

Email: mayaagdali@gmail.com

Home Institution: Hunter College CUNY

Undergraduate Major and Graduation Date: Psychology, December 2023

Science Interests: My scientific interests lie in cognitive neuroscience, specifically consciousness. The origins and neural mechanisms of consciousness and the implications of this on human behavior.

Career Goals: I plan to pursue a Ph.D. in cognitive neuroscience. In my future career i hope to investigate the quantum physics behind consciousness in the brain, such as ORCH theory.

Milagros Alday

Pronouns: She/Her

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Home Institution: University of Arizona

Undergraduate Major and Graduation Date: Neuroscience and Spanish, 2024

Science Interests: My scientific interests include learning about how the brain influences behavior. I am interested in studying addiction as well as other conditions like depression, and anxiety.

Career Goals: My career goal is to be a neurosurgeon. However, before I reach that goal, I want to participate in clinical research specifically researching topics in neuroscience.

Noor AlraShed

Pronouns: She/Her

Email: nalras@lsuhsc.edu

Home Institution: Xavier University of Louisiana

Undergraduate Major and Graduation Date: Biology, May 2024

Science Interests: My interests lie in understanding the physiology of the brain after it has been exposed to certain events such as addiction and pain. In addition to the brain, I am interested in learning about eye diseases and treatment. Nonetheless, I am also interested in gaining insight about the health disparities communities face and what treatments we could do to prevent such disparities.

Career Goals: I plan to pursue an M.D./M.P.H. or M.D./Ph.D. I will use my degree and skills to help people, specifically Middle Eastern, in gaining the health care they need. I hope to spread awareness to the lack of knowledge we have on Middle Eastern health data and how we can prevent that in the future as well.

Daniela Anderson

Email: daniela8324@gmail.com

Home Institution: Universitario Ana G. Méndez

Undergraduate Major and Graduation Date: Biology, 2023

Science Interests: I am interested in studying how various neuropeptides within different regions of the brain modulate social behavior in males and females. I look forward to utilizing this new knowledge to improve the lives of others in the future.

Career Goals: I plan to pursue an M.D./Ph.D. I plan to continue my behavioral research and specializing in endocrinology in medical school. I hope to be able to apply the knowledge I discover in my research to treat my patients more effectively.

Giovanna Arantes de Oliveira Campos

Pronouns: She/They

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Home Institution: Temple University

Undergraduate Major Graduation Date: Neuroscience, 2024

Home Institution Mentors: Dr. Nora Newcombe, Dr. Ingrid Olson

Science Interests: My main scientific interests are episodic and semantic memory, language, learning, and attention, especially in early and middle childhood. The intersections between neuroscience, psychology, and education in research particularly appeal to me. I would like to study these topics in neurotypical populations as well as in those with developmental disabilities, such as autism and ADHD.

Career Goals: After completing my B.S. in neuroscience with a minor in psychology and a certificate in American Sign Language, I will pursue a Ph.D. in either neuroscience or psychology. I plan to become a pediatric clinical neuropsychologist who sees patients, does research, and, eventually, teaches.

Jasper Rei Balinas

Pronouns: They/Them

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Home Institution: University of Washington

Undergraduate Major and Graduation Date: Computer Science, 2024

Science Interests: Brain-computer interfacing, closed loop systems, neuromodulation, autoimmune disorders.

Career Goals: Improving brain-computer interfaces in existing vagal nerve stimulators to maximize the potential of remission for people living with Crohn's disease (and other autoimmune illnesses).

Jacqueline Banuelos

Pronouns: She/Her

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Home Institution: University of Washington

Undergraduate Major and Graduation Date: Speech and Hearing Sciences, 2023

Home Institution Mentors: Dr. Sheri Mizumori, Victoria Hones

Science Interests: As an aspiring speech pathologist, I am passionate about understanding the biological processes that enable communication. I am particularly interested in how the brain influences dynamic learning and memory as both are often involved in impairments seen in language disorders.

Career Goals: After obtaining my bachelor's degree at the University of Washington, I will pursue a graduate degree in medical speech-language pathology. I hope to specialize in treating complex neurogenic disorders and traumatic brain injuries after obtaining my degree, while continuing to pursue research opportunities relating to this field.

Maria Bonilla

Pronouns: She/Her

Email: maria.bonilla5@upr.edu

Home Institution: University of Puerto Rico-Río Piedras

Undergraduate Major and Graduation Date: Molecular & Cellular Biology, 2023

Home Institution Mentor: Dr. Christian Bravo-Rivera

Science Interests: My main research interests are behavioral, cognitive, and molecular neuroscience. I am especially interested in memory and what happens in the brain when it is affected.

Career Goals: My career goal is to use my love for neuroscience to understand diseases like Alzheimer's, depression, and addiction and help those who suffer because of them.

Shelby Bruneniefs

Pronouns: She/Her

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Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Cognitive Behavioral Neuroscience, 2023

Science Interests: My research interests include the causes and treatment of psychiatric and neurological disorders. The neural consequences trauma has on resiliency, empathy, and circadian rhythms. As well as how to create more equitable treatment models for those dealing with substance abuse.

Career Goals: I hope to increase equity through medicine by becoming a physician's assistant.

Darwin Buckner, II

Email: dbuckner@ucsd.edu

Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Psychology, 2024

Home Institution Mentors: Drs. Ashley Juanvinett, Brenda Bloodgood, Terry Gaasterland

Science Interests: I am interested in abnormal physiological brain functioning and its correlation with various mental health illnesses.

Career Goals: I will become a neuropsychologist.

Melody Chao

Pronouns: She/Her

Email: melody.chao126@gmail.com

Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Neurobiology, Spring 2023

Home Institution Mentors: Dr. Thomas S. Hnasko, Lucie Oriol

Science Interests: I am interested in the cellular and molecular mechanisms behind psychiatric disorders as well as substance abuse disorders. I am also generally interested in understanding different processes in the brain at a physiological level, as I often wonder what changes are being made physiologically to produce their effects when presented with a new problem.

Career Goals: I first plan to enter a post-baccalaureate program or work as a lab technician for a year or two. Afterwards, I intend to pursue a neuroscience Ph.D. and eventually work on the discovery and development of drugs in the pharmaceutical industry.

Nancy Collie-Beard

Pronouns: She/Her

Email: nancy.k.collie@gmail.com

Home Institution: Hunter College CUNY

Undergraduate Major and Graduation Date: Biology, 2023

Home Institution Mentor: Dr. Nesha Burghardt

Science Interests: Electrophysiology, emotions, decision-making, neurobiology, brain circuits, psychopathology, disinhibition, eating disorders.

Career Goals: I aspire to get my Ph.D. not only to contribute to the broader scientific understanding regarding the brain's role in behavior, but so that I can help mentor the next generation of scientists. Eventually, I hope to create an environment where experience and perspective, particularly of underrepresented groups in higher education, are celebrated. I think doing so will only increase the quality of science possible.

Shylyn Collier

Pronouns: He/They

Email: shylyn@wustl.edu

Home Institution: University of Missouri-St. Louis

Undergraduate Majors and Graduation Date: Biochemistry and Biotechnology, 2024

Home Institution Mentor: Dr. Jennifer Siciliani

Science Interests: My scientific interests are learning about neurodevelopment and how interruptions in metabolic pathways can lead to neurological disorders.

Career Goals: My career goals are to be a lecturer and researcher that works with minority undergraduates to become more interested in STEM and research.

Natali Colombo

Pronouns: She/Her

Email: Natali21@uw.edu

Home Institution: University of Washington

Undergraduate Major and Graduation Date: Neuroscience, 2025

Science Interests: In future research I am looking to continue to understand and learn about the individuality of the human brain when it comes to the relationships between mental illness, medicine, and the brain's natural biology. These key relationships are especially important to me as I am looking to study medicine through the lens of a psychiatrist.

Career Goals: As a current student at the University of Washington I am working towards applying for medical school. My future goals include specializing in adolescent psychiatry and opening my own

practice.

Luis Colon

Pronouns: He/Him

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Home Institution: University of Puerto Rico-Cayey

Undergraduate Major and Graduation Date: Chemistry, 2025

Science Interests: Due to the different experiences I have been able to participate in the last couple of years, I determined that neuroscience and pharmacology are the areas of most interest to me.

However, I also like the immunological aspect of humans and the research done in this area.

Moreover, these areas of study can merge between them.

Career Goals: I first want to finish my bachelor's in chemistry with a minor concentration in neuroscience. Then I will be working on obtaining my doctoral degree. Until now, I am leaning more to get a Pharm.D. However, I do not discard the possibility of working for a Ph.D. in neuropharmacology. I would like to work in the industry and, at the same time, do research.

Julieann Colon-Sarriera

Pronouns: She/Her/Ella

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Home Institution: University of Puerto Rico-Río Piedras

Undergraduate Major and Graduation Date: Molecular and Cell Biology, 2024

Home Institution Mentor: Dr. Alfredo Ghezzi

Science Interests: I am currently interested in understanding the neuroadaptation mechanisms of chronic alcohol exposure in *Drosophila melanogaster*. My research focuses on studying transcriptional responses that occur due to developmental alcohol exposure. Therefore, I am interested to see how exposing *Drosophila* to alcohol at different stages of its life cycle, either during larval or adult stage, results in changes in genetic expression that can account for previously observed changes in behavior and cognition. With my research efforts I aim to contribute to the understanding of alcohol use disorder (AUD) and fetal alcohol syndrome (FAS) in the human population.

Career Goals: I am currently in my Senior year completing a major in molecular and cell biology with a minor degree in medical humanities at the University of Puerto Rico, Río Piedras Campus. My career goals are to obtain an M.D./Ph.D. degree; I would like to complete a comprehensive training in general pediatrics and a further residency in neurology, as well as a Ph.D. in neuroscience. With both my clinical and research training, I aim to help children born with FAS and other neurological and neurodegenerative diseases as well.

Jocelyn Contreras

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Home Institution: New Mexico State University

Undergraduate Major and Graduation Date: Biology and Microbiology, 2023

Science Interests: My scientific interests are neuroscience with a focus to immunology.

Career Goals: My career goals are to become a research scientist.

Priscilla Coriano

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Home Institution: Interamerican University of Puerto Rico

Undergraduate Major and Graduation Date: Biology, 2023

Home Institution Mentor: Dr. Elizabeth Padilla-Crespo

Science Interests: The specific line of inquiry I would like to pursue as a graduate research student are the mechanisms behind the sensory and motor nervous system related conditions. Primarily, the mechanisms behind epilepsy and Parkinson's disease. These issues pose of particular interest to me as my proximity to these health conditions lead my curious mind to question the "why's" and "how's" of the intricate cellular and molecular mechanisms behind them.

Career Goals: My career goals include academic research in the field of neurosciences specifically within the sensory motor system. My long-term goals with this career are to expand humanities knowledge on our intricate brains as well as posing as a mentor for like-minded individuals who also wish to pursue a career in research. I intend on conducting research on epilepsy pathology from various forms of the condition.

Andrea Corretjer

Pronouns: She/Her

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Home Institution: University of Puerto Rico-Río Piedras

Graduation Date: 2025

Home Institution Mentors: Dr. Carmen Maldonado, Dr. José Garcías-Arrarás

Science Interests: My interests include studying mental health and alternative or new medications. I specifically am intrigued using psychedelics as a treatment for disorders such as PTSD, major depression, and anxiety.

Career Goals: I envision a career in either academia or industry where I am able to work in a lab to better understand the mechanisms of these mental disorders.

Christian Cortes

Pronouns: He/Him

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Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Clinical Psychology, 2024

Science Interests: I am very interested in cognitive neuroscience questions, particularly those involving neurodegeneration.

Career Goals: I aspire to attain a Ph.D. in clinical psychology. I would like to have my own practice and teach.

Fabrizio Darby

Pronouns: He/Him

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Home Institution: University of Miami

Undergraduate Major and Graduation Date: Biology and Health Science, May 2023

Science Interests: I am interested in studying the neural mechanisms behind bias and in-group behavior. I am also fascinated by chronobiology and translational applications of chronobiology to patient care.

Career Goals: I hope to pursue an M.D./Ph.D. and become a physician-scientist.

Netanya Dennis

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Home Institution: North Carolina Central University

Undergraduate Majors and Graduation Date: Chemistry and Psychology, May 2023

Science Interests: Behavioral neuroscience, neuropharmacology. I want to examine the relationships between behaviors and environment/socioeconomic status as well as how pharmaceuticals can affect it.

Career Goals: I want to work in both academia and industry to study behavior and drug discovery.

Bra'a Durubeh

Pronouns: She/Her

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Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Neurobiology, Spring 2023

Home Institution Mentors: Drs. Brenda Bloodgood, Ashley Juavinett, Eduardo Macagno, Kay Tye

Science Interests: Emotions, memories, decision making, spinal cord injury.

Career Goals: Clinical psychologist, neuroscientist.

Pansée ElGhayati

Pronouns: She/Her

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Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Cognitive and Behavioral Neuroscience, 2024

Science Interests: My scientific/research interests lie within learning and understanding neurological disorders such as autism spectrum disorders.

Career Goals: After finishing my undergraduate, I would like to get more experience in research abroad and then apply to graduate school.

Immanuela-Nicole Enwesi

Pronouns: She/Her

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Home Institution: University of Maryland, College Park

Undergraduate Majors and Graduation Date: Neuroscience and French Language and Studies, 2024

Home Institution Mentor: Dr. Tracy Riggins

Science Interests: I am interested in Pediatric Developmental studies.

Career Goals: I am interested in either research or being an OB/GYN.

Joyce Escatel

Pronouns: She/Her

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Home Institution: Brooklyn College CUNY

Undergraduate Major and Graduation Date: Psychology, 2024

Home Institution Mentor: Dr. Yu Gao

Science Interests: My scientific interests are aspects of abnormal behavior, the study of mental health disorders, addiction, brain injuries that cause behavioral changes, and how the chemistry in the brain plays a role in how symptoms of mental illnesses are exhibited. My overall interest is on behaviors.

Career Goals: My career goals are to gain experience doing research to develop new skills in how to conduct studies, data analysis, writing, and communication. I want to earn a Ph.D. to become a researcher and explore my interests in behaviors.

Alexdiel Figueroa

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Home Institution: University of Puerto Rico-Río Piedras

Undergraduate Major and Graduation Date: Interdisciplinary Studies in Natural Sciences, 2023

Science Interests: Interested in the neurobiology of anxiety-related behaviors.

Career Goals: I aspire to be a scientist that transform knowledge into real-world solutions by working with the Academia and private industry. To accomplish that goal, I will gain my Ph.D. in neuroscience while networking with professionals in the private industry.

Daisy Flores

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Home Institution: University of California San Diego

Undergraduate Major: Ecology, Behavior, and Evolution

Home Institution Mentors: Drs. Brenda Bloodgood, Ashley Juavinett, Eduardo Macagno, Stanley Lo

Science Interests: I am interested and feel lucky to be able to study Neuroscience using iPSCs. Yet am also interested in Behavioral neuroscience and enjoy learning how it intertwines with Evolutionary biology.

Career Goals: I hope to continue conducting research in my career, an M.D.-Ph.D.

Brittney Fietze

Pronouns: She/Her

Email: bbfreit@nmsu.edu

Home Institution: New Mexico State University

Undergraduate Major and Graduation Date: Biology, 2023

Science Interests: Neuroinflammation; glial cells; inflammation; microbiology; research techniques.

Career Goals: Overall I want to help people and I want to be a part of a lab. Whether that be a tech position or work on my post doc I will have to see but I do want to be in a research lab and try to help figure things out.

Rebeca Fuquen

Pronouns: She/They

Email: rebecawf7@gmail.com

Home Institution: University of Maryland, College Park

Undergraduate Majors and Graduation Date: Animal Science and Studio Art, 2024

Home Institution Mentor: Dr. Catherine Carr

Science Interests: Learning behavior, growth/development, physiology, anatomy, neural pathways, general animal behavior.

Career Goals: I am interested in pursuing a D.V.M.-Ph.D.; however, I am also considering scientific illustration or possibly wildlife research.

Jonathan Garcia

Pronouns: He/Him

Email: jgarc97@terpmail.umd.edu

Home Institution: University of Maryland, College Park

Undergraduate Major Graduation Date: Cellular & Molecular Neuroscience, 2024

Home Institution Mentor: Dr. Marco Venniro

Science Interests: I am interested in investigating the neurobiological mechanisms modulating symptoms of PTSD and the intergenerational transmission of depression and trauma. Additionally, I am interested in working with preclinical models for childhood adversity.

Career Goals: I am currently working towards establishing a career in neuroscience research. I will be applying to graduate school next fall, and I hope to one day make contributions to the field of neuroscience as the principal investigator of my own lab.

Brandon Gehrke

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Home Institution: University of Colorado Denver

Undergraduate Major and Graduation Date: Biochemistry, 2023

Home Institution Mentor: Dr. Katherine Rennie

Science Interests: I am interested in understanding the therapeutic potential of psychedelics and how they facilitate changes in the brain. I am also interested in studying the neurotoxic effects of heavy metals from industrial practices.

Career Goals: After getting my undergraduate degree I plan to apply to a Ph.D. program so that I can pursue my research goals and further my education.

Jalyssa Gonzales

Pronouns: She/They

Email: Jalyssagonzales@icloud.com

Home Institution: University of Colorado

Undergraduate Major and Graduation Date: Neuroscience, 2026

Science Interests: I am still exploring interests, but my internship has piqued my interest in the field of prosthetics and optogenetics.

Career Goals: My goal is to obtain a Ph.D. in neuroscience and conduct research.

Abdelrhman Gouda

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Home Institution: Hunter College CUNY

Undergraduate Major and Graduation Date: Clinical Psychology, 2024

Science Interests: I am primarily interested in consciousness research. I am currently working with Dr. Paul Glimcher at New York University, using the neuroeconomic and robust mathematical frameworks he pioneered to empirically study questions of the mind which were previously exclusively in the realm of philosophical thought such as volition, dualism, and decision-making. Over the summer I worked with Dr. Dinesh Pal at the University of Michigan where we modulated the 'level' of consciousness in rats using psychedelics to try to gain a better understanding of what exactly consciousness is.

Career Goals: I would like to pursue a Ph.D. and continue doing research on consciousness, hopefully using psychedelics as a tool for manipulating that aspect of the mind. If possible, doing my own psychedelic-assisted clinical work, informed by my concurrent research is something I am very interested in.

Nicole Granados

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Email: ngranados@ucsd.edu

Home Institution: University of California San Diego

Undergraduate Major: General Biology

Home Institution Mentors: Dr. Ashley Juavinett, Daniela Cassataro

Science Interests: Currently, my scientific interests include HIV and its effect on the brain (HAND) particulate matter and its effect on the brain (its intersection to Alzheimer's and autism).

Career Goals: Once I obtain my bachelor's I would like to pursue a Ph.D. in biology. My goal is to become a lecturer and find an intersection between biology and public health education.

Jordan Gross

Pronouns: She/Her

Email: jg6149@nyu.edu

Home Institution: New York University

Undergraduate Major and Graduation Date: Psychology, 2023

Home Institution Mentors: Dr. Julieta Lischinsky, Dr. Dayu Lin

Science Interests: I am interested in understanding the neuroscience underlying behavior. I am interested in a variety of topics within behavioral neuroscience, like the neural mechanisms of autism

and related social behaviors, memory, and Alzheimer's disease, and how learning/experience alters the brain and affects future generations' genes and behavior. I am currently working with Dr. Julieta Lischinsky at Dr. Dayu Lin's lab to investigate neural circuitry for innate social behaviors, specifically aggression and mating in mice.

Career Goals: I plan to apply to Ph.D. programs in behavioral neuroscience and related areas this fall with the goal of one day leading research at my own lab. As a researcher, I would like to emphasize the importance of mentorship, especially for fellow women of color in STEM. I would like to pursue research topics using interdisciplinary techniques in neuroscience, psychology, and genetics.

Andrea Guerra Chong

Pronouns: She/Her

Email: aguerrachong@ucsd.edu

Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Neurobiology, 2024

Science Interests: Neurobiology, optogenetics, neurodegenerative diseases, molecular and cellular biology.

Career Goals: Achieving a Ph.D. in neurobiology, make science more accessible for different underrepresented communities, teach about neuroscience/science in different education levels.

Yuval Guetta

Pronouns: She/Her

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Home Institution: Hunter College CUNY

Undergraduate Major and Graduation Date: Psychology, 2023

Home Institution Mentor: Dr. Ekaterina Likhtik

Science Interests: Neural circuits involved in learning and memory, fear, and stress responses.

Career Goals: M.D.-Ph.D. in clinical, translational neuroscience.

Glorianna Gutierrez

Pronouns: She/Her

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Home Institution: University of Washington

Undergraduate Major and Graduation Date: Neuroscience and Psychology, 2024

Home Institution Mentors: Dr. de la Iglesia, Asad Beck

Science Interests: My interest in research includes studying the circadian rhythm, its origins in the brain, and its effects on human behavior and brain disorders like epilepsy. I am also interested in the

application of machine learning in neuroscience, specifically, how it can be used to better understand the human brain and its applications in treatment development. I am currently researching the use of a machine learning algorithm to prevent the onset of seizures in a Dravet Syndrome mouse model. In the future, I hope to expand on this research by focusing on the circadian rhythm and its relationship to brain disorders.

Career Goals: After completing my bachelor's degree, I will pursue a Ph.D. in neuroscience to continue researching circadian rhythms, brain disorders, and machine learning applications in neuroscience. My long-term career goal is to become a research scientist in this field and continue innovating and discovering new ways to use the circadian rhythm to improve people's quality of life and treat brain disorders.

Ryan Henry

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Home Institution: Hunter College CUNY

Undergraduate Major and Graduation Date: Psychological Physiology, 2024

Home Institution Mentor: Dr. Thomas Preuss

Science Interests: My research interests include systems neuroscience methods that investigate the functional connectivity of distinct neural circuits, reward prediction error as it relates to temporal difference learning, and cross-modal multisensory integration. I am currently conducting research in the neuroethology lab of Dr. Thomas Preuss, where they are investigating the role of spontaneous activity on a predicted startle response in the Mauthner circuit of zebrafish.

Career Goals: Future goals include completing a doctorate in neuroscience and working to fill critical gaps in our understanding of human brain function to facilitate the development and optimization of electrical and biological brain modulation therapies, as well as intraoperative neurophysiological assessment of functional integrity during surgical procedures on the nervous system.

Stephanie Hernandez

Pronouns: She/Her

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Home Institution: University of Puerto Rico-Humacao

Undergraduate Major and Graduation Date: Microbiology, May 2023

Home Institution Mentor: Dr. Rafael Maldonado Hernandez

Science Interests: My scientific interests involve molecular and biochemical mechanisms in neuroscience. I would love to keep working with the aggregations of tau proteins in Alzheimer's disease since there is still so much to learn about this topic. True understanding of knowledge comes upon teaching others and that affective communication is the biggest responsibility of a scientist.

Therefore, I want to make science accessible to a large and diverse audience including colleagues, researchers, science communicators, teachers, students, and other science- interested non-experts, with my end goal being to constantly push frontiers of knowledge.

Career Goals: Currently my long-term career goal after I finish my Ph.D. in neuroscience is to work as a researcher for a US federal government laboratory. I plan to dedicate my years in graduate school not only to my main project but to also to be an advocate and help spread more knowledge about neuroscience. After fulfilling that aspect, I want to dedicate my time to provide even more knowledge advancement and knowledge application.

Han Hoang

Pronouns: She/Her

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Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Data Science, 2025

Home Institution Mentor: Dr. Ashley Juavinett

Science Interests: Synesthesia, mindfulness studies, bioinformatics, neural data science.

Career Goals: Lead data scientist/quantitative researcher.

Penelope Hurtado-Stuart

Pronouns: She/Her

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Home Institution: University of Arizona

Undergraduate Majors and Graduation Date: Neuroscience and Cognitive Science, Linguistics, Arabic, 2024

Home Institution Mentors: Dr. Scott Kilgore, Dr. Mary Alt

Science Interests: Neuroscience, neuroimaging, linguistics, neural correlates of consciousness, sleep and insomnia, child development.

Career Goals: I intend to pursue a Ph.D. in neuroscience following my graduation.

Noah (Munassar) Hussein

Pronouns: He/Him

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Home Institution: Brooklyn College CUNY

Undergraduate Major: Psychology

Home Institution Mentors: Dr. Andrew Delamater, Daniel Siegel

Science Interests: My scientific research interests are in the field of behavioral neuroscience. I look

forward to furthering my understanding of the brain and its inner mechanisms that allow for learning, memory, and neuroplasticity, which influence both our perception of the world and how we learn to react to events within it. My research experience thus far has been thrilling, by working on uncovering processes that are still a mystery and pushing our knowledge in neuroscience. Some questions I am interested in exploring is how the brain learns and stores memories and then be able to retrieve that information later. Career Goals: My career goal is to deepen and develop my knowledge to become an expert in my field and graduate with a Ph.D. in neuroscience. After graduating I wish to always continue learning and present my own questions and be able to perform the science required to answer them as a researcher, so I may become a knowledge creator. I look forward to having a lab of my own and leading a group of researchers to new discoveries and accomplishments that will heighten our insight as a community and be used to benefit society.

Natalie Ito

Pronouns: She/Her

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Home Institution: New York University

Undergraduate Major and Graduation Date: Neural Science, 2024

Science Interests: I am interested in understanding the disruptions in molecular mechanisms that may be involved in neurodevelopmental and neurodegenerative disorders, such as Alzheimer's disease. I am interested in combining behavioral, molecular, and genetic approaches to investigate the role of genetic and environmental factors on regulatory processes and cognition.

Career Goals: I plan to pursue an M.D./Ph.D. in a neuroscience program to complement neuroscience research with clinical practice. I believe having a background in both would help bridge the gap between research and medicine and offer me valuable insight to conduct translational research in the hope of advancing current clinical interventions and treatments.

Monica Jensen

Pronouns: She/Her

Email: mljensen@ucsd.edu

Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Neurobiology, 2024

Science Interests: I am interested in learning about memory, the unconscious, perception, and neurodegenerative diseases.

Career Goals: I hope to graduate and continue to get a Ph.D. or a master's degree. I hope to work somewhere that is innovative and contributes to the growth of science, medicine, or and technology. I am hoping to help others and work with people and data.

Mariyah Jiwanji

Pronouns: She/Her

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Home Institution: Temple University

Undergraduate Major and Graduation Date: Neuroscience, 2023

Home Institution Mentor: Dr. Mathieu Wimmer

Science Interests: Prosthetics, robotics, machine learning, AI.

Career Goals: Not sure yet.

Odelia Johnson

Email: odeliaj9000@gmail.com

Home Institution: Brooklyn College CUNY

Undergraduate Major and Graduation Date: Chemistry, 2023

Home Institution Mentor: Dr. Laura Rabin

Science Interests: I am currently interested in the study of neurodegenerative disorders, more specifically Alzheimer's disease, from a neural cognitive perspective as well as a molecular perspective. I am looking to join another lab where I can make connections to my cognitive research and how impairments occur through molecular mechanism impairments.

Career Goals: I would like to pursue a Ph.D. in neuroscience and continue the research I am doing at my home institution. Post Ph.D., I anticipate working in a biopharmaceutical company where I can contribute my research skills to developing new technologies that are much needed in the field of neuroscience.

Shay Kathiresh

Email: sushmitha.kathiresh@ucdenver.edu

Home Institution: University of Colorado Denver

Undergraduate Major and Graduation Date: Biology, Spring 2024

Home Institution Mentor: Dr. Nidia Quillinan

Science Interests: As a sophomore in college, I was selected for a competitive research program at my university called the MARC-U STAR research program. This program is aimed towards students who would like to pursue a career in research. I am interested in a combination of medicine and research which is why I originally applied to the program. Upon joining the program, I joined a lab at the CU Anschutz Medical Campus. Getting a spot to research at Anschutz is extremely competitive and I am grateful for given the opportunity to research at a medical campus. The lab I started with works with fruit flies to investigate metabolic pathways in fat bodies. The project I worked on aimed to investigate the differences in fat body storage between male and female larvae as well as if there were any

specific metabolic genes that regulate these differences. I have expanded my area of research into neuroscience so I can study the development of the brain and how it regulates specific functions throughout the body. My current project focuses on learning about how different durations of cardiac arrest influences brain injury.

Career Goals: I am looking to the M.D./Ph.D. route upon graduation from college. I love the idea of being able to do a little bit of both. I would like to do research in the cardiology field and use what I have learned to treat patients. I love learning more about the body and the science behind medicine and how patients are treated. With a combination of interests in both fields, I decided to pursue the M.D./Ph.D. route.

Javier Kelly Cuenca

Pronouns: He/him

Email: jek4mg@umsystem.edu

Home Institution: University of Missouri-Columbia

Undergraduate Major and Graduation Date: Biochemistry, 2023

Home Institution Mentor: Dr. Johannes Schul

Science Interests: Most of my undergraduate experience and research passion revolve around neural circuits. However, with my most recent introduction to the type of technology and science behind the research underlying genetic disorders and immunology, I have gained an interest in these fields.

Because of this, my scientific interests comprise any subject related to neural circuits (e.g., CGPs), genetic disorders (e.g., dementia), communication between systems (e.g., how information is processed to react to events), and circadian rhythms (e.g., behavioral rhythms).

Career Goals: Current goals include applying to graduate school and earning a Ph.D. in neuroscience. After that, my perspectives would consider either a job in teaching/researching at a college institution or industry. Both paths seem personally engaging and attractive as a final job position.

Alexus Lawrence

Pronouns: She/They

Email: Alexislawrence1@gmail.com

Home Institution: Brooklyn College CUNY

Undergraduate Major and Graduation Date: Psychology, Spring 2023

Home Institution Mentors: Drs. Louise Hainline, Mark Stewart, Paul Forlano, Alejandra Castillo

Science Interests: I am broadly interested in cognitive neuroscience and mechanisms underlying social decision making in humans. More specifically I am interested in studying the dysregulation of brain circuits and neurochemistry that contribute to mental health disorders that have a severe impact on human social interactions such as bipolar disorder. I would like to incorporate an integrative

approach using behavioral and quantitative neuroimaging techniques to explore these questions.

Career Goals: My future career goal is to earn a Ph.D. focused on cognitive neuroscience and mental health. Although I am unsure of the exact occupation and field (academia or industry), I know that in my future career, I would like to perform research that would lead to better treatments for mental health disorders such as bipolar disorder.

Ekaterina Lebayle

Email: ekaterina.lebayle49@myhunter.cuny.edu

Home Institution: Hunter College CUNY

Undergraduate Major and Graduation Date: Physiological Psychology, 2023

Science Interests: Neural mechanisms of psychiatric and neurological diseases in humans.

Career Goals: Neuroscience Ph.D.

Pearl Leon Guerrero-McInally

Pronouns: She/Her

Email: pearl1g@uw.edu

Home Institution: University of Washington

Undergraduate Major and Graduation Date: Biochemistry, 2024

Home Institution Mentor: Dr. Eric Peterman

Science Interests: I am interested in pharmaceutical sciences and molecular/cellular biology. My research interests include drug development related to cancer and neurodegenerative diseases.

Career Goals: After graduating with a BS in biochemistry, I aim to pursue a Ph.D. and become a pharmaceutical researcher. I plan to work in research and drug development. After working in industry for a while, I would like to become a high school chemistry teacher.

Ashley Letona

Email: ALetona93@Gmail.com

Home Institution: University of Washington Tacoma

Undergraduate Major and Graduation Date: Psychology, 2023

Science Interests: I am interested in the different learning process of people (culture) and the difference between an addictive pathway and a non-addictive pathway.

Career Goals: I want to become a school psychologist or psychologist. I also want to work on studying addiction and learning disabilities.

Caroline Lewis

Pronouns: They/Them

Email: lewis29c@mtholyoke.edu

Home Institution: Mount Holyoke College

Undergraduate Major and Graduation Date: Neuroscience and Behavior, 2023

Home Institution Mentor: Dr. Ken Colodner

Science Interests: Cellular and molecular aspects of neurodegeneration, specifically in Alzheimer's disease.

Career Goals: I would like to have my own lab that studies potential therapies and preventions of Alzheimer's disease.

Justin Lopez-Roque

Pronouns: He/Him

Email: j.a.lopez-roque@wustl.edu

Home Institution: Washington University in St. Louis

Undergraduate Major and Graduation Date: Cognitive Neuroscience, 2023

Home Institution Mentors: Dr. Susan Perlman, Dr. Khalil Thompson

Science Interests: Brain development, brain imaging, adolescent and child brain development, emotional development, trauma (and effects of trauma on structural/functional brain development), coping, mechanisms, experimental imaging, fear development.

Career Goals: The current goal is to get into a Ph.D. program and complete a Ph.D. focusing on brain imaging research within the field of cognitive neuroscience. Afterwards, I plan to be open to a couple options that include consistent research, such as teaching. I hope to eventually have the resources to build my own lab.

Madison Marcus

Pronouns: She/Her

Email: mpm0214@nmsu.edu

Home Institution: New Mexico State University

Undergraduate Majors and Graduation Date: Genetics and Biotechnology, Psychology, 2024

Science Interests: I have a love for genetics and have a specific interest in inheritance and disease related research. Participating in neuroscience research branches my genetics and psychology background. I have enjoyed looking at the underlying genetic mechanisms that contribute to disease and would like to continue down this path.

Career Goals: After completing my undergraduate degree I would like to study either genetic counseling or another genetic related research field in graduate school.

Shayne Mayo

Email: shmayo@ucsd.edu

Home Institution: University of California San Diego

Undergraduate Major: Cognitive Science with a specialization in Neuroscience

Home Institution Mentors: Dr. Ashley Juavinett, Dr. Brenda Bloodgood

Science Interests: Leaning towards systems neuroscience and the use of optogenetics.

Career Goals: Research scientist potentially running my own lab.

David Melendez-Perdomo

Pronouns: He/Him

Email: dmelendezperdomo@ucsd.edu

Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Biochemistry, 2024

Science Interests: Neuroscience.

Career Goals: Run a neuroscience lab.

Rachel Membreno Almendares

Pronouns: She/Her

Email: rachelmembreno9@gmail.com

Home Institution: San Diego State University

Undergraduate Major: Psychology with an emphasis in Neuroscience

Science Interests: Cognitive neuroscience.

Career Goals: Research professor.

Mariel Kristine Micael

Email: mmicael@ucsd.edu

Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Cognitive and Behavioral Neuroscience; 2023

Home Institution Mentors: Dr. Ashley Brandebura, Dr. Nicola Allen

Science Interests: My scientific interests include neurodegenerative diseases, aging, learning and memory.

Career Goals: My short-term career goals are to obtain a position as a research assistant in a neuroscience lab and prepare to apply for graduate programs. My long-term career goal is to conduct research on Alzheimer's Disease whether it be in an industry or academic setting.

Joyce Milandu

Pronouns: She/Her

Email: joylmilandu@gmail.com

Home Institution: University of Maryland, College Park

Undergraduate Major and Graduation Date: Neuroscience, 2024

Home Institution Mentor: Dr. Edward Bernat

Science Interests: My primary interest focuses on cognitive and clinical neuroscience. I am interested in research regarding how psychopathology affects cognitive processes such as decision-making. I currently conduct research at the Clinical and Cognitive Neuroscience Lab, led by Dr. Edward Bernat, where we are assessing the shared and unique relationships that the P300 event-related potential, and the medial-frontal theta waveform have with the psychopathology "p" factor.

Career Goals: Immediately after graduating with a Bachelor of Science in Neuroscience, I intend on getting more research experience through Post-Baccalaureate Research Education programs.

Following this, I plan to pursue an M.D/Ph.D. in Psychiatry and Neuroscience.

Nylah Miles

Pronouns: She/Her

Email: tuk43286@temple.edu

Home Institution: Temple University

Undergraduate Major and Graduation Date: Neuroscience, 2023

Home Institution Mentors: Drs. Lisa A Briand, Ingrid Olson, Vishnu Murty

Science Interests: Memory and recall, cognition, addiction.

Career Goals: Graduate undergraduate and go to graduate school and pursue a Ph.D. in neuroscience.

Maxwell Miyasato

Pronouns: He/Him

Email: mmiyasato@nevada.unr.edu

Home Institution: University of Nevada Reno

Undergraduate Majors and Graduation Date: Chemistry and Neuroscience, 2023

Science Interests: I am interested in the neurobiological underpinnings of psychopathology, and how treatments affect such disorders. I am also interested in the neural mechanisms behind plasticity.

Career Goals: I would like to go to graduate school for my Ph.D. in neuroscience and continue doing research in academia.

Evelyn Mpofu

Email: empofu@lsuhsc.edu

Home Institution: Xavier University of Louisiana

Undergraduate Major and Graduation Date: Neuroscience Pre-med, 2024

Science Interests: Currently, my scientific interests include traumatic brain injuries as well as learning to slow the progression of neurodegenerative diseases like Alzheimer's and Parkinson's.

Career Goals: As of right now, I plan to take my degree and experience in neuroscience to the field of sports medicine, analyzing and treating various sport related brain injuries, such as concussions.

Atheer Musad

Email: Atheer.Musad60@bcmail.cuny.edu

Home Institution: Brooklyn College CUNY

Undergraduate Major and Graduation Date: Psychology, May 2023

Home Institution Mentors: Drs. Louis Hainline, Mark Stewart, Paul Forlano

Science Interests: My main interests are in the treatments of the mental disorders.

Career Goals: My career goal is applying to Ph.D. program in neuropsychiatry.

Lewis Nunez

Pronouns: He/Him

Email: lewis.nunezseverino565@myhunter.cuny.edu

Home Institution: Hunter College CUNY

Undergraduate Major and Graduation Date: Psychology, 2024

Home Institution Mentor: Dr. Nesha Burghardt

Science Interests: I am interested in studying underlying mechanisms and abnormalities involved in behavior and disorders, such as anxiety.

Career Goals: Once I graduate from Hunter College with a Bachelor of Arts in psychology and a minor in sociology, I plan to pursue a Ph.D. in neuroscience. I want to broaden my knowledge in the field and build a network of people as I learn about their experiences while I make mine. My goal is to gather experience in research and different techniques to, then, pursue a career in academia as a primary investigator.

Beverly Obodaifio

Email: bobodaifio2@gmail.com

Home Institution: University of Maryland, College Park

Undergraduate Major and Graduation Date: Psychology, 2022

Home Institution Mentor: Dr. Scott Juntti

Science Interests: My interests for research are in mood disorders, racial differences in the success of psychopharmacology, autism, and the connection between social behaviors and genes.

Career Goals: My career goals include becoming a physician scientist with focuses in psychiatry and psychopharmacology. I want to make research more accessible in terms of language as well as in diversity of who it applies to. I am also passionate about using research to inform practice in terms of patient care and the pharmacological interventions used in psychiatry.

Geraldine Ortiz

Pronouns: She/Her

Email: geraldine.ortiz@upr.edu

Home Institution: University of Puerto Rico-Cayey

Undergraduate Major and Graduation Date: Natural Sciences, 2024

Home Institution Mentor: Dr. Ricardo Chiesa

Science Interests: I am intrigued to comprehend the mechanisms of neurodegenerative disorders' progression as well as the effects of cerebrovascular diseases contributions to these conditions. I am inclined towards the medical field and particularly take interest in the diagnosis of neurological disorders and how existing treatments can be improved.

Career Goals: After my undergraduate education, I am aiming to obtain a medical degree to specialize on the study of the brain and neurological diseases. One of my goals is to contribute to the development of improved treatments including disease-modifying therapies. I particularly aspire to reach minority groups and communities that do not have access to good medical care and collaborate with researchers in the field to provide patients effective therapies that are specific to each of their needs.

Stephanie Ortiz Espailat

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Home Institution: University of Puerto Rico-Río Piedras

Undergraduate Major and Graduation Date: Cellular Molecular Biology, May 2024

Science Interests: My research interests are cognitive and behavioral Neuroscience.

Career Goals: As for now, my future career goal is realizing an M.D./Ph.D.

Beau Oster

Pronouns: He/Him

Email: boster@nevada.unr.edu

Home Institution: University of Nevada Reno

Undergraduate Major and Graduation Date: Neuroscience, 2023

Home Institution Mentor: Dr. Marian Berryhill

Science Interests: Neuroplasticity, neurodegeneration, neurobiology, cortical thickness, cognitive function, neuropsychology, molecular neuroscience.

Career Goals: My interest in the overlap between clinical disease pathology and neuroscience research solidifies my plan to attend a Medical Scientist Training Program (MSTP) where I will earn my M.D. and Ph.D. after I graduate.

Juan Padilla

Pronouns: He/Him

Email: juan.padilla5@upr.edu

Home Institution: University of Puerto Rico-Río Piedras

Undergraduate Major and Graduation Date: Biology, 2024

Home Institution Mentor: Dr. Christian Bravo

Science Interests: Lateral habenula extended circuits involved in fear regulation and circadian rhythm influence on memory consolidation.

Career Goals: Short term career goals include completion of my bachelor's degree and post Bach program entry. Long term career goals are to complete a Ph.D. and continue to a post doc program.

Leila Paige

Email: lp Paige@nevada.unr.edu

Home Institution: University of Nevada Reno

Undergraduate Major and Graduation Date: Neuroscience, 2024

Science Interests: I am interested in learning more about how to help people with different mental disorders and disabilities.

Career Goals: My current goal is to get experience in the labs and then work either at my school or at a hospital.

Matthew Piniero

Pronouns: He/Him

Email: tun41426@temple.edu

Home Institution: Temple University

Undergraduate Majors and Graduation Date: Neuroscience and Psychology, 2024

Home Institution Mentor: Dr. Emily M. Black

Science Interests: I am interested in neuroscience and psychology research in general, but I am especially interested in research about substance abuse, autism, and TBI.

Career Goals: I would like to pursue a Ph.D. in neuroscience research.

Trinidi Prochaska

Pronouns: She/Her

Email: prochaskat@wustl.edu

Home Institution: Washington University in St. Louis

Undergraduate Major and Graduation Date: Neuroscience, 2023

Home Institution Mentors: Dr. Rachel Lean, Dr. Cynthia Rogers

Science Interests: Neuroscience, electrophysiology, uterus excitability.

Career Goals: Obtain an M.D./Ph.D. and become an OB/GYN, with the Ph.D. focusing on the neuroscience and excitability of the uterus.

Fabiola Ramos

Pronouns: She/Her

Email: frbaez13@gmail.com

Home Institution: Antillean Adventist University

Undergraduate Major and Graduation Date: Nursing, December 2022

Home Institution Mentor: Dr. Sylvia Carmenatty Martorell

Science Interests: I am currently interested in neuroscience research specifically in the analysis of circadian rhythms and its effects on the female reproductive axis.

Career Goals: I aspire to be an M.D. student. I am currently perusing an M.D. to then specialize in neurosurgery. I would like to integrate my neuroscience research in the practice of medicine by continuing to help patients with the evaluation, diagnosis, and treatment of neurological diseases.

Alexis Reed

Pronouns: She/Her

Email: alexis.reed@lions.lincoln.edu

Home Institution: Lincoln University of Pennsylvania

Undergraduate Major and Graduation Date: Biology, 2024

Science Interests: My interests are in Neurology and Dermatology.

Career Goals: My goals are to become a dermatologist or neurologist and open my own practice in an area that serves my community.

Joel Rejouis

Pronouns: He/Him

Email: joelrejouis91@gmail.com

Home Institution: Brooklyn College CUNY

Undergraduate Major and Graduation Date: Psychology, 2024

Home Institution Mentor: Dr. Elizabeth Chua

Science Interests: My scientific interests are brain trauma, brain damages, and the neurologic changes in brain activity.

Career Goals: My career goals are to gain lab experience in the field of neuroscience to help me become a Ph.D. student and to work in an environment where I am doing task surrounding the study of brain injury or neurologically damages.

Catrina Reyes

Pronouns: She/Her

Email: catrinadr19@gmail.com

Home Institution: Washington University in St. Louis

Undergraduate Major and Graduation Date: Cognitive Neuroscience, 2024

Home Institution Mentors: Dr. Daniel Gibson, Dr. Mayssa Mokalled

Science Interests: Cognitive neuroscience and neuroscience.

Career Goals: M.D./Ph.D. or M.D.

Camille Reynoso Fernandez

Email: camillepatricia250@icloud.com

Home Institution: Brooklyn College CUNY

Undergraduate Major and Graduation Date: Psychology, 2024

Science Interests: Neuroscience, clinical psychology and personality disorders research, stem cell therapy (neuroscience), interoception.

Career Goals: Clinical psychologist and/or researcher.

Wilma V. Richiez Mateo

Pronouns: She/Her

Email: wilma.richiez@upr.edu

Home Institution: University of Puerto Rico-Bayamon

Undergraduate Major and Graduation Date: Human Biology, December 2023

Home Institution Mentor: Dr. Jennifer Barreto

Science Interests: My scientific interests are in neuroscience research that focuses on studying behavior and neuropsychiatric disorders such as addiction, schizophrenia depression, etc. I am also interested in learning more about neurodegeneration and how this affects memory and behavior. Furthermore, I am interested in developing more research in the future that is focused on clinical work.

Career Goals: My career goals are to acquire a Ph.D. in neuroscience and focus on learning more

about psychiatric disorders. I am also interested in working in scientific administrative roles such as working at the NIH.

Natalia Rincon

Pronouns: She/Her

Email: natalia.rincon016@gmail.com

Home Institution: University of Maryland, College Park

Undergraduate Major and Graduation Date: Psychology, 2024

Science Interests: Behavioral psychology, neuroscience, addiction.

Career Goals: To go to graduate school and earn a Ph.D. in neuroscience. Gain a better understanding of addiction, drugs, and the brain.

Shamauri Rivera

Pronouns: They/Them

Email: Shamauririvera@gmail.com

Home Institution: Hunter College CUNY

Undergraduate Major and Graduation Date: Physiological Psychology, 2023

Science Interests: My interests are in the emergent properties of group behaviors and how individual neurophysiological differences contribute to certain group dynamics. Specifically, I am interested in physiological entrainment during task-based cooperation and exploring methods to increase group cohesion through technological intervention (e.g., XR, architectural and environmental manipulation, group-state feedback, etc.). My interests are in the emergent properties of group behaviors and how individual neurophysiological differences contribute to certain group dynamics. Specifically, I am interested in physiological entrainment during task-based cooperation and exploring methods to increase group cohesion through technological intervention (e.g., XR, architectural and environmental manipulation, group-state feedback, etc.).

Career Goals: I will contribute to the development of technology that allows for the optimization of cooperation. I will directly apply my research to the current world and directly work with teams in all shapes and forms. I hope to further humanities understanding of how we are deeply connected with one another.

Angelys Rivera Hernández

Email: angelys.rivera4@upr.edu

Home Institution: University of Puerto Rico-Río Piedras

Undergraduate Major and Graduation Date: Biology, 2025

Home Institution Mentors: Dr. Carmen Maldonado-Vlaar, Dr. José Garcías-Arrarás

Science Interests: I am super interested in researching Alzheimer's disease in a molecular and clinical way. Also, I am interested in continuing to work on behavioral neuroscience. Within that field of behavioral neuroscience, I have always been fascinated with studying and correlating the behavior of serial killers with neural diseases or conditions.

Career Goals: I am interested in completing a Ph.D. degree on Neuroscience. Also, I plan to make contributions to my Puerto Rican scientific community.

Yanilis Rodriguez

Pronouns: She/Her

Email: yrodriguez0086@intersg.edu

Home Institution: Interamerican University of Puerto Rico

Undergraduate Major and Graduation Date: Psychology, 2023

Science Interests: I am interested in continuing research in Neurosciences, especially behavior projects. As a Psychology student, I want to focus on behavior and its abnormalities when the organism (humans, animals) has a disease.

Career Goals: My career goals are study a Ph.D. in clinical psychology and a postdoc in neuropsychology. I want to impact the society and be part of research in this field.

Amanda Rodriguez Leon

Pronouns: She/Her

Email: amanda.rodriguez24@upr.edu

Home Institution: University of Puerto Rico-Río Piedras

Undergraduate Major and Graduation Date: Cellular & Molecular Biology, 2024

Home Institution Mentors: Dr. José Garcías-Arrarás, Dr. Carmen Maldonado-Vlaar

Science Interests: I am interested in the neurobiology of drug addiction, the sleeping cycle and how neurobehavioral diseases come to be developed in the brain.

Career Goals: I will pursue an M.D./Ph.D. after I graduate from my bachelor's degree to work in the fields of neuroscience and neurology.

Jesús Rosario-Claudio

Pronouns: He/Him

Email: jesus.rosario10@upr.edu

Home Institution: University of Puerto Rico-Cayey

Undergraduate Major and Graduation Date: Natural Sciences, 2023

Home Institution Mentor: Dr. Ruth Pietri-Melendez

Science Interests: During my first years of undergraduate studies, I began gaining biomedical research

experience and I became highly motivated to do science, largely because due to the immense contributions it provides to human health in ways that traditional physicians do not. Since then, I have participated on multiple research experiences and developed a strong interest on topics such as neurobiology of pain and inflammation, neuroimmune interactions and neurodegenerative disease. The biomedical research field, and the impact it has, is truly mesmerizing, and I am excited to continue gaining more experiences on said field to prepare for my career goals.

Career Goals: My professional goal is to become a physician-scientist to serve overlooked communities and contribute to our understanding of human afflictions. I firmly believe that all the experiences I have described, and the ones I will continue to gain, have given me enough consciousness to understand the commitment of pursuing a career in research and medicine and to be excited about it. Furthermore, I believe becoming a physician-scientist is not only a professional goal but the process that will provide me with the necessary tools and training to serve to the highest degree I can.

Jacob Ross

Pronouns: He/Him

Email: jaross@ucsd.edu

Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Neurobiology, 2023

Science Interests: Investigation of non-opioidergic analgesic agents and techniques.

Career Goals: Start a successful brewery here in San Diego.

Michelle Ruiz Velazquez

Email: mruizvelazquez@nevada.unr.edu

Home Institution: University of Nevada Reno

Undergraduate Major and Graduation Date: Psychology, Spring 2024

Home Institution Mentors: Dr. Sarah Haigh, Stephanie Otto

Science Interests: I am specifically interested in anything involved in cognitive neuroscience, especially memory.

Career Goals: I plan to pursue a Ph.D. in cognitive neuroscience and work towards a career in academia.

Caleb Ryce

Email: calebryce22@gmail.com

Home Institution: University of Nevada Reno

Undergraduate Major and Graduation Date: Neuroscience, Spring 2024

Science Interests: I am interested in researching the cellular mechanisms and cell cycle of cancerous cells in glial tumors of the brain. More specifically, how these cells avoid the intended processes of the cell cycle such as the G₀ phase and programmed cellular death. I have gained skills that will help me with my future endeavors such as becoming well acquainted with light, fluorescent, and imaging microscopy during my time spent in Ann Arbor over the past summer.

Career Goals: Following my graduation in 2024, I plan to pursue an MSTP program in hopes of obtaining both an M.D. and Ph.D. I hope to be in a neuroscience related medical field, so that I will be able to have my research of interest coincide with my everyday work. I hope to serve as an example for other young Black men in STEM, as I know we account for a very small population in both research and the medical field.

Axelle Salazar

Pronouns: He/Him

Email: axelles1@uw.edu

Home Institution: University of Washington

Undergraduate Major and Graduation Date: Neuroscience, 2025

Home Institution Mentor: Jovana Navarrete

Science Interests: I am interested in the behavioral changes that arise because of stress in animals. Specifically, I more interested in the changes that come because of altering circadian rhythms.

Career Goals: I plan on majoring in neuroscience and later apply to medical school to further study this in hopes of pursuing a career as a neurologist or a neurosurgeon.

Taliana Salcedo

Pronouns: She/Her

Email: taliana.salcedo@upr.edu

Home Institution: University of Puerto Rico-Bayamon

Undergraduate Major and Graduation Date: 2024

Home Institution Mentor: Dr. Demetrio Sierra Mercado

Science Interests: My scientific and research interest are related with the anxiety and fear behaviors. Also, I have interest in neurological disorders, drug abuse, emotional responses, and post-traumatic stress disorders. (TBI)

Career Goals: I want to pursue an M.D./Ph.D. specialized in neurology to perform research that contribute to the health of the society. Also, with an M.D./Ph.D. I can aid people in the clinical area.

Samir Samadov

Email: samirsamadov72@gmail.com

Home Institution: Brooklyn College CUNY

Undergraduate Major and Graduation Date: Psychology, 2024

Science Interests: In this research we are looking for causes and effects of the SUDEP (sudden, unexpected death in epilepsy). The reason I am interested in it is because my uncle has a sudden epileptic seizure. I saw him suffering and it is quite scary to see it. Our research will involve work with animal models of seizures and obstructive apnea. In a rat model, urethane anesthetized animals are studied during periods of controlled airway occlusion to simulate laryngospasm-induced obstructive apnea. Our planned experiments will address the time course of brainstem failure following respiratory arrest. We will make multiple measures of brainstem function to define the time window after respiratory arrest within which animals can be successfully resuscitated.

Career Goals: When I graduate from Brooklyn college, I will receive my Bachelor of Science in psychology and neuroscience. After graduating I plan to obtain an M.D./Ph.D. in neuroscience and one day become a neurosurgeon.

Koralee Santiago Rivera

Pronouns: She/Her

Email: koraleesantiago@gmail.com

Home Institution: University of Puerto Rico-Cayey

Graduation Date: 2024

Science Interests: Neuroscience, immunology, cancer.

Career Goals: Ph.D.

Safa Sheik

Pronouns: She/Her

Email: safa.sheik36@myhunter.cuny.edu

Home Institution: Hunter College CUNY

Undergraduate Major and Graduation Date: Biology, 2024

Science Interests: My interests lie in neuroscience. I am intrigued by early adversity and depression. Furthermore, I want to explore cognitive functions through the lens of neuroscience.

Career Goals: I love solving problems and being enchanted by stories of humanity. I believe that becoming a physician-scientist is the highest pursuit for someone with these qualities.

Annabelle Tangen

Pronouns: She/Her

Email: caseytangen@gmail.com

Home Institution: Colorado State University

Undergraduate Major and Graduation Date: Neuroscience, 2023

Home Institution Mentors: Dr. Jaclyn Stephens, Dr. Courtney Ngai

Science Interests: Psychiatric disorders, neuroimaging

Career Goals: Obtain a Ph.D. in neuroscience.

Maria Tello Borja

Pronouns: She/Her

Email: mariadelmar@wustl.edu

Home Institution: Washington University in St. Louis

Undergraduate Majors: Philosophy, Neuroscience, Psychology (PNP) and English Literature

Science Interests: I am interested in investigating the use of alternate treatments to treat depression and other mental health illnesses. I am particularly captivated by the growing field of psychedelics as an intervention.

Career Goals: Upon graduation, I plan to work in a lab for a year or two before applying to neuroscience graduate school.

Tyara Thompson

Pronouns: She/Her

Email: tthompson24@wooster.edu

Home Institution: The College of Wooster

Undergraduate Major and Graduation Date: Neuroscience, 2024

Home Institution Mentors: Drs. Laura Burch, Amber Garcia, Grit Herzmann

Science Interests: I am interested in the impacts of food deserts on brain development and function.

Career Goals: I would like to get my Ph.D. in neuroscience to do research on food deserts and eventually become a professor of neuroscience.

Iliana Todorovski

Pronouns: She/Her

Email: tul57962@temple.edu

Home Institution: Temple University

Undergraduate Major and Graduation Date: Psychology, 2023

Home Institution Mentor: Dr. Lisa A. Briand

Science Interests: I am interested in sex differences in opiate seeking and taking.

Career Goals: I wish to work in a clinical setting.

Citlalli Tomas Baltazar

Pronouns: She/Her

Email: tuk93275@temple.edu

Home Institution: Temple University

Undergraduate Major and Graduation Date: Neuroscience, 2023

Home Institution Mentors: Dr. Mathieu Wimmer, Dr. Dana Zeid

Science Interests: Addiction, memory, behavior, stress, sleep, epigenetics, development.

Career Goals: Become a researcher at a pharmaceutical company.

Alondra Torres

Pronouns: She/Her

Email: atorre@uw.edu

Home Institution: University of Washington

Undergraduate Major and Graduation Date: Psychology and Sociology, 2023

Home Institution Mentors: Dr. Garret Stuber, Dr. Brandy Briones

Science Interests: Cognitive Behavioral Therapy: Psycho-social interventions to reduce the symptoms of various mental health conditions, primarily regarding depression and anxiety disorders. Patterning between socioeconomic status and mental disorders – how the lack of proper mental health resources exacerbates symptoms of mental disorders, especially for low-income marginalized communities. Psychoactive drugs as treatment for mental health disorders: Potential of certain psychoactive drugs such as hallucinogens for treatment in mental disorders such as depression, PTSD, schizophrenia, and bi-polar disorder.

Career Goals: I hope to work as a psychotherapist post-graduate school.

Cristal M. Torres Rodriguez

Email: cristal.torres3@upr.edu

Home Institution: University of Puerto Rico-Río Piedras

Undergraduate Major and Graduation Date: Biology, May 2024

Science Interests: Some of my scientific interests are in the following areas: behavioral neuroscience, cognitive neuroscience, cellular and molecular neuroscience, and neuropharmacology.

Career Goals: When I finish my bachelor's degree in molecular cellular biology, I would like to pursue a M.D./Ph.D. in neuroscience studies.

Isaac Toscano

Pronouns: He/Him

Email: itoscano@scu.edu

Home Institution: Santa Clara University

Undergraduate Major and Graduate Date: Neuroscience, 2024

Home Institution Mentor: Dr. Laura Cocas

Science Interests: I am interested in looking at the beneficial effects of psychedelics and how they can be used to further explore consciousness.

Career Goals: I wish to work with psychedelics either in academia or industry.

Javian Vasconcelos

Pronouns: He/Him

Email: jvasconcelos@ucsd.edu

Home Institution: University of California San Diego

Undergraduate Major: Cognitive and Behavioral Neuroscience

Science Interests: I am interested in looking at the beneficial effects of psychedelics and how they can be used to further explore consciousness.

Career Goals: I wish to work with psychedelics either in academia or industry.

Zixian Wang

Email: zixian1213@gmail.com

Home Institution: Hunter College CUNY

Undergraduate Major and Graduation Date: Biology, June 2023

Science Interests: Zixian is currently studying the impact of extracellular matrix on oligodendrocyte myelination, and the trigeminal ganglion-cornea signaling pathway. Her future interest has three main directions. First, continue to study the vision signaling pathway and mechanism. Second, study oligodendrocyte and neuron interaction with the developed TG-Eyeball model. Third, navigate therapeutic potential underneath the visual signaling pathway and neuron-glia interaction.

Career Goals: Ph.D. in neuroscience.

Zuzanna Warchol

Pronouns: She/Her

Email: Zwarchol6223@gmail.com

Home Institution: Brooklyn College CUNY

Undergraduate Majors and Graduation Date: Psychology and Biology 2024

Home Institution Mentors: Dr. Paul Forlano, Alejandra Myerston Castillo

Science Interests: Research applying to drugs and their potential uses, mental illness, drugs for mental illness, and neurotransmitters.

Career Goals: After graduating with a bachelors, I plan to apply to Ph.D. programs.

Glen Miguel Angel Wickersham Garcia

Pronouns: They/Their

Email: gwickersh72@sagrado.edu

Home Institution: Universidad del Sagrado Corazon

Undergraduate Major and Graduation Date: Biotechnology, 2024

Home Institution Mentor: Dr. José Garcías-Arrarás

Science Interests: Identifying the putative factors involved in innervation of the mesentery of the sea cucumber during regeneration of the intestine. Outside interests include anti-aging of the Human and mouse central nervous system, specifically targeting prevention of degeneration, ROS generation, dedifferentiation of glial cells into neurons and migration of these, improved optimized signaling as well as overall monitoring and precise intervention medicine using both optimized non- invasive imaging and spatial sequencing. Although not my main interests, I also include behavioral neuroscience and development neuroscience.

Career Goals: The main goal career-wise is to start a biotech company based on answering and producing alternative precise drugs, the in-vivo non-invasive imaging software, and devices, while maintaining a rich collaborative environment with academia focused on neuroscience. Before this however, I need to prosper inside a Ph.D. in neuroscience and engineering with Dr. Sinclair's laboratory and continue to participate actively inside Nucleate's organization.

Linisa Williams

Pronouns: She/Her

Email: Lvwilliams@ucsd.edu

Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Clinical Psychology, 2024

Science Interests: Biological makers of PTSD and Fear disorders.

Career Goals: Clinical therapist.

Justin Woods

Pronouns: He/Him

Email: j.woods@wustl.edu

Home Institution: Washington University in St. Louis

Undergraduate Major and Graduation Date: Cognitive Neuroscience, May 2023

Home Institution Mentors: Dr. Ream Al-Hasani, Marwa Mikati

Science Interests: My research interests lie in better understanding the neurological bases of how addictions; from food addictions to substance abuse I wish to understand how they are facilitated and the systematic effects of withdrawal.

Career Goals: My career aspirations lie in medicine; I plan to continue my studies after undergraduate in med school with the hopes of becoming a physician. There are a lot of disciplines within medicine that I could see myself becoming, but my main goal is to increase medical literacy and bolster preventative care measures within my race.

Solomon Wossene

Email: Solomander37@gmail.com

Home Institution: University of Washington

Undergraduate Major and Graduation Date: Neuroscience, 2023

Science Interests: Neuroscience is a mechanism our brains do on their own, however, we struggle to figure out how. Though there have been major breakthroughs in neuroscience development, so much more is still out there to be discovered. My scientific interest starts here. I like posing important unknown questions and enjoy the “thrill of the chase” trying to find a solution.

Career Goals: After finishing undergraduate, I want to apply to UW Med. Though I enjoy research, I also find surgery to be super important. That said, my main career path focuses on becoming a neurosurgeon. With the help of a neuroscience degree and experience working in research, I want to focus most of my time in surgery, but also doing research on the side. There is still so much to learn, and I want to be the neurosurgeon people come too when everyone else says no.

Hanan Yafai

Pronouns: She/Her

Email: hanan.yafai78@bcmail.cuny.edu

Home Institution: Brooklyn College CUNY

Undergraduate Major and Graduation Date: Psychology with minor in Neuroscience, May 2023

Home Institution Mentor: Dr. Mark Stewart

Science Interests: My primary research interest in behavioral neuroscience is in the neural mechanisms that support learning and memory and motivate approach and avoidance behavior.

Identifying the mechanisms by which factors like stress, sleep, and antidepressants affect these brain circuits and how they alter the cognitive and emotional processes Understanding how these mechanisms are disrupted in depression and other stress-related psychiatric disorders, and eventually developing a treatment, is part of my goal. At Liston Lab, we are testing a treatment for stress-induced spine elimination in the prefrontal cortex (PFC), which is believed to be a primary driver of depressive

symptoms.

Career Goals: I want to obtain a Ph.D. in an interdisciplinary neuroscience program. Furthermore, to bridge the gap between the lab bench and the clinical world, my postdoctoral aim is to apply the skills I acquired during my scientific training to advance translational medicine.

Olivia Young

Pronouns: She/Her

Email: jey018@ucsd.edu

Home Institution: University of California San Diego

Undergraduate Major and Graduation Date: Neurobiology 2024

Home Institution Mentors: Dr. Ashley Juavinett, Dr. Brenda Bloodgood, Jack Olmstead

Science Interests: My interests include the molecular bases of behaviors, learning, memory, and consciousness. I also enjoy learning about experimental techniques, as I find it fascinating how we can observe things that are not visible to the naked eye.

Career Goals: I would like to obtain a Ph.D. in neuroscience.

ENDURE SCHOLAR RESEARCH ABSTRACTS

Dina Abdalla

Research Experience Institution: Washington University in St. Louis

Research Mentors: Erica Periandri, Zhaoyi Li, Melanie Ford, Dr. Andrew Lim, Dr. Josh Shulman, Dr. Paul J. Shaw

Project Title: Exploring the Relationship Between Sleep and Mitochondrial Complex II in Alzheimer's Disease using *Drosophila*

Project Abstract: The neuropathological hallmarks of Alzheimer's Disease (AD) are bi-directionally correlated with sleep. Using transcriptomic studies of human brain tissue, we have identified a potential link between AD, sleep and genes associated with mitochondrial complex II (succinate dehydrogenase (SDH)). SDH is an enzyme localized to the inner mitochondrial membrane and is involved in electron transport chain (ETC) and the tricarboxylic acid cycle (TCA). Transcriptomic studies reveal that changes SDH are associated with improved sleep, reduced AD pathology and improved cognitive ability. To determine whether these changes are causative, we knocked down the *Drosophila* homologue of Human Succinate Dehydrogenase Assembly Factor 4 (SDHAF4), Starvation- upregulated protein (Sirup), using the GAL4/UAS binary expression system. Pan-neuronal knockdown of Sirup resulted in an increase in sleep, and decreased sleep latency in healthy flies indicating that it plays a role in sleep regulation. Knocking down Sirup in the context of A β or Tau expression also increased sleep. To determine whether increased sleep in A β or Tau flies would restore neuronal plasticity, we tested their response to social enrichment. We found that pan-neuronal knockdown of Sirup rescued neuronal plasticity in AD model flies. These data indicate that Sirup induces healthy sleep, and that sleep can be used as a therapeutic to treat AD pathology. Future studies will explore the relationship between, SDH, reactive oxygen species, sleep, and AD pathology.

Laila Abdalla

Research Experience Institution: University of Washington

Research Mentors: Abna Moalin, Dr. Katie Stanchak, Dr. Tanvi Deora, Dr. Alison Weber, Dr. Bing Brunton, Dr. Tom Daniel

Project Title: Distribution of Campaniform Sensilla in *Manduca sexta*

Project Abstract: Insects require rapid feedback to control their fast ariel maneuvers. One example of mechanosensors that provide rapid feedback are campaniform sensilla on insect wings. During flight, wing surfaces experience deformations that are a resultant of both voluntary flight and external perturbations. The campaniform sensilla are located on structural wing veins and sense strain in the local wing cuticle. This strain information is then relayed to the brain as sensory feedback, which enables the moth to detect externally applied forces. In this way, the sensors can gain information about the body's environment, which can be applied to a whole range of flying techniques. However, while the literature recognizes that sensor

placement is generally important for flight control, we have yet to understand the extent of importance and consistency in sensor placement across individuals. Here, we investigated the distribution of these campaniform sensors on the wings of hawkmoths (*Manduca sexta*) and sought to find patterns in their spatial distribution. First, we prepped the moth wings by descaling them, and then we imaged the locations of individual sensors using both transmitted light and epifluorescence on a compound microscope. The use of high-powered imaging techniques in this study has allowed us to probe how campaniform sensors are spatially distributed in moth wings. Our results show a surprising number of differences among individual moths, although general patterns of sensor placement are consistent.

Khalid Abrera

Research Experience Institution: University of Washington

Research Mentors: Dr. Raaj Gowrishankar, Dr. Michael Bruchas

Project Title: Understanding regulation of dopamine dynamics in the nucleus accumbens during motivated behavior

Project Abstract: Motivated animal behavior is governed by the neuromodulator dopamine. Maladaptive behaviors such as depression and addiction have been associated with dysfunctions in dopamine signaling. Specifically, reward and motivation are controlled by dopamine neurons projecting from the ventral tegmental area (VTA) to the nucleus accumbens (NAc). Within these projections, we hypothesized that there is inherent anatomical and functional heterogeneity that would aid in an animal's ability to form cue-reward associations. In this study, we experimented mice using Pavlovian conditioning where mice were put in a chamber with a predictive cue (light) as the conditioned stimulus and sucrose pellets as the unconditioned stimulus. Using high-quality fluorescence protein (FP) based dopamine sensors (DLight1.3) we were able to record optical dopamine dynamics at the subsecond timescale in the NAc. With repeated fiber photometry recordings in the NAc, two types of dopamine signatures occurred during Pavlovian learning across the dorso-ventral gradient of the NAc shell (dNAcSh – vNAcSh). Firstly, we found an increase in the density of dopamine projections in the dorsal NAc shell compared to the ventral. Conversely however, we showed that dopamine response to predictive cues and rewards in the ventral NAc shell, compared to the dorsal, as animals learn Pavlovian conditioning. This is further apparent when comparing the cue/reward ratios of fluorescence, which was significantly different in the vNAcSh, but not the dNAcSh. The data shows that projections from VTA to vNAcSh but not dNAcSh are directly but differentially engaged in reward and reinforcement behavior in real time.

Alexander Acevedo

Research Experience Institution: University of Chicago

Research Mentor: Dr. Xiaoxi Zhuang

Project Title: Haloperidol-induced inhibitory learning following Progressive Ratio 7 reward training in mice

Project Abstract: Understanding the biological mechanisms and neuronal pathways by which the brain inhibits behavior and exhibits behavioral extinction is crucial to understanding many diseases such as Parkinson's disease, drug and alcohol addiction, and other behavioral problems such as impulsivity. Research about inhibitory learning has been rapidly expanding in the field of neuroscience and many animal models to study this phenomenon have been developed. However, there is no consensus on which of the models' using mice or other types of rodents works best for these studies. In this experiment, we compared the effects of haloperidol, a D2 receptor antagonist, on inhibitory learning in mice that were in Fixed Ratio 1 or a Progressive Ratio 7 schedule in a skinner box. The results from this study demonstrate that mice in the FR1 and PR7 models experience similar levels of extinction after receiving a Haloperidol injection. The only significant difference obtained was between the FR1 groups in day 4, although we can see a trend in which haloperidol induces drastic changes in the rate of lever pressing in PR7 compared to FR1. PR7 may be the best model to test the amount of work done by subjects seeking a reward. Without additional data, the result of this study indicates that FR1 is a better model since it offers many logistical advantages regarding time.

Oumayma Agdali

Research Experience Institution: Yale University

Research Mentor: Dr. Hal Blumenfeld

Project Title: Neural mechanisms of awareness of action

Project Abstract: Awareness of Action (AoA) is the ability to name a complex motor action previously performed and is a fundamental aspect of human consciousness. Loss of AoA is not only seen in cases of neuropsychiatric disorders but is a common phenomenon in everyday experience. However, the spatiotemporal dynamics of neural activity underlying AoA remain unknown. We employ an experimental paradigm based on the classic move-based board game Rush Hour. As subjects (N=19) play the full game, periodically, the puzzle disappears, and subjects may be shown a quiz asking about the move just performed in a multiple-choice question. After answering, subjects indicate their confidence in their choice on a sliding scale. We considered correct/high-confidence answers to be aware, and incorrect/low-confidence to be unaware. High (>75th percentile) and low (<25th percentile) confidence were defined through the subject's slider selections. We hypothesize that actions performed with or without awareness of the action can be characterized by differences in ERPs and EEG data, and eye metrics such as blink duration and pre-action readiness potentials. In the EEG domain, the execution of a move was preceded by a robust readiness potential, and the subsequent disappearance of the board

produced a series of ERPs. Pre- action readiness potential onset was seen to begin earlier in unaware actions as compared to aware actions. Additional studies of AoA through methods such as functional neuroimaging will help further illuminate the neuroanatomical origins of these findings.

Milagros Alday

Research Experience Institution: Michigan State University

Research Mentor: Cristina Rivera-Quiles

Project Title: Assessment of the effects of ventral tegmental area neuromedin S activation and morphine exposure on cellular activity in the nucleus accumbens

Project Abstract: Drug addiction is a debilitating disease that has life-long consequences. Opioid drugs, like other drugs of abuse, engage the brain's reward circuitry to promote the euphoric feeling that rewards and reinforces drug use. Morphine, specifically, increases dopamine signaling in the nucleus accumbens (NAc) via modulation of ventral tegmental area (VTA) dopamine neuron activity. Our lab found that neuromedin S (NMS) expression increases in a subset of VTA dopaminergic neurons after exposure to chronic morphine. We believe that VTA NMS neuron activation increases morphine reward and thus promotes morphine behavior and response. To test this, we are using designer receptors exclusively activated by designer drugs (DREADDs) to activate NMS expressing neurons in the VTA using an excitatory Cre-dependent-DREADD viral vector (AAV-DIO-hM3Dq- mCherry) in NMS-Cremice and administration of the designer drug, clozapine-n-oxide, CNO. NMS-Dq and control mice will then undergo morphine behavioral testing to determine whether NMS activation increases morphine behaviors. Following behavioral testing, we will assess activation of NAc neurons via IHC staining for c-fos, a cellular marker of neuronal activity. We will also conduct IHC studies to assess the proximity of VTA NMS neuronal terminals to the NMS receptor, NMUR2, in the NAc. Collectively, these data will help us define the function of the novel VTA NMS - NAc circuit and its role in addiction by showing how VTA NMS neuron activation affects morphine behaviors and responses.

Noor Alrashed

Research Experience Institution: Louisiana State University of New Orleans Health Sciences Center

Research Mentor: Dr. Scott Edwards

Project Title: Translational investigation of sex differences in alcohol analgesic efficacy: Comparison across preclinical and clinical domains

Project Abstract: Although chronic pain affects over 220 million Americans and significantly contributes to the development and maintenance of alcohol use disorder (AUD), there is an alarming gap in knowledge regarding the mechanisms underlying the anti-nociceptive effects of alcohol. The goals of the current project were to: 1) describe self-reported pain ratings in people living with HIV (PLWH) in relation to alcohol use and 2) investigate neuroadaptations produced by alcohol in the context of persistent

inflammatory pain. The clinical portion of the project identified a significant effect of recent alcohol use (indicated via serum phosphatidyl-ethanol) to reduce pain symptoms and interference as measured by the SF-36 Survey in the New Orleans Alcohol Use and HIV (NOAH) cohort of PLWH. Next, using an anti-nociceptive dose of ethanol and the complete Freund's adjuvant model of inflammatory pain, we quantified phosphorylation of glutamate receptor type 1 (GluR1) subunit and the intracellular signaling molecule ERK. We found that alcohol alters male CeA ERK phosphorylation based on pain status, suggesting pain may alter the central effects of alcohol. Ongoing investigations are clarifying sex differences in these relationships, and future work will examine how acute and chronic alcohol regulates pain in PLWH. These findings will help elucidate the mechanism of analgesic action of alcohol in the context of chronic inflammatory pain states across sexes with the goal of identifying a novel target for treating pain in AUD patients.

Daniela Anderson

Research Experience Institution: Michigan State University

Research Mentors: Jessica Lee, Elie Huez, Dr. Alexa Veenema

Project Title: Characterization of the Gad1-iCre rats as a tool for studying the role of GABAergic neuronal pathways in social play behavior of juvenile male and female rats

Project Abstract: Social play is a rewarding behavior displayed by juveniles across various mammalian species, including humans and rats. Engaging in social play is critical for the development of social skills throughout lifetime. Autistic children show social play deficits which may contribute to deficiencies in social communication later in life. Furthermore, autism spectrum disorder is diagnosed four times more in boys than girls, suggesting the neural circuits contributing to this disorder are sex specific. Therefore, it is crucial to understand the brain mechanisms that underlie social play to develop effective means of treatment. One system that may be involved in regulating social play is the GABAergic system, or the brain's main inhibitory neurotransmitter. Studies have demonstrated that extracellular GABA concentration changes as juvenile rats engage in social play, suggesting the involvement of GABAergic signaling in regulating social play. Current neuroscience techniques have allowed researchers to target the GABAergic system by using Gad1-iCre rats, in which cre recombinase is expressed on Gad1+ cells. Gad1 is a GABA-producing enzyme that can be used as a marker for GABAergic cells. Since Gad1-iCre rats have never been used to study social play, we first determined whether social play behavior in Gad1-iCre rats was comparable to that of wildtype rats. We then determined whether iCre expression is specific to Gad1 cells via in situ hybridization. These steps are necessary to validate the use of Gad1-iCre rats in studying social play behavior and enables researchers to study the involvement of the GABAergic system in regulating social play behavior.

Giovanna Arantes de Oliveria Campos

Research Experience Institution: Temple University

Research Mentors: Dr. Nora Newcombe, Dr. Ingrid Olson

Project Title: Relating the fornix to episodic memory and spatial navigation in development

Project Abstract: The cognitive abilities of remembering past experiences and of knowing how to navigate an environment are both essential throughout one's life. Neutrally, episodic memory and spatial navigation depend on medial temporal lobe structures (e.g., hippocampus) and the white matter tracts that connect them (e.g., fornix). Several studies have found correlations between fornix microstructure and episodic memory in adults, but fewer have investigated this relationship in children. Additionally, the literature on human navigation and the fornix is virtually non-existent. With participants undergoing a real-world encoding experience, we will relate spatial performance and episodic memory to fornix microstructure. In our study, children (8-13) and young adults are taken on tour that combines a real-world spatial experience with sixteen episodic events. Then, participants undergo a diffusion weighted imaging scan. Linear modelling revealed that spatial navigation significantly predicted better episodic recall and recognition, with adults recalling more events than children. We are currently extracting fornix and arcuate fasciculus (control tract) microstructure using probabilistic tractography. We will run multilevel linear models with microstructure metrics interacting with age and predicting spatial composite score and episodic memory variables, individually. We hope to further tease apart the nuances of this interconnected network and track its developmental trajectory.

Jasper Rei Balinas

Research Experience Institution: University of Washington

Research Mentors: Zoe Steine-Hanson, Linxing Preston Jiang, Dr. Bingni W. Brunton, Dr. Rajesh P.N. Rao

Project Title: Investigating low-dimensional structures in naturalistic ECoG data

Project Abstract: Increasing studies have found low-dimensional structures from neural population activity during complex movement control. However, most studies analyzed population recordings during repeated, task-dependent control of movements with little trial-to-trial variabilities. It remains unclear whether such low-dimensional structures, or neural manifolds, exist during self-initiated, naturalistic movements that are highly variable. It also remains elusive how these low-dimensional structures might change over longer time scales. We analyzed human electrocorticography (ECoG) data during arm movements across five days recorded from twelve epilepsy patients. In all participants, principal component analysis (PCA) revealed low-dimensional manifolds that explained a significant number of neural variabilities. These manifolds persisted across days in all participants. We further quantified the geometric variations of the manifolds through principal angle analysis. Neural dissimilarities, defined as the sum of the principal angles, decreased by the end of the participants' hospital stay. These findings raise the possibility of low-dimensional structures as a general computational principle of the brain

during generation and control of movements.

Jacqueline Banuelos

Research Experience Institution: University of Washington

Research Mentors: Victoria Hones, Dr. Sheri Mizumori

Project Title: Altered motivational state after naloxone-precipitated morphine withdrawal

Project Abstract: The lateral habenula has been an area of interest in addiction research due to its influence modulating responses to internal state and environmental context changes. In this pilot study, we were interested in the behavioral markers for anxiety before and after naloxone-precipitated morphine withdrawal. Using an open field box experiment and sucrose preference test, we analyzed the behavior of three rats, anticipating anhedonia responses to morphine withdrawal. We expected to see adverse changes in behavior signaling a difference in motivational state and found that behaviors such as rearing, locomotion, time in center and immobility differed after naloxone administration. Our data suggests that naloxone-precipitated morphine withdrawal reduces behavioral activation and increases anxiety. While we expected to see a decrease in sucrose preference after naloxone administration indicating anhedonia, no significant differences were recorded in our rats. Due to the concurrence of symptoms between depression and addiction and the promising use of psilocybin for treatment of depression, our future direction is to identify whether psilocybin treatment can restore normal activity, as measured by calcium imaging, in the lateral habenula during opiate withdrawal and restore baseline behaviors.

Maria Bonilla

Research Experience Institution: University of Michigan

Research Mentors: Dr. Ada Eban-Rothschild, Bibi Alike Sulaman

Project Title: Development of a new learning task to assess spatial-reward associative memory

Project Abstract: The neuronal processes that occur during sleep contribute to the consolidation of various types of memories. Studies have shown that negatively affecting sleep after a learning experience can lead to memory recall impairment. Using mice, we plan to study the role sleep has in reward memory consolidation. However, we first need to assess if mice are capable of learning within a short period (≤ 2 days) in the spatial-reward 4-arms learning task we developed. In this task we first determine the mice arm preference in the empty maze and later associate their least preferred arm with a reward (chocolate and peanut butter). To see if mice can learn we then measure their arm preference again in the empty maze. Mice spent more time in their least preferred arm after associating it with a reward. This result leads us to conclude that mice are capable of learning in our spatial-reward 4-arms learning task.

Melody Chao

Research Experience Institution: University of California San Diego

Research Mentors: Lucie Oriol, Dr. Thomas S. Hnasko

Project Title: Projections from μ -opioid receptor expressing neurons of the ventral tegmental area

Project Abstract: The ongoing opioid epidemic calls for a closer look into the mechanism behind opiate addiction. μ -opioid receptor (MOR) helps mediate the effects of opioids, specifically their analgesic and rewarding effects. In the ventral tegmental area (VTA), MOR is expressed on GABAergic neurons referred to as interneurons because they have been thought to release GABA onto local dopamine neurons exclusively. The binding of an opiate to MOR inhibits GABA neurons. Thus, dopamine neurons will be disinhibited, which contributes to the rewarding effects of opiates. However, neurons in the VTA have been shown to project both distally and locally. Currently, there are no selective molecular markers to identify neurons that only project locally in the VTA, unlike other brain regions, so it is unknown if certain subsets of neurons in the VTA are indeed interneurons. Therefore, we examined MOR-expressing GABA neurons to clarify whether they make distal projections. We injected an AAV5 virus into the VTA of 3 mice to express ChR2: mCherry and then performed immunohistochemistry, which allowed for the tracing of projections. We found that MOR-expressing VTA neurons make distal projections to the ventral pallidum, nucleus accumbens, prefrontal cortex, and lateral habenula. Our results indicate that at least some MOR-expressing neurons in the VTA make distal projections, showing that MOR is not a selective interneuron marker in the VTA. While there is the possibility that some are indeed interneurons, this finding will lead to a greater foundational understanding of the circuitry of opiate addiction.

Nancy Collie-Beard

Research Experience Institution: Brown University

Research Mentors: Dr. Peter Hitchcock, Dr. Michael J. Frank

Project Title: Gender differences in the relationship between perseverative thinking and attentional impulsivity: A network analysis

Project Abstract: Externalizing disorders refer to those characterized by impulsive behavior, and internalizing disorders by problematic internal behaviors. While intuitively these behaviors may seem inversely related, in fact, they are positively correlated, suggesting shared core features. Clinically, boys are twice as likely to be diagnosed with attention deficit/hyperactivity disorder (ADHD), and women are more prevalently diagnosed with anxiety disorders. The symptoms of ADHD in girls are less disruptive and more likely to be overlooked, as they present in the attentional rather than hyperactive subdomain. Fixation is also common in ADHD, making it possible that hyperfocus on perseverative thoughts results from attentional fixation, rather than a mood disorder. We will quantitatively assess the inter-relations among these symptoms via self-report measures examining traits associated with both externalizing and internalizing disorders. The Perseverative Thinking Questionnaire (PTQ) measures repetitive and

intrusive thoughts, including those with depressive and anxiety-related content. The Barratt's Impulsivity Scale (BIS-15) measures impulsivity in three factors; attentional, motor, and non-planning. A moderated network analysis (n=300) of the items within these scales will assess 1) if measures of attentional impulsivity associate more strongly with perseverative thinking than do the motor and non-planning factors and 2) if they do so more strongly in women. These data could help explain the rates of differential diagnoses seen in women, as the diagnostic disparities continue into adulthood. Generally, this work may call for further distinction of these measures and have clinical relevance.

Shylyn Collier

Research Experience Institution: Washington University in St. Louis

Research Mentors: Dr. Jason Yi, Kellan Weston

Project Title: Proteasomal liquid-liquid phase separations

Project Abstract: The ubiquitin-proteasome system is responsible for tagging and degrading unwanted proteins in the cell. In non-neuronal cells, the proteasome has been shown to form macromolecular structures in the nucleus in response to stress through a process of liquid-liquid phase separation (LLPS). These large structures can be visualized as intense foci in the cytoplasm and nucleus. However, whether such a response is preserved in neurons remains unknown. Proper function of the ubiquitin-proteasome system is critical for proper neuronal development, and disruption of this system is known to cause numerous neurodevelopmental and behavioral disorders. Specifically, my laboratory seeks to understand how changes in the activity of the E3 ubiquitin ligase UBE3A perturbs nervous system development and causes pathology. Previous work has shown that UBE3A ubiquitinates the proteasome, and this facilitates LLPS and the formation of proteasomal stress foci. Thus, my research project seeks to answer if LLPS of the proteasome occurs in neurons and whether changes in UBE3A activity impact this property of the proteasome.

Natali Colombo

Research Experience Institution: Seattle Children's Research Institute

Research Mentors: Dr. Franck Kalume, Arena Manning

Project Title: Neural activity during seizures in a brain stem and cerebellum specific mouse model of Leigh syndrome epilepsy

Project Abstract: Leigh syndrome (LS) is the most common form of mitochondrial disease in children. It affects 1 in every 40,000 births and is characterized by ataxia, seizures, failure to thrive and premature death. There are more than 75 gene mutations that have been associated with LS. Among them is NDUF54, the gene that codes for a subunit of the protein complex I of the mitochondria. Mice carrying a whole-body knockout (KO) of this gene greatly model this illness; they recapitulate multiple phenotypes of LS in patients. Prior studies in the lab have shown that the KO of Ndufs4 in GABAergic neurons, not in

excitatory neurons, across all brain regions, reproduce the epilepsy phenotype seen in the global KO mice. Moreover, GABAergic neurons in a specific brain region such as the brainstem are sufficient to lead to epilepsy in mice. Mice with *Ndufs4* KO in brainstem and cerebellum interneurons, mediated by *GlycineCre*, have epilepsy. However, it is still unclear as to what brain regions housed neurons involved in seizure activity in these mice. In this study, brain regions experiencing neuronal hyperactivity and hypersynchrony during seizures in this new model of LS were examined. A thermal seizure was induced in the *Ndufs4 GlycineCre* KO mice. Forty-five minutes after the seizures, the mice were anaesthetized, the brains were fixed, and harvested. Brain slices were prepared and stained with a c-Fos antibody and finally imaged on the confocal microscope. Surprisingly, high c-Fos immunoactivity was observed in the cerebellum alone and not in other brain regions generally known to be involved in seizure generation. These findings indicate the participation of the cerebellum in seizure generation in Leigh Syndrome epilepsy. In future studies, we will repeat this experiment to increase the sample size and confirm these findings.

Luis Colon

Research Experience Institution: Michigan State University

Research Mentor: Dr. Andrew L. Eagle

Project Title: Role of entorhinal cortex neurons in the consolidation and/or recall of a cocaine-context memory

Project Abstract: Drugs, like cocaine, hijack the brain's reward circuitry, including a key region called the nucleus accumbens (NAc), leading to the dysfunctional processing of reward and motivation underlying addiction. Reward dysfunction can be mediated by altered afferent neuronal projections to the NAc. Neurons in the lateral entorhinal cortex (LEC) project to the NAc suggesting that the LEC may be important for mediating cocaine's rewarding effects. Supporting this, previous studies showed that LEC is activated by cocaine cues in cocaine-dependent humans and cocaine self-administering rats. However, it is currently unknown whether this population of LEC neurons that project to NAc (LEC-NAc) are important for cocaine reward. We use cFos immunohistochemistry to show that LEC-NAc neurons are activated by cocaine. Using DREADDs (Designer Receptors Exclusively Activated by Designer Drugs), we further demonstrate that LEC-NAc activity is important for cocaine conditioned place preference (CPP) in mice, a test of cocaine's rewarding effects. We now aim to determine whether LEC-NAc neurons are important for the consolidation and/or recall of a cocaine CPP. To test this hypothesis, we are using DREADDs to inhibit LEC-NAc neuron activity during either cocaine place conditioning (consolidation) or a test of a cocaine CPP (recall). The results of these experiments will tell us whether LEC-NAc neurons are important for the consolidation and/or recall of cocaine place associative memory. Such findings will elucidate the role of LEC neurocircuitry in the development of cocaine addiction.

Julieann Colon-Sarriera

Research Experience Institution: University of Puerto Rico-Río Piedras

Research Mentor: Dr. Alfredo Ghezzi

Project Title: Long-lasting transcriptional responses of developmental alcohol exposure in *Drosophila*

Project Abstract: Chronic alcohol use impairs development and leads to tolerance and dependence due to neuroadaptations in the brain, while promoting deficiencies in learning, memory, and sleep, all of which are characteristic of alcohol use disorder (AUD). Moreover, a strong correlation has been shown between alcohol consumption during pregnancy and children with fetal alcohol syndrome (FAS). These constitute important public health issues that must be addressed to further understand how they can affect individuals and elucidate new ways for treatment and prevention. We believe that changes in genetic expression are the underlying cause of the deficiencies produced by chronic alcohol consumption. Nevertheless, how alcohol exposure at different stages of an individual's life cycle can produce changes in genetic expression that result in changes in behavior and cognition remains unknown. To further understand this phenomenon, we expose *Drosophila melanogaster* to ethanol at different stages of its life cycle to target genes whose expression is changing in response to this stimulus. Using head tissue from *Drosophila*, RNA was extracted and quantified for sequencing. Previous results demonstrated flies exposed to ethanol in both larvae and adult stages had no significant difference in odor-guided behavior experiments compared to control flies, therefore we expect no changes in genetic expression will be observed. Changes in genetic expression are expected to be observed in flies that were treated with ethanol during larvae but not during adulthood and vice versa. Collectively, these results will demonstrate how chronic ethanol consumption produces long-lasting transcriptional responses that result in behavioral and cognitive differences.

Jocelyn Contreras

Research Experience Institution: University of Colorado Anschutz Medical Campus

Research Mentors: Dr. Daniel Ramirez-Gordillo, Dr. Diego Restrepo

Project Title: Hippocampal PV Interneurons

Project Abstract: The existing balance between excitatory and inhibitory signals in the brain allows proper learning and memory functions. Interneurons regulate inhibitory and excitatory signals.

Parvalbumin (PV) interneurons contribute to the occurrence of gamma (65-95 Hz) bursts of neuronal activity at specific phases of theta (6-14 Hz) oscillations (phase-amplitude coupling, or PAC). We asked whether PV interneuron-modulated theta-referenced PAC is involved in learning to discriminate odorants in a go-no go task where the animal responds to the rewarded odorant by clicking on a spout to obtain a water reward. The mice were implanted with bilateral optrodes targeting hippocampal dorsal CA1. PV interneurons were stimulated at specific phases of the theta local field potential (LFP) using closed loop optogenetics in both hippocampi in PV-Cre mice infected with AAV virus expressing channelrhodopsin in

cells expressing Cre. We found that the closed loop Arduino circuit accurately stimulated at the peak and trough of theta oscillations. Preliminary experiments indicate that stimulating PV interneurons at the peak improves the mouse's ability to differentiate odorants in a go-no go task in the reverse order pair and increases phase amplitude coupling. These results suggest dorsal CA1 PAC is involved in encoding information in the olfactory go-no go task. This research was supported by NIH grants K01 NS127850-01 (to DRG), NIH R01 DC000566 (to DR).

Priscilla Coriano

Research Experience Institution: Michigan State University

Research Mentor: Dr. Caryl E. Sortwell

Project Title: The impact of exercise on substantia nigra dopamine neuron survival in the alpha-synuclein preformed fibril model of Parkinson's disease

Project Abstract: The degeneration of dopamine (DA) neurons in the substantia nigra and the presence of Lewy Bodies (intracellular misfolded α -synuclein aggregates) are the two main pathological hallmarks of Parkinson's disease (PD). It's observed that PD patients who frequently exercise show improved motor function. However, the mechanism behind this improvement has yet to be discovered. Previous preclinical studies that have investigated this issue have not used PD animal models that display both Lewy body-like pathology and nigral degeneration. The α -synuclein pre-formed fibril (α -syn PFF) model results in Lewy body-like aggregates followed by nigral degeneration. We have previously observed that treadmill exercise alleviates PFF induced motor deficits. In the study, we examined whether exercise decreases the extent of nigral degeneration in the α -syn PFF model in rats. 40 young F344 male rats received either unilateral nigrostriatal injections of α -syn PFFs or injection of saline as a control. Half of the rats in each group received treadmill exercise (5, 30-minute sessions/week) starting one month after surgery and continuing until Month 6. The remaining rats received no exercise. Rats were euthanized at 6-months. Postmortem evaluation included analysis of nigral DA neuron survival using immunohistochemistry for tyrosine hydroxylase (TH), combined with stereological assessment. PFF injection resulted in significant loss of ipsilateral nigral DA neurons, with no impact from treadmill exercise observed. This suggests that the mechanism whereby treadmill exercise improves motor function is not by increasing nigrostriatal DA neuron survival. Future experiments will examine other dopaminergic outcome measures to evaluate the impact of treadmill exercise.

Andrea Corretjer

Research Experience Institution: University of Puerto Rico-Río Piedras

Research Mentor: Dr. José Garcías-Arrarás

Project Title: Identification of lengsin in *Holothuria glaberrima* nervous system

Project Abstract: The field of neurobiology has used echinoderms as a model to study the nervous

system for a long period of time. *Holothuria glaberrima* is a species of cucumber that provides great insight into neurogenesis. Its nervous system can completely regenerate itself after injury. A big obstacle with using these animal models is the scarcity of tools available to conduct experiments. Most antibodies are created to be used on mammal models and do not work on echinoderms. This investigation will focus on finding an antibody that will target lensin protein in the *Holothuria glaberrima* nervous system. The immunofluorescence technique will be used to test the anti-LGSN antibody. After the preparation of the tissue sample, the technique of indirect polyclonal immunofluorescence is used to tag the glial cells. After the process of immunofluorescence, the tissue samples are viewed on the microscope and the images are observed. The expected results from this experiment are to find the right concentration of the anti-LGSN antibody that will identify glial cells in *Holothuria glaberrima* tissue.

Fabrizio Darby

Research Experience Institution: Washington University in St. Louis

Research Mentors: Dr. Erik Herzog, Maria Gonzalez

Project Title: Glucocorticoids entrain and sustain daily rhythms in glioblastoma cells

Project Abstract: Glioblastoma (GBM) is the most common and aggressive type of brain tumor in adults (Slat, et. al. 2017) with survival averaging around 15 months (Stupp et al., 2009). Understanding how synchronization occurs is the first step in enabling the possibility of chrono chemotherapy (a method of cancer treatment that uses knowledge of circadian rhythms to select the best possible time-point for therapeutic agent administration) and creating effective treatments for GBMs. Data from our lab has shown that GBM cells express daily rhythms in gene expression that follows the rhythms of the host when implanted in vivo. However, it is not yet known what causes these daily rhythms. Glucocorticoids have been shown to be responsible for entraining daily circadian rhythms in several peripheral clock oscillators such as the liver (Balsalobre et al., 2000) as evidenced by their expression of Per2, a ubiquitous marker of circadian oscillation. Hence, we hypothesized that corticosterone (CORT), a common glucocorticoid, entrains and sustains daily rhythms in vitro. I, therefore, measured Per2-luciferase activity in LN229 and GL261 (human and mouse) GBM cell lines with CORT treatments at different concentrations compared to controls with no CORT. Cells were left to record bioluminescence, indicative of Per2 expression, in a photomultiplier for two days, followed by three days of adding CORT to their media, and two more days of recording without CORT addition. Preliminary data has shown that CORT shifted circadian phase angle by as much as 8 hours and showed a stable shift for a period of up to four days with the addition of 0.1 or 1 μM of CORT as compared to the vehicle (control), while 10 μM of CORT shifted expression only temporarily, followed by a quick decline in expression. Moreover, 1 μM of CORT caused the most consistent shift in phase angle of Per2 expression, indicating that 1 μM of CORT is capable of entraining and sustaining GBM circadian rhythms, while 0.1 μM of CORT can entrain

but does not sustain GBM circadian rhythms.

Netanya Dennis

Research Experience Institution: Michigan State University

Research Mentors: Dr. Gina Leininger, Jariel Virella-Ramirez

Project Title: The role of $\beta\beta$ -arrestin biased agonism in NtsR1 to modulate weight loss behaviors

Project Abstract: Obesity is an ongoing epidemic that increases the likelihood of developing life-threatening type 2 diabetes and cardiovascular disease. However, current treatments have not been effective in tackling the obesity epidemic. Some promise has been seen via systemic neurotensin (Nts) treatment that largely acts on neurotensin receptor-1 (NtsR1) to induce dual weight loss behaviors by reducing feeding and increasing locomotion. Unfortunately, systemic agonism NtsR1 also causes detrimental side effects like lowering blood pressure and body temperature. Recent research suggests that the ventral tegmental area (VTA) specific agonism of NtsR1 promotes weight loss behaviors without invoking the undesired side effects. Excitingly, a novel NtsR1 β -arrestin biased agonist, SBI-553, was developed to bypass the deleterious effects but, it is yet to be determined how it influences energy balance. We hypothesize that SBI-553 treatment will promote weight loss behaviors in lean and obese mice. To test this, we used a cross-over study treating normal weight and diet-induced obese mice with vehicle and SBI-553. To evaluate the alterations in feeding and other metabolic traits we used TSE metabolic cages and monitored weight change. We also examined potential changes in motivated feeding through operant responding. Taken together, these findings will reveal if SBI-553 agonism of NtsR1 may be a safe and effective pharmacological approach to promote weight loss and ultimately curb the obesity epidemic.

Bra'a Durubeh

Research Experience Institution: Salk Institute for Biological Studies

Research Mentors: Dr. Kay Tye, Deryn LeDuke

Project Title: Internal state changes elicit differential responses from distinct amygdala circuits

Project Abstract: How do dynamic changes in homeostatic needs govern reactions to reward and punishment? Positive and negative emotional stimuli are encoded by valence states in separate populations of basolateral amygdala (BLA) projections to the nucleus accumbens (NAc) and centromedial amygdala (CeM), respectively. Diversified mechanisms as such influence the search for food, despite an increased likelihood of being prone to circumstantial threats. In vivo two-photon calcium imaging unveils increased activity in BLA→NAc neurons following food deprivation, and reciprocal decreased activity in BLA→CeM neurons. A model introduced supporting these findings establishes the excitability from BLA→NAc neurons vitalizes food-seeking behavior in response to food-deprivation. In a sated state, negative valence overrules positive valence processing. A drastic relocation

in BLA projections is influenced based on altered homeostatic needs, which changes valence encoding. This increased reward value results in a rapid shift between NAc-projecting and CeM-projecting populations of BLA neurons mediating approach and avoidance behaviors. Our findings contribute to the greater question of how changes in homeostatic state influence the processing of negative and positive valence. Understanding this fundamental relationship between valence processing and homeostatic need contributes to further investigation of how these systems may be disordered in the case of pathologies such as eating disorders or depression.

Immanuela-Nicole Enwesi

Research Experience Institution: University of Maryland, College Park

Research Mentor: Dr. Tracy Riggins

Project Title: Using MRI to assess brain development in the healthy brain and child development study

Project Abstract: The impact of infants born with opioid withdrawal on future developmental outcomes is difficult to ascertain due to 1) limited understanding of the impact of opioids and co-occurring risk factors on the developing brain and 2) limited understanding of early brain development more generally. The Healthy Brain and Child Development study is designed to address both gaps. First, the goal is to follow infants and a comparison group through the first 10 years of life to obtain data on developmental trajectories associated with prenatal substance exposure. Second, a cohort of infants without such specific risk factors will also be recruited and followed to track brain development in a sample that is representative of the United States in terms of race, ethnicity, socioeconomic status and urbanicity. Magnetic resonance imaging (MRI) will be obtained on infants (n=7,500) near the time of birth and longitudinally over the next 10 years. MRI provides a safe and unique opportunity to explore the structure and regional activation of the developing brain. Breakthroughs in image acquisition allow for shorter scan durations, which are critical for scanning young individuals with limited attention spans and increased propensity to move (i.e., multi-band acquisition and compressed sense). In addition, there are several strategies and techniques that promote the collection of high-quality data (e.g., swaddling infants, scanning during natural sleep). Together these methods will be used to track structural and functional development of the brain across the first decade of life. Collecting and analyzing these data across the first decade of life is crucial for better understanding of the effects of maternal substance use on the development of children.

Joyce Escatel

Research Experience Institution: Brooklyn College CUNY

Research Mentor: Dr. Yu Gao

Project Title: Psychophysiological/psychosocial contributions to behavioral problems

Project Abstract: The lab examines the neurobiological and psychosocial etiologies of antisocial

behavior, aggression, and psychopathic traits in youths and adults. Different psychophysiological techniques are used in the lab, including electrocardiogram (ECG) to measure heart rate, heart rate variability, as well as respiratory sinus arrhythmia, electrodermal activity (EDA), and structural and functional magnetic resonance imaging (MRI). The overall aim of the research program is to understand how neurobiological characteristics interact with psychosocial factors to contribute to the development of antisocial behavior. Using data from an ongoing longitudinal study that repeatedly assesses behavioral and personality traits in adolescents, I plan to investigate how behavioral problems change over time and what psychophysiological and psychosocial factors may contribute to these changes.

Alexdiel Figueroa

Research Experience Institution: University of Puerto Rico-Medical Sciences Campus

Research Mentor: Dr. Demetrio Sierra-Mercado

Project Title: Glyphosate decreases object but not social exploration

Project Abstract: Glyphosate is the most common active ingredient in herbicides. Glyphosate is considered safe for mammals because it acts by inhibiting a metabolic route almost exclusive to plants. However, recent studies in rodents have shown that glyphosate can increase anxiety-like behaviors. Moreover, studies have shown that emotional states can influence exploration of novelty. The effect of glyphosate on the exploration has not been evaluated. Therefore, we aimed to evaluate the effect of pure glyphosate and a glyphosate-based herbicide (GBH) on the exploration of a novel object and a caged rat. To achieve this, rats were treated with a target dose of 2.0 mg/kg of glyphosate daily (chronic references dose approved by the EPA) in their drinking water. Control rats received filtered drinking water. After 4 weeks of exposure, we assessed for exploration in an open field with either a novel object or caged rat in the center. Interestingly, glyphosate but not GBH, decreased the number of approaches to the novel object ($F(2, 35) = 3.970$; $p = 0.0279$) as well as the time exploring the novel object ($F(2, 35) = 3.843$; $p = 0.0310$). However, neither glyphosate nor GBH affected the number of approaches ($F(2, 35) = 0.09876$; $p = 0.9062$) nor the time spent exploring the caged rat ($F(2, 35) = 0.1516$; $p = 0.8599$). Given these results, we conclude that pure glyphosate exposure decreases exploratory behaviors of inanimate object but not animate animals. Current work is evaluating for neuronal activity and markers of inflammation in brain regions such as the hippocampus and the anterior cingulate cortex that are involved in exploratory behaviors and social interaction.

Daisy Flores

Research Experience Institution: Scripps Research Institute

Research Mentors: Ana Verduzco, Dr. Hollis Cline

Project Title: Enhancing synaptic density in iPSC-derived neurons

Project Abstract: Human induced pluripotent stem cells (iPSCs) are derived from somatic cells and can

be differentiated into many cell types of interest, (Chang et al., 2019), thus we can use them to access iPSC-derived neurons as human neuronal tissue is otherwise limited. This system allows us to investigate human genetic risk factors. In our lab, we are interested in studying iPSC-derived neurons with different genotypes for apolipoprotein E (APOE), one of which is a risk factor for Alzheimer's disease. Our method involves using lentivirus to force the iPSCs to express the transcription factor NGN2 which is inducible via doxycycline (DOX). We support the differentiating cells by transitioning them from iPSC to neuronal media with neurotrophic factors like BDNF, NT3, and GDNF. Previous work in our lab found that this method of differentiation generates neurons that express markers like B-III Tubulin, Map2, Cux1. However, they express synaptic markers at very low levels. Some research shows that Neurobasal Plus medium (NB+) improves synaptic density. Thus, I sought to boost synaptic density by testing two different neuronal mediums, NB vs NB+ and analyze synaptic density via immunocytochemistry for synaptic markers synapsin and PSD95 with the use of a confocal microscope. Although analysis is still on-going, I hope to answer whether NB+ can enhance synaptic density. The modified differentiation method will allow us to study the effect of the risk factor APOE on neuronal connectivity in the future.

Brittney Fietze

Research Experience Institution: University of Colorado Anschutz Medical Campus

Research Mentors: Dr. Wendy Macklin, Dr. Andrew Lapato

Project Title: Understanding the impact of glycoprotein nonmetastatic melanoma protein B (GPNMB) on oligodendrocyte differentiation

Project Abstract: Multiple sclerosis (MS) is an irremediable demyelinating autoimmune disease affecting the central nervous system, characterized by lesions frequently failing to remyelinate. Glycoprotein nonmetastatic melanoma protein B (GPNMB) is a transmembrane signaling peptide expressed by microglia, possessing a role in inflammation and cancer cell proliferation yet its effects in oligodendrocyte differentiation remain inadequately characterized. Based on its association with myelin repair, we hypothesized that GPNMB directly signals to oligodendrocytes to stimulate differentiation. We also hypothesized that GPNMB could signal through $\alpha\beta1$ integrin receptors. To test the effect of GPNMB on differentiation, rat oligodendrocyte progenitor cells (rOPCs) were treated with increasing concentrations of GPNMB. To measure if GPNMB acted on $\alpha\beta1$ integrin we performed live staining on rOPCs and mature oligodendrocytes. To investigate GPNMB's actions on $\alpha\beta1$ integrins I performed a western blot to examine signaling downstream of integrin interaction on cultured rOPCs and mature oligos. Preliminary data from these experiments identified that $\alpha\beta1$ integrins are receptors that GPNMB interacts with at the functional level with oligodendroglia. Also, this data indicates that GPNMB is unlikely to be a main driver of differentiation, rather it may work with other signals to enhance differentiation.

Rebeca Fuquen

Research Experience Institution: University of Maryland School of Medicine

Research Mentors: Ashley Marquardt, Dr. Margaret McCarthy

Project Title: Effects of inhibiting play behavior in juvenile rats on adult empathy behavior

Project Abstract: The purpose of play behavior that occurs between weaning and sexual maturity is unknown; however, it has been found to be associated with the reward center of the brain. Prior studies have demonstrated that males play more than females in almost all species that engage in play behavior. These sex differences are driven by the medial amygdala, and the gene networks in this brain region that mediate play are different in males and females. Additionally, prosocial behavior is demonstrated when a rat performs an act of service towards another, with the aim of helping for the other's benefit. This leads to the question of whether play behavior may serve different functional purposes in males and females, and whether it will impact empathy as they develop. Pairs of rats are placed into an experimental arena, with one individual inserted into the ice drip box while the other roams freely around it. The boxed rat is unable to escape the dripping water unless its companion pushes or pulls open the exterior handle, which prevents the internal door from being pushed open. This tests for both the empathy of the free-roaming rat, as it may or may not show interest in assisting, and learning ability, as it takes time to solve the puzzle of how to open the door. The length of time it took for rats in the ice drip box to exit and the total duration the free-roaming rats spent interacting with the box were analyzed with a two-way ANOVA through R Studio to determine if there was a significant effect on these measures by sex or housing condition.

Jonathan Garcia

Research Experience Institution: University of Maryland School of Medicine

Research Mentors: Kimberly M. Papastrat, Dr. Adam C. Puche, Dr. Marco Venniro

Project Title: Olfaction drives socio-sensory buffering of drug choice

Project Abstract: Volitional social interactions with peers are highly rewarding and can be used as a buffer against abused drugs. Organisms across all species require sensory systems to capture emotions, communicate during social interactions, and share information about the surrounding environment. First, we tested the role of olfactory system in either acquisition or maintenance of volitional social interaction. Using our volitional social-choice self-administration rat model, we trained male and female rats for either food (2-h/d, 5-d) or social self-administration (2-h/d, 10/12- d). To test the role of olfaction, we removed the olfactory bulbs (bulbectomy – or sham surgery) before (experiment 1) or after (experiment 2) acquisition of operant social behavior. Next, we tested the role of the olfactory system in social choice-induced inhibition of drug self-administration. After training bulbectomy or sham rats for social (2-h/d, 10-d) and cocaine (6-h/d, 12-d) self- administration, we introduce a choice between social interaction and cocaine. In both sexes bulbectomy selectively prevented acquisition and

maintenance of social interaction, although the other sensory components were intact. Bulbectomized rats exhibited reliable food and cocaine self-administration, showing motivation for other rewards. Rats with an intact olfactory system showed strong social preference over cocaine. However, cocaine self-administration resumed in rats deprived of the olfactory system. We identified the olfactory system as the primary driver of socio-sensory communication mediating volitional social interaction and of the protective effect of social reward on drug choice. From a translational perspective, these findings highlight the critical importance of sensory cues during peers' communication for implementation of social-based addiction treatments.

Brandon Gehrke

Research Experience Institution: University of Colorado Denver

Research Mentors: Dr. Katherine Rennie, Dr. Frances Meredith

Project Title: Aging and its effects on the vestibular system

Project Abstract: The vestibular system is a sensory system of the inner ear. This system likely plays a large role in age-related balance issues and decreased motor function in the elderly. Previous literature has explored how glutamate excitotoxicity and loss of ribbon synapses are likely a mechanism of synaptopathy leading to vestibular dysfunction with age. My project aims to develop protocols to address how age-related synaptopathy of hair cells and their afferent synapses is associated with vestibular dysfunction in aging gerbils. Preliminary immunohistochemistry experiments were conducted using antibodies to CTBP2, TubulinBIII, Myosin7A, and GluA2 to stain parts of the hair cell and afferent nerve. Rotarod protocols were developed to study motor differences between two age groups 33-55 days and 426-447 days old. Initial results indicate that older gerbils performed worse than younger ones on an accelerating rotarod suggesting decline of vestibular function. Future experiments will explore how ribbon synapse counts associated with age correlate with behavioral changes in rotarod and balance beam experiments.

Jalyssa Gonzales

Research Experience Institution: University of Colorado

Research Mentor: Dr. John Caldwell

Project Title: Testing AAV serotypes for optimal expression in DRG neurons

Project Abstract: By utilizing an adeno-associated virus (AAV) based optogenetic peripheral nerve interface, one could significantly increase sensory feedback and dexterous movement in upper-limb prosthetic devices. The interface would use light to both stimulate and decipher neural signals. The first step towards developing an optogenetic peripheral nerve interface is to determine which AAV serotype would express in the dorsal root ganglion (DRG), where sensory neurons are stored. To determine this 8 μ l of the virus is injected into the sciatic nerve of a mouse. Four serotypes were injected, AAV8 (affinity

for general neurons), AAV9 (affinity for general neurons), AAV2-Retro (affinity for spinal neurons), and AAV Php.s (affinity for peripheral neurons). All four viruses are paired with a cytomegalovirus (CMV) promoter which drives transgene expression in DRGs and an enhanced green fluorescent protein (EGFP) transgene. 3-5 weeks post-injection, the sciatic nerve, spinal cord, and DRG neurons are dissected out and perfused with 4% paraformaldehyde. To determine whether expression occurred in the targeted locations, the spinal cord and sciatic nerve were cryosectioned at 16-20 μm and the DRG neurons were whole mounted and imaged with a confocal microscope using three channels, a red channel to show auto-fluorescence, a green channel to show GFP markers, and an overlapping channel in which yellow is auto-fluorescence and green is true expression. Across all serotypes and in all tissues no expression was observed. The next steps of the project will be to determine a combination serotype and promoter that will be expressed in the DRG. Later steps will include increasing target specificity to subclasses of sensory neurons, beginning pattern and sensory feedback experiments, and ultimately developing an optogenetic peripheral nerve interface.

Abdelrhman Gouda

Project Title: Dimethyl sulfoxide combined with polyethylene glycol 400 as a vehicle for salvinorin A

Project Abstract: Despite a resurgence in psychedelic research, salvinorin A, the psychoactive molecule in *Salvia divinorum*, has received little attention. One of the major hindrances has been its poor solubility in aqueous solutions, necessitating the use of organic solvents. We investigated different combinations of dimethyl sulfoxide (DMSO) and polyethylene glycol 400 (PEG400) as a solvent and vehicle for intravenous delivery of salvinorin A in rats. First, we tested the solubility of salvinorin A in different proportions of DMSO and PEG400 and found it to be soluble in a 35:65 DMSO: PEG400 ratio with a maximum solubility of 1 mg/mL. Next, to determine the effect on patency and structural integrity of the intravenous catheters, we soaked the catheters (microrenathane tubing) for 2h in either 35:65 DMSO: PEG400 solution or 35:65 DMSO: PEG400 diluted with saline (14:26:60 DMSO:PEG400:saline). The tubing began to break down after 20 minutes of exposure to the DMSO/PEG400 alone, while the addition of saline preserved structural integrity with only minor blockage occurring. Finally, five male rats were surgically fitted with a jugular vein catheter for administration of the 14:26:60 DMSO: PEG400:saline solution and electrodes for simultaneous electroencephalogram recordings to quantify power spectral changes (1-180Hz) before and after vehicle administration. The results showed that a solution of DMSO (35%) and PEG400 (65%) was sufficient to dissolve salvinorin A (1mg/mL), while the addition of saline preserved the catheter tubing. Furthermore, the solution did not elicit changes in spectral power or behavior, supporting its use as a vehicle for intravenous salvinorin A administration in rats.

Nicole Granados

Research Experience Institution: Salk Institute for Biological Studies

Research Mentor: Daniela Cassataro

Project Title: A potential cortical source of value signals in the superior colliculus

Project Abstract: An organism makes decisions like prioritizing points of interest or avoiding danger based on a combination of value and sensory information. The prefrontal cortex (PFC) is a well-established part of value-guided decision-making circuitry, but how the brain coordinates value and sensory information is not well-understood. The midbrain superior colliculus (SC) receives inputs from the retina and almost the whole cortex, including sensory, motor, and PFC regions. We hypothesize that SC neurons integrate value with spatial and sensory information, and the source of value information is PFC. To investigate this, we designed a two-alternative forced choice task where water-restricted mice associate value with visual stimuli viewed on two screens. On each trial, mice choose between licking a left or right lick spout, corresponding to the left or right stimulus. Mice must lick in the direction of the high-value stimulus to maximize their reward collection. While mice perform this task, we use multi-shank silicon probes to simultaneously measure the neural activity in the PFC and SC. We will analyze the neural signals in both PFC and SC and determine whether neuronal firing correlates with variables like running speed, upcoming choice, location and orientation of the stimuli, and the mouse's subjective value estimate, which we will model by feeding the animal's choice behavior into a reward prediction error algorithm. Next, we will ontogenetically tag the PFC projection to SC and analyze neural signals in those cells. This experiment will allow us to determine whether SC-projecting PFC neurons encode value information.

Jordan Gross

Research Experience Institution: University of Pennsylvania

Research Mentors: Dr. Hongjun Song, Dr. Qian Yang

Project Title: Investigating the impact of the autism risk gene *PTEN* on cortical development using a human brain organoid model

Project Abstract: Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by social deficits and repetitive behaviors. ASD is a highly heritable disorder possibly due to mutation in candidate ASD risk genes. Phosphatase and tension homolog (PTEN) gene mutation is observed in people with concurrent autism and macrocephaly. Past research used animal models and monolayer cell cultures to identify cell-specific PTEN variations; however, forebrain organoids provide the unique opportunity to observe neurogenesis, cell interaction, and human-specific cell types. Forebrain organoids are derived from induced pluripotent stem cells (iPSC) to model early cortical development in vitro. We used forebrain organoids derived from the iPSCs of an ASD patient with a PTEN mutation and macrocephaly to investigate PTEN's role during neurodevelopment. Then, we compared the patient-

derived organoids to mutation-corrected forebrain organoids produced from isogenic iPSCs. Our research suggests that PTEN mutation transiently delayed neuron differentiation in early- stage development, enhanced maintenance of neural stem cells and progenitor cells, and may produce more neurons during the later stages of organoid development. Our results demonstrate alterations in early cortical development associated with a mutation in the PTEN gene. More translational research focused on the genetic background of ASD could further our knowledge of ASD etiology and contribute to targeted gene therapies.

Yuval Guetta

Research Experience Institution: Vanderbilt University Medical Institute

Research Mentor: Dr. Alan Lewis

Project Title: Molecular and cellular changes in the ventral dentate gyrus in a mouse model of 22q11.2 deletion syndrome

Project Abstract: Physiological impairments and dysfunction of the hippocampal formation, including the dentate gyrus (DG), have been frequently associated with psychiatric disease; however, the underlying molecular and cellular reasons for this are incompletely understood. Mossy cells, a glutamatergic neuronal population with cell bodies in the hilus of the DG play important roles in key cognitive processes, such as pattern separation, that are impaired in psychiatric disorders. Here, we investigated changes in the mossy cell system in a mouse model of 22q11.2 deletion syndrome, a genetic disorder which in humans confers substantially increased risk of psychiatric disease. Using immunohistochemistry for GluR2/3, a marker of hilar mossy cells, we found that mossy cell number was reduced in the ventral, but not dorsal, DG of adult Df(h22q11)/+ mice as compared to wildtype littermates. We did not find changes in the density of DG granule cells or number of parvalbumin-positive interneurons. Ventral mossy cell number was reduced in P28 Df(h22q11)/+ mice as well. We then conducted an RNA sequencing study from wildtype and Df(h22q11)/+ mice to identify possible molecular mechanisms involved in mossy cell reduction, and found significant reduction of Fos and JunB transcripts, which are components of the activator protein 1 transcription factor. Future studies will seek to further clarify the time course of mossy cell loss, and whether impairments of stimulus-dependent transcription may play a role in the observed deficits.

Gloria Gutierrez

Research Experience Institution: University of Washington

Research Mentors: Asad Beck, Dr. Franck Kalume, Dr. Horacio O. de la Iglesia

Project Title: Machine learning-based labels of epileptic activity are correlated with environmental temperature in a mouse model of Dravet syndrome.

Project Abstract: Dravet syndrome (DS) is a form of epilepsy caused by mutations in the SCN1A gene

encoding for NaV1.1 channels in inhibitory interneurons. Symptoms include febrile seizures and developmental delays. DS is drug-resistant, increasing the risk of suffering from sudden unexpected death in epilepsy. We tested the generalizability of a machine learning-based epileptic activity detection algorithm to a dataset collected in an experimental paradigm independent of the algorithm-training data. Two EEG electrodes and one EMG electrode were implanted in a mouse model of DS (SCN1a+/-) at the Kalume lab, and recordings were made over two consecutive days in 5–6 hour-time windows each day. Temperature was manipulated using a temperature controller and a heat lamp placed over the mouse's enclosure. Extraction of ninety-eight time- and frequency- domain characteristics in 5-second epochs were used for data analysis. To autonomously detect interictal spikes, we trained a Stochastic Gradient Descent-based model using manually scored data from de la Iglesia lab. Spikes were binned by minute to generate interictal spike frequency. There was a moderate, positive correlation between temperature increases and changes in interictal spike frequency ($\beta = 0.318$, $p < .0001$). On both recording days, temperature increases triggered seizures, although, on the second day, a lower temperature threshold was required to induce seizures. Thus, the relationship between temperature and interictal spike frequency prior to seizure onset may be leveraged for seizure forecasting. We also show increased seizure likelihood on the second day of temperature-induced seizures, suggesting the importance of prior epileptic events in seizure forecasting.

Ryan Henry

Research Experience Institution: Brown University

Research Mentors: Dr. Alexander Fleischmann

Project Title: Odor Identity Coding Within Specific Neural Projections in Olfactory Cortex

Project Abstract: The sensory cortex comprises several neuron types that project to distinct target regions. It is crucial to determine their individual functional features to comprehend how sensory information is conveyed between brain regions. Piriform cortex (PCx), the primary receiver of sensory information from the olfactory bulb, has neurons that project to a variety of regions, including the olfactory bulb (PCxOB) and the medial Prefrontal Cortex (PCxmPFC). It is known that PCxOB and PCxmPFC cells are both deep-layer pyramidal cells, but it is unclear if they receive separate information preferentially. In this study, we use GRIN lens technology and two-photon calcium imaging microscopy to capture neuronal activity in the PCx of awake, freely behaving male and female mice (4-6 months). We label PCxOB and PCxmPFC subpopulations with a retrogradely transported Adeno-associated virus and assess their response properties to odor response profiles. Our findings imply that PCx cell types encode odor information differently, shedding fresh light on how olfactory information is transmitted throughout brain regions. Odor identity is shown to encode more effectively in PCxmPFC neurons than in PCxOB neurons.

Stephanie Hernandez

Research Experience Institution: Michigan State University

Research Mentor: Dr. Irving E. Vega

Project Title: The identification of proteins differentially associated with 4R and 3R tau isoforms in normal aging and Alzheimer's disease

Project Abstract: Tauopathies are a group of neurodegenerative diseases characterized by the aberrant aggregation of tau proteins, where Alzheimer's disease (AD) is the best known. There are six tau protein isoforms divided in two major groups based on the inclusion of four (4R) or three (3R) microtubule binding repeats. Aggregation of either 4R or 3R tau protein isoforms are a pathological hallmark that distinguishes specific tauopathies. However, how 4R and 3R tau protein isoforms differentially aggregate is still unknown. We hypothesize that 4R and 3R tau protein isoforms may form different interactomes in specific brain regions and disease states. To test this hypothesis, we propose to identify proteins that associate with either 4R or 3R tau, specifically in temporal cortex and cerebellum samples from normal aging and AD cases. Human recombinant 2N4R and 2N3R tau proteins were purified from bacteria and incubated with either temporal cortices or cerebellum protein lysates from three normal aging and AD cases. The recombinant proteins were pulled down and the associated proteins identified by tandem mass spectrometry. This approach allowed us to identify the interactome for 4R and 3R tau in a brain region specific and disease associated manner. Validation and further characterization of the identified associated proteins will contribute to better understanding of the biological and pathological roles of tau proteins in the central nervous system.

Penelope Hurtado-Stuart

Research Experience Institution: Michigan State University

Research Mentor: Dr. Barbara Thompson

Project Title: Probing the impact of adverse childhood experience on parent-child interactions

Project Abstract: Early exposure to adverse experiences in infancy impacts neurodevelopment and social and emotional development throughout childhood and into adulthood. In this study, we recruited moms and their infant child to participate in a study examining the longitudinal effects of early life events. A population-based sample of mother-infant dyads from low-income backgrounds (n= 113) was recruited between 2016-2018 from primary care clinics in Boston, Massachusetts and Los Angeles, California. Dyads were recruited as part of a broader longitudinal study when the infants were less than 2 months old. We gathered videos of the dyad engaging in a free play session and coded these videos using the Coding Interactive Behavior (CIB) rating scheme. The CIB is a global rating scheme for coding interactions between two individuals and includes 43 behavior codes (22 for parent behavior, 16 for infant behavior, and 5 for dyadic behavior). Data already analyzed from the LA dyads indicate relationships between demographic factors and CIB codes, and our current study examines whether those same relationships exist for the participating dyads in Boston.

Additionally, analyses will combine the two sites to examine which demographic and maternal mental health factors correlate with the CIB. Monitoring free-play interactions is an easy task and can help to reveal nuanced behaviors which may not be reflected by responses to surveys and questionnaires. As such, analysis of these kinds of interactions could prove invaluable to clinical research in early childhood health, development, and resiliency to stress.

Noah (Munassar) Hussein

Research Experience Institution: Brooklyn College CUNY

Research Mentors: Dr. Andrew Delamater, Daniel Siegel

Project Title: Neural basis of reward timing prediction errors in Pavlovian learning

Project Abstract: Through simple Pavlovian learning, it is well documented that animals will form new associations between environmental stimuli and food rewards to the extent that the rewards are surprising when they occur, i.e., when there is a “reward prediction error.” These prediction errors are often described in terms of a mismatch between actual and anticipated reward values, but the reward’s size, type, and time of occurrence are other features that may be important. Our current study investigates the role of time prediction errors in rats with a focus on its underlying neurobiological substrates. We trained 12 rats for 28 days to expect food rewards at different times from stimulus onset in the presence of different predictive cues (e.g., a tone stimulus predicts food occurring after 10s, but a flashing light predicts food after 60s). During a test session, for some rats the specific stimulus-food time relations were maintained, but for other rats they were switched to induce time prediction errors. Shortly after the test session, we extracted the rats’ brains and then stained them for phosphorylated ribosomal protein s6, expressed in recently activated neurons. Preliminary results with a small sample size suggested that the switch group had a significant increase in the number of activated cells in the basolateral amygdala and a reduction in activated cells in the central amygdala as well as in the nucleus accumbens shell. Furthermore, we observed that a high portion of the dopamine neurons were projecting to neurons that were activated within the basolateral amygdala. A replication experiment is ongoing to assess the reliability of these preliminary findings. This novel approach to examining the locus of time-based prediction error coding in the brain will inform future studies designed to assess the causal status of specific pathways in prediction error-driven neuroplasticity.

Natalie Ito

Research Experience Institution: Vanderbilt University

Research Mentor: Dr. Fiona Harrison

Project Title: Performance changes in attentional and behavioral tasks following sepsis in a cecal slurry mouse model

Project Abstract: Sepsis is one of the leading causes of admission to the Intensive Care Unit (ICU) with

1.7 million cases of sepsis per year in the U.S. and high rates of mortality. Up to one-third of sepsis patients exhibit delirium, a confused mental state, and the duration of delirium is a strong predictor of later development of Alzheimer's disease. Measurement of the cognitive changes due to sepsis as a predictor for cognitive impairment after recovery is difficult in animal models due to confounds of sickness behaviors including motivation and activity levels. In this study, we used sixteen male and female wild-type (C57Bl/6J) mice aged 8-10 weeks. Mice were trained to criterion on the 5-choice serial reaction time task (5-CSRTT) as a measure of sustained attention over the course of 6-8 weeks and were then treated with an injection of a cecal slurry to induce acute polymicrobial peritonitis as a model for sepsis. Attentional function following either cecal slurry or control treatment was assessed through subsequent accuracy, response latencies, and omitted responses in operant chambers. Additionally, we monitored their spontaneous locomotion to account for hypoactivity during sickness and recovery. Preliminary results suggest a prolonged attentional deficit, suggesting that a single acute illness can impact cognitive function even after recovery.

Mariyah Jiwanji

Research Experience Institution: Temple University

Research Mentor: Dr. Mathieu Wimmer

Project Title: Using a machine-vision approach for automated pain measurement at millisecond timescales in rats

Project Abstract: Chronic pain, one of the most common reasons adults seek medical attention, has been linked to limitations in mobility and daily activities, opioid dependence, anxiety and depression, and poor perceived health or a lower quality of life. One of the hurdles to improving available treatments for chronic pain is the difficulty to measure pain precisely and accurately, especially in non-verbal rodents. The most commonly used assessment method in preclinical models is scoring the paw withdrawal reflex to a natural stimulus, with binary responsiveness used as an endpoint for inferring pain states. However, one limitation of this method is that it lacks resolution. This can now be overcome thanks to advancements in videography and automated tracking. We recently established a novel pain scale that combined paw kinematics and face grimaces into a single pain score using principal component analyses. Here, we automated part of the analytical and scoring procedure using high-speed videography, as well as automated paw tracking powered by machine and deep learning approaches. A software known as sLEAP (Social LEAP Estimates Animal Poses), utilizes both top-down and bottom-up approaches and animal identity tracking via kinetic or image models. We previously used sLEAP with high-speed videography in mice at baseline states and here we apply sLEAP in a different experimental context in rats. We use rats because rats represent an important component of basic science research, and it was important to extend the validated scale in mice to rats as well. By using this automated method, we intend to improve the consistency of the pain scoring even more by pinpointing the paw with high spatiotemporal resolution. To validate this pain scoring method, we

compared our previous manual scores to this new automated scoring pipeline. In conclusion, this algorithmic pain quantification method may improve validity in collecting rigorous behavioral data and is compatible with other neural circuit dissection methods for analyzing rat pain states.

Odelia Johnson

Research Experience Institution: Brooklyn College CUNY

Research Mentor: Dr. Laura Rabin

Project Title: Cognitive empathy and its relation to objective cognitive test performance in older adults along the Alzheimer's disease continuum

Project Abstract: Empathy forms the basis of many social encounters and is essential for understanding others' intentions and behaviors and maintaining high quality relationships. The cognitive component of empathy (i.e., understanding others' thoughts and feelings) has been studied in Alzheimer's disease, with evidence of impairment relating to deficits in memory and executive functioning. However, research has not determined whether this finding holds for older adults across the cognitive continuum. Methods. Participants included healthy controls (HC, $n = 8$), and those with subjective cognitive decline (SCD, $n = 11$), mild cognitive impairment (MCI, $n = 7$) and mild Alzheimer's disease ($n=1$). Ages ranged from 61-90 years ($M = 75.2$, $SD = 8.4$). The Social Faux Pas Task (Slessor et al., 2007) was used to assess cognitive empathy. Participants read scenarios about characters engaged in a situation where someone says or does something socially inappropriate— and answered questions related to what social faux pas was committed. Results. Accuracy scores on the Social Faux Pas Task correlated with scores on the Montreal Cognitive Assessment (MoCA), $r(25)=0.62$, $p < .001$, Repeatable Battery for the Assessment of Neuropsychological Status delayed list and story recall tasks, $r(24)=0.53$, $p < .01$ and $r(24)=0.41$, $p < 0.05$, respectively, and Trail Making Test (Switching Condition), $r(23) = 0.56$, $p < 0.01$. Conclusion. Greater cognitive empathy was associated with better global cognitive functioning, memory, and executive functioning. Those with global and specific cognitive deficits may lack the ability to accurately detect emotions of others and rely more on inhibitory mechanisms (less affected by neurocognitive impairments). These results have important implications for everyday social functioning and the design of effective interventions.

Shay Kathiresh

Research Experience Institution: University of Colorado Anschutz Medical Campus

Research Mentor: Dr. Nidia Quillinan

Project Title: Evaluating hippocampal injury and plasticity following a neonatal cardiac arrest model

Project Abstract: Neonatal hypoxic-ischemic encephalopathy resulting from sudden cardiac arrest (CA) is an unfortunate and devastating condition, which leads to long-lasting neurological impairments. However, little experimental data on the pathophysiology of neonatal CA is currently accessible due to

the lack of animal models. A novel experimental model of neonatal cardiac arrest and cardiopulmonary resuscitation (CA/CPR) was developed utilizing postnatal 9–11-day rats. Cardiac arrest durations of 8, 10, 12, and 14 minutes were observed and evaluated. Hippocampal CA1 and striatal neuronal injury were quantified 3 days after resuscitation with NeuN and Fluoro-Jade B staining. Blood analysis for circulating troponin levels were evaluated at 2 hours after CA/CPR. Neonatal rats exhibited a lack of Fluoro-Jade B positive neurons in both CA1 hippocampal and striatal neurons following an 8-minute CA/CPR. Increasing ischemia time to 10 min or greater CA/CPR resulted in an increase in hippocampal injury in neonatal rats. We detected increases in blood troponin levels indicating myocardial injury associated with CA/CPR. This is the first report of a cardiac arrest and CPR model of global cerebral ischemia in term-equivalent neonatal rats. Therefore, the neonatal rat CA/CPR model we developed is unique and will provide as an important new tool to the research community for the study of neonatal brain injury. Future studies will focus on the functional outcomes of neonatal CA/CPR.

Javier Kelly Cuenca

Research Experience Institution: Washington University in St. Louis

Research Mentors: Dr. Yehuda Ben-Shahar, Erik Nolan

Project Title: Determining the role of the *eIF4H1* gene, a William syndrome factor, in sociability using *Drosophila melanogaster*

Project Abstract: William syndrome (WS) is a human genetic disorder characterized by delays in cognitive development, congenital vascular and heart disease, growth deficiency, infantile hypercalcemia, and hyper-sociability. WS is caused by the deletion of approximately 1.8 Mb on chromosome 7, resulting in the hemizygosity of 25-28 genes. However, it is still not understood which and how these genes contribute to the behavioral and cognitive features observed in WS. Our lab previously identified the eukaryotic translation initiation factor 4H1 (*eIF4H1*) gene – a fly ortholog of the William syndrome gene, *eIF4H* – as a possible candidate associated with sociability. Our presented research aimed to expand the findings of this previous study by identifying the neurons that underlie the courtship defects induced because of *eIF4H1* knockdown. Ppk23 neurons, pheromone-sensing neurons located in the forelegs, are a strong candidate to explain this relationship. These neurons richly express *eIF4H1* and play a crucial and immediate role in fly social behaviors. Because of this, we hypothesized that *eIF4H1* could regulate fly sociability via its expression in ppk23 neurons. We knocked down *eIF4H1* exclusively in this neuron group and scrutinized whether the reduced gene expression limits sociability in male courtship behavior via standard courtship analysis. Courtship behavior was analyzed to quantify courtship latency and courtship index. We also performed *eIF4H1* knockdown in two separate fly lines during different stages of development – neuroblast (*poxn-GAL4*), and adulthood (*ppk23-GAL4*). Our findings suggest that *eIF4H1* knockdown via *ppk23-GAL4* was increased courtship latency, while *poxn-GAL4* knockdown led to a greater effect on the courtship index. Thus, in this study we identified a

tractable set of sensory neurons in which we can further investigate important functions of *eIF4H1*, potentially revealing conserved mechanisms that underlie Williams syndrome.

Alexus Lawrence

Research Experience Institution: Brown University

Research Mentors: Dr. Oriel FeldmanHall, Isabella Aslarus

Project Title: Categories' effect on social navigation

Project Abstract: Categories affect our everyday social activity, whether it be race, gender, or social class. We use these categories to determine the choices we make and how we choose to interact with people. However, it is still unknown how people determine which features are relevant and irrelevant in different contexts, and whether categories make it more difficult to shift attention. In this study we addressed these questions by having participants engage with avatars that had traits (hat, shirt, and pants) that varied, with variations in only two of those traits determining what category they were in. Because people have priors about real-world social traits and categories, we used abstract avatars that would not activate existing biases. Participants first learned how to categorize avatars based on those two traits, then interacted with avatars in an economic game, where they had to learn that an avatar's trustworthiness was based on the third trait. We hypothesized that participants who had a high level of accuracy when learning the categories would demonstrate a poorer performance in the trust game because they paid attention to the features that predict category membership, rather than the feature that predicts trustworthiness. In contrast, poor learners during categorization would have an easier time learning that the third feature predicts trustworthiness. Our initial results did not support our hypothesis. The subjects that did well during the categorization trials, did equally as well during the trustworthiness game. In future research we hope to subtract the confidence interval from the data because subjects that learned the categories well, may have gained confidence from the feedback given during those trials, motivating them to do well during the trust game as well. We also plan to increase our sample size to strengthen to validity of our findings.

Ekaterina Lebayle

Research Experience Institution: New York University

Research Mentors: Dr. Marisa Carrasco, Helena Palmieri

Project Title: Interaction between spatial and temporal attention

Project Abstract: Cognitive and perceptual resources are limited due to the high neuronal metabolic cost. Optimizing attention is essential for reducing the bioenergetic cost of neuronal activity and improving the ability to process information. Attending to a point in space or time results in benefits of enhanced visual perception respectively, but it also has a cost of impairment at unattended ones. A lot is known about mechanisms of spatial and temporal attention when they are deployed alone, but it is

not well understood how these types of attention interact with each other: what mechanisms do they have in common, and what are the costs and benefits (subadditive, additive, or superadditive) of combining them in the same task? We developed an experimental protocol where participants were asked to report the orientation of tilted Gabors at one of four locations at a specific time. At the beginning of each trial, they were given a pre-cue (valid, invalid, or neutral) which indicated space, time, both, and none. We examined sensitivity (d') and reaction times for every combination of the location and time. We hypothesized that combining spatial and temporal attention in this high-difficulty task will result in a superadditive benefit to performance. Given our preliminary results, we found spatial effects (costs and benefits) across all pre-cue conditions, but we did not see clear temporal effects at this time. With more data, we will be able to clarify how humans combine spatial and temporal attention to optimize behavior. Our results will also give insight into whether spatial and temporal attention mechanisms are independent, or do they depend on each other.

Pearl Leon Guerrero-McInally

Research Experience Institution: University of Washington

Research Mentors: Dr. Eric Peterman, Dr. Jeff Rasmussen

Project Title: Calcium signaling in zebrafish skin-resident immune cells

Project Abstract: Skin is a densely innervated sensory organ. Its residing somatosensory receptors help us perceive various touch stimuli. Frequent injuries to skin cause axon damage and lead to subsequent degeneration. Degenerating axons leave behind debris that must be cleared before reinnervation can occur and feeling is restored. To study innervation and injury, adult zebrafish are used as a model as they have homologous cells and structures to humans. Scale pluck assays in adult zebrafish have revealed that skin-resident immune cells known as Langerhans cells use motile protrusions to engulf axonal debris. Calcium signaling has been previously shown to regulate phagocytosis and cell motility in other cell types, but the role of calcium signaling in Langerhans cells is unstudied. Here, we use scale pluck assays and confocal microscopy to establish a model for monitoring calcium signaling in Langerhans cells. We observe very transient calcium flashes in Langerhans cells that vary in intensity and frequency. To examine if calcium signaling has any effect on cell motility in Langerhans cells, we use the calcium chelator BAPTA-AM. We first confirm that BAPTA-AM perturbs calcium signaling, in which we show that BAPTA-AM decreases calcium flash intensity but does not impact flash frequency in Langerhans cells. Initial observations also suggest that cell displacement temporarily halts after treatment with BAPTA-AM, but protrusion motility does not change when compared with control cells. Identifying what regulates cells involved in debris removal is relevant to understanding diseases in which axon homeostasis is altered, including diabetic and chemotherapy-induced peripheral neuropathies.

Ashley Letona

Research Experience Institution: University of Washington

Research Mentors: Lydia Gordon-Fennell, Dr. Stefan Sandberg, Dr. Paul E.M. Phillips

Project Title: The role of CRF receptors in the nucleus accumbens core during cocaine self-administration in rats

Project Abstract: Cocaine has been shown to be an addictive drug that has been increasingly causing a national crisis throughout the years. Corticotropin-releasing factor (CRF) is known to be active following drug usage. CRF receptors 1 (CRFR1) antagonists (blocks CRFR1 transiently) have been known to decrease escalated drug use. Data suggests that CRF levels are increased in the Nucleus Accumbens following drug use. The involvement of CRF 1 receptors specifically in the nucleus accumbens during cocaine consumption is still not clear. In the 1st experiment, we antagonized CRFR1 in the Nucleus Accumbens by injecting CP-154,526 (CRFR1 antagonist) into rats who have been in long-access (6 hours of cocaine access a day) to see if it would reduce cocaine consumption in escalated rats. In the 2nd experiment we knocked out CRFR1 in the nucleus accumbens by microinjecting a CRISPR-Sacas9 virus (knocks out CRFR1 permanently) in the rats before they went through training, short (1 hour of cocaine access a day), and long access to see if the rats would not escalate in drug taking. For experiment 1, we found no significant differences in drug consumption between the microinjections of CP-154,526 or the control (artificial cerebrospinal fluid) in the rats. For experiment 2 through preliminary data, it seems that the rats that received the CRISPR-Sacas9 microinjections are consuming less cocaine than the rats that received the control virus. In conclusion, CRF in the Nucleus Accumbens does not seem to be necessary to maintain elevated levels of drug taking post-escalation but through experiment 2's preliminary data there may be a relationship at the early stages of drug consumption and escalation.

Caroline Lewis

Research Experience Institution: Washington University in St. Louis

Research Mentors: Dr. David Holtzman, Nimansha Jain

Project Title: Impact of TREM2 agonist antibody on pre- and post-synaptic proteins in amyloid mice seeded with Alzheimer's disease (AD) tau

Project Abstract: Mutations in the gene for triggering receptor on myeloid cells 2 (TREM2) increase the risk of acquiring Alzheimer's Disease (AD). In AD, there are two hallmark pathologies: amyloid- β ($A\beta$) plaques and misfolded tau fibrils known as neurofibrillary tangles (NFTs). To model tau pathology, we used a model system in which AD-tau is injected into both the cortex and hippocampus in a mouse model called 5XFAD mice that develops Ab amyloidosis. Based on prior data from the Holtzman lab utilizing genetically modified mice that express normal levels or reduced levels of TREM2, we hypothesized that activation of TREM2 would decrease amyloid-induced tau seeding and spreading and

associated synaptic loss. We used a TREM2 agonist, an anti-TREM2 antibody, to increase TREM2 activity and looked at the presence of pre- and post-synaptic markers as an indicator of neuronal synapses surrounding amyloid plaques. We found a significantly greater decrease of a presynaptic marker, synapsin, surrounding A β plaques, in the hippocampus of 5XFAD mice ipsilateral to the AD-tau injection in mice treated with TREM2 antibody vs. control IgG. We additionally found a not statistically significant trend of decreased synapsin in the ipsilateral cortex. Additionally, we found no differences in the presence of a postsynaptic marker, PSD-95, surrounding A β plaques, in the hippocampus of 5XFAD mice ipsilateral to the AD-tau injection in mice treated with TREM2 antibody vs. control IgG. We also found an increased presence of disease-associated microglia and a decrease of co-localization between neuritic dystrophy and presynapses in the cortex that is contralateral to the AD-tau injection in TREM2 antibody-treated mice. From our data, we conclude that tau seeding in the presence of increased TREM2 agonism may decrease axonal synapses around Ab plaques.

Justin Lopez-Roque

Research Experience Institution: Washington University School of Medicine

Research Mentor: Dr. Khalil Thompson

Project Title: High irritability modulates activation in social learning brain regions in young children

Project Abstract: Previous research exploring irritability has established a strong connection between the development of childhood psychopathology and high levels of irritability. To decrease the burden that heightened irritability may cause in young childhood, it is important to identify neural biomarkers that may be linked to future psychological vulnerabilities. We took 98 children between the ages of 4-7 and had them complete a specialized social task, the FETCH task, designed to induce frustration (win vs lose rounds). fMRI data was collected during gameplay, along with parent-reported questionnaire data. Whole brain analyses revealed that Win>Lose blocks were associated with significant activation in the left putamen and surrounding striatal region. Lose>Win blocks were associated with increased cluster-level activation in the right temporal parietal junction, as well as increased connectivity with the right mid temporal lobe, a region implicated in memory consolidation. Overall, the data shows that young children display increased activation in brain regions involved in perspective-taking and memory consolidation when experiencing frustration and loss. This may be indicative of early social learning processes, specifically the identification of competitive persons or individuals that elicit stress in the child during social contexts.

Madison Marcus

Research Experience Institution: University of Colorado Anschutz Medical Campus

Research Mentor: Dr. Jessica Nelson

Project Title: The cadherin gene *cdh16* is required for habituation in zebrafish

Project Abstract: Habituation learning allows animals to reduce responding to repetitive stimuli in their environment. This simple form of plasticity is thought to underlie more complex forms of cognition and disruptions in habituation are associated with disorders such as schizophrenia. A previous forward genetic screen identified a mutant allele *irresistible*^{p173} that caused habituation deficits in zebrafish. Whole-genome sequencing showed that the habituation phenotype was linked to mutations in the gene *cdh16* (cadherin 16, kidney-specific cadherin). Although *cdh16* functions in the kidney and is involved in the development of the thyroid in mammals, it is not yet known how *cdh16* might contribute to behavioral plasticity in vivo. We set out to determine whether habituation deficits in *irresistible* mutants are a result of mutations in *cdh16*. Furthermore, we examined where *cdh16* is expressed and how mutations in *cdh16* impact whole-brain activity, as well as kidney and thyroid function. Our data show that *irresistible*^{p173} is an allele of *cdh16*, indicating a new role for this gene in the regulation of habituation in the larval zebrafish. Moreover, we identify a small handful of brain regions whose activity is disrupted in *cdh16* mutants, consistent with a possible role for this gene in the brain. Finally, our preliminary results have not yet revealed dysfunction in the kidney or thyroid. Taken together, our results uncovered a new role for *cdh16* in the regulation of habituation in the larval zebrafish and identify candidate regions through which it may exert this function in the brain.

Rachel Membreno Almendares

Research Experience Institution: Washington University in St. Louis

Research Mentors: Dr. Jeffrey M. Zacks, Dr. Maverick E. Smith

Project Title: The impact attention to event segmentation on memory in healthy older adults

Project Abstract: To understand and remember a continuous activity, one must parse the activity into its constituent parts in a process called event segmentation. How activities are segmented during the perception of continuous activity affects how events are later remembered. For instance, those who segment in a more normative fashion have better memory than those who segment more idiosyncratically. Further, instructing young adults to attend to how they segment an activity leads to better memory up to one month later than instructing them to intentionally encode the activity for a later memory test (Flores et al., 2017). We explored if instructing older adults, who typically show worse than younger adults' ability to segment and remember continuous activities, to attend to how they segment improved their event memory. Forty-six cognitively healthy older adults watched four videos with instructions to intentionally encode them for a later memory test. We then randomly assigned participants to watch four additional videos with instructions to either segment them into the smallest units that seem natural and meaningful to them, or to intentionally encode them. We tested participants' memory using a free recall test and a recognition memory test at four different delays from 30 minutes to 4 weeks after encoding the videos. Consistent with prior work, we found that memory worsened as the time between encoding and testing increased. Importantly, we predicted that attention

to event segmentation would improve recall and recognition memory. Contrary to this hypothesis, we found that attention to segmentation did not improve recall or recognition memory. Our results suggest that attending to event segmentation may not benefit delayed memory in healthy older adults.

Maríel Kristine Micael

Research Experience Institution: Salk Institute for Biological Sciences

Research Mentors: Dr. Ashley Brandebura, Dr. Nicola Allen

Project Title: Disease progressions in Alzheimer's disease mouse models by sex

Project Abstract: In Alzheimer's disease (AD), there is a loss of synapses in the hippocampus, making astrocytes a candidate cell type to target for therapeutic treatments aimed at slowing or preventing the loss of synapses. However, astrocytes are difficult to target in vivo with current genetic tools due to the availability of only a small number of specific markers. The Glial fibrillary acidic protein (Gfap) promoter is specific for astrocytes, but Gfap is upregulated in Alzheimer's Disease, and is differentially expressed between wildtype (WT) and mutant (MUT) mice. We created a breeding scheme where Cre-dependent viruses can be targeted to astrocytes using ubiquitous promoters to drive the construct, but the specificity for astrocytes is achieved through Cre recombination driven by the astrocyte-specific promoter Aldh1L1. Aldh1L1 transcript is not differentially expressed between WT and MUT mice and thus is a preferable method to target astrocytes in AD. The APP/PS1 and Tau*P301S mice have previously been characterized for the onset and progression of amyloid plaque and NFT pathology. To study the gliosis and plaque formation in the APP/PS1x Aldh1L1-Cre and Tau*P301Sx Aldh1L1-Cre mice, immunohistochemistry (IHC) will be used to visualize reactive astrocytes, plaques and tangles in the hippocampus and frontal cortex. WT and MUT mice of both genders will be characterized at 4 months, 6 months, and 9 months to compare disease onset and progression to published reports. Total area of Gfap will be used as a readout for the extent of astrocyte reactivity. This data will ultimately help us as we move forward with testing Cre-dependent viruses targeting astrocytes to slow the onset and progression of AD.

Joyce Milandu

Research Experience Institution: University of Maryland, College Park

Research Mentor: Dr. Edward Bernat

Project Title: Brain measures of shared variance between internalizing and externalizing psychopathology

Project Abstract: P3 amplitude reductions have been observed across a variety of psychopathologies. Developed models demonstrate two primary latent factors underlying psychopathology: internalizing (e.g., depression, anxiety, PTSD) and externalizing (e.g., antisocial, and disinhibited behavior). Recent work has shown that the shared variance between these latent factors represents a general

psychopathology (p) factor. In an initial study, we examined P3 amplitudes in an undergraduate sample (N=125) with self-report measures of internalizing and externalizing problems and demonstrated that a p-factor measure best explained the amplitude reductions related to problem behaviors. The participants (N=125) completed the rotating heads visual oddball task, and IAPS photos were used as infrequent novel stimuli. In the extension of this study, we will add a measure of medial frontal theta, indexing early attention shifting toward the stimulus. This will provide an assessment of another component with stronger inferences about the attentional mechanisms involved. We will thus assess for shared and unique relationships for P3 and medial-frontal theta to the p-factor.

Evelyn Mpofu

Research Experience Institution: Louisiana State University Health Sciences Center – New Orleans

Research Mentors: Dr. Jorgelina Calandria, Dr. Nicolas Bazan

Project Title: Maresin 1 drives protection of dopaminergic neurons and microglia conversion to M2 in 6HODA Model of Parkinson's disease

Project Abstract: Parkinson's disease (PD) is a neurodegenerative disorder that affects the dopaminergic neurons in the Substantia Nigra (SN). Due to the function of several genes in which mutations are a cause of genetic inherited PD, inflammation and phagocytosis are key processes to understand its pathology and progression. Microglia, the resident macrophage-like cells located in the central nervous system, mediate synaptic pruning, perform phagocytosis of cellular depositions and waste, and release pro and anti-inflammatory responses contributing to neurodegeneration or neuroprotection. Microglia polarizes into M1 and M2. These phenotypes modulate defensive or neuroprotective efforts to modulate neuroinflammation. The M1 phenotype exhibits pro- inflammatory cytokine secretion, while the M2 shows predominantly LC3-associated phagocytosis (LAP). We hypothesize that Maresin 1 triggers conversion from M1 to M2 phenotypes to protect dopaminergic neurons from the toxicity elicited by 6-hydroxydopamine (6-HODA). This hypothesis was tested in a 6HODA toxicity transgenic rat model that expresses GFP driven by the Tyrosine hydroxylase promoter. The rats were administered 5 µg of Maresin 1 intranasally, pre and post stereotactic injection of 6HODA. We used immunocytochemistry to detect IBA1, a marker of microglia in different areas of the rat brain. Microglia were more abundant in the substantia nigra (SN) area, and the shape resembled more to M2 in the rats treated with Maresin 1 when compared with the controls. Stereology measurements showed protection induced by Maresin 1, evidenced by the presence of GFP signals in the SN region. Maresin 1 protected dopaminergic neurons and induced significant positive effects in the polarization from M1, inflammatory, to M2, pro-survival phenotype, laying the road for future therapeutical development.

Atheer Musad

Research Experience Institution: Yale University

Research Mentors: Dr. Alicia Che, Dr. Lin Lin

Project Title: Cell type profile of oxytocin receptor-expressing neurons in the prefrontal cortex

Project Abstract: Oxytocin is a peptide hormone that is involved in parturition and lactation, as well as social behaviors. The early social interactions between the infant and the parents contribute to the development of future social behavior. The neural mechanisms underlying the interaction between external sensory inputs and social behavior are not well understood, but oxytocin signaling has been attributed to transmitting social information to neurons by modulating inhibition. The prefrontal cortex (PFC) is an important brain structure responsible for orchestrating social interactions. In this project, I investigate the neuronal types that express oxytocin receptors (OXTRs) in the PFC in mice at weaning age, at postnatal day (P) 21. I utilize a variety of techniques including cryostat slicing, immunohistochemistry, and confocal microscopy to label and quantify the OXTR-expressing neurons in the PFC. Specifically, I will focus on the Somatostatin (SST)-expressing portions and compare it to the Parvalbumin (PV)-expressing neurons. I found that SST-expressing neurons make up a large portion of OXTR-Ai9 cells in the PFC compared to PV-expressing neurons. I also found that cortical layers 5 and 6 contain the most OXTR-expressing neurons compared to other layers.

Lewis Nunez

Research Experience Institution: University of Michigan

Research Mentors: Dr. Kevin Jones, Taylor Craig

Project Title: NMDA receptor activity regulates ER81 expression

Project Abstract: N-methyl-D-aspartate receptors (NMDAR) hypofunction is considered a leading risk factor for schizophrenia. Pre-clinical studies established that transient NMDAR block during early development can cause lasting deficits in animal models that mimic schizophrenia, but the mechanisms are unclear. Preliminary studies from our lab show that administering the NMDAR channel blocker, MK-801, to neonatal mice, causes an increase in expression of the activity-dependent transcription factor, ER81, in the adult cortex. ER81 plays a prominent role in the specification of neuronal properties and regulates the expression of the potassium channel Kv1.1 in parvalbumin-expressing fast-spiking interneurons (FSIs) (Dehorter et al., 2015). Earlier work from our group showed Kv1.1 expression is reduced in FSIs from mice treated with MK-801 during early development (Jones et al., 2014). Altering ER81 expression could be an important mechanism by which MK-801 causes long-lasting changes in neurophysiology. The goal of this project is to investigate whether MK-801 alters ER81 expression by specifically blocking NMDAR current or because of general decrease in network activity. We hypothesize ER81 expression to be moderately affected by altering overall network activity. To test this, we used an in-vitro model in which we cultured murine cortical neurons and treated them on day-in-vitro (DIV) 7 with

a drug to increase network activity (Bicuculline – GABA A receptor antagonist); decrease network activity (Tetrodotoxin – sodium channel blocker) network activity; or selectively block NMDARs (MK-801). On the DIV 28 cells were fixed and fluorescently stained for ER81 and imaged by confocal microscopy. The data suggests that NMDAR regulates the expression of ER81. Further studies will investigate whether NMDAR blockage influences the downstream targets of ER81, like Kv1.1.

Beverly Obodaifio

Research Experience Institution: University of Maryland School of Medicine

Research Mentor: Dr. Sarah Clark

Project Title: Quinolate phosphoribosyltransferase (QPRT): a potential mediator of postnatal hippocampal neurogenesis.

Project Abstract: The kynurenine pathway is the major catabolic pathway for the degradation of tryptophan; it also represents the de novo synthesis pathway for NAD⁺ and therefore plays an important role in cellular metabolism and energy production. Quinolate phosphoribosyltransferase (QPRT) is the enzyme in the kynurenine pathway that transforms quinolinic acid (QA) into NAD⁺ and its loss increases levels of QA, an NMDA receptor agonist, while also reducing de novo synthesis of NAD⁺. We have previously shown that components of the kynurenine pathway are expressed in the sub granular zone of the dentate gyrus in the hippocampus. Given that this is a neurogenic niche, we hypothesized that the kynurenine pathway mediates postnatal hippocampal neurogenesis. Consistent with prior reports that NMDA receptor activation in the dentate gyrus is associated with reduced neurogenesis, we predicted a reduction in cell proliferation in QPRT knock out (KO) mice associated with increased levels of QA. To determine if disrupting the kynurenine pathway by knocking out QPRT impacts postnatal hippocampal neurogenesis, we used the thymidine analog BrdU in combination with cell-type specific markers to assess cell proliferation in the dentate gyrus of young adult QPRT KO mice. In contrast to our expectations, there was a significant increase in BrdU⁺ cells in the dentate gyrus of QPRT KO mice indicating enhancement in cell proliferation in these mice. Given that the cell cycle is driven by changes in the redox state, this may be attributed to the decrease in NAD⁺ synthesis rather than a direct relation to QA.

Geraldine Ortiz

Research Experience Institution: Michigan State University

Research Mentor: Dr. Scott Counts

Project Title: Effects of cerebrovascular disease on amyloid pathology in a novel rat model of mixed dementia

Project Abstract: Alzheimer's disease (AD) is characterized by amyloid plaques and neurofibrillary tangles associated with neurodegeneration in cognitive brain regions. The interplay between co-morbid

cerebrovascular disease (CVD) and AD results in the most common form of mixed dementia, in which the CVD element accelerates the clinical presentation of dementia. However, the extent to which CVD impacts the accrual of AD pathological hallmarks such as amyloid plaques remain unclear. To address this question, we are using a rat model of mixed dementia generated by crossing Tg344-19 AD rats with spontaneously hypertensive stroke-prone rats. This project will compare amyloid plaque density in male and female 9-month-old mixed dementia and AD rats (n=4-6/group), as well as non-transgenic controls, to test the hypothesis that CVD potentiates amyloid pathology in AD. Immunohistochemistry will be performed on formalin-fixed, paraffin-embedded brain tissue sections using an antibody that detects AD-like amyloid pathology. Slides will be digitally scanned and quantified for hippocampal and cortical amyloid load using HALO machine-learning image analysis software. This investigation, using a novel translational rat model may provide new insights into mechanisms and disease-modifying therapies for AD mixed dementia.

Stephanie Ortiz Espallat

Research Experience Institution: University of Massachusetts Medical School

Research Mentors: Dr. Michael Francis, Kasturi Biswas

Project Title: Exploring neurotransmitter regulation of organismal stress response

Project Abstract: Neurons sense environmental stresses, including oxidative stress and elevated temperature, and modulate organismal physiological responses. However, the mechanisms by which the nervous system encodes organismal stress responses remain unclear. My work is designed to investigate how specific neurotransmitter systems act to coordinate organismal stress responses. Previous unpublished work in the Francis laboratory indicated that the cholinergic neurotransmitter system protects against oxidative damage in the nematode *Caenorhabditis elegans*. To assess potential contributions of other neurotransmitter systems to oxidative stress responses, I exposed mutant *C. elegans* strains lacking function of specific neurotransmitter systems to oxidative stress using chemical stressors and measured their survival over time. I found that disruption of glutamate neurotransmission decreased survival in the presence of the chemical oxidative stressor paraquat, potentially indicating a protective role of glutamatergic transmission. In contrast, disruption of serotonin transmission did not have an appreciable effect on survival in the presence of paraquat, suggesting that serotonin signaling might not be involved. To investigate whether the effects I observed are specific to oxidative stress produced by paraquat, I am also investigating survival in the presence of juglone, another oxidative stress agent. In contrast to oxidative stress, I found that survival following heat stress was not appreciably altered by disruptions in many of the neurotransmitter systems I tested. Notably however, disruption of cholinergic neurotransmission increased vulnerability to heat stress. These results suggest that cholinergic neurotransmission may be particularly important for heat stress responses, while other neurotransmitter systems are not centrally involved. Further, our findings that the cholinergic system

affects survival during both heat and oxidative stress emphasize how critical cholinergic neurotransmission is for *C. elegans* and points towards an umbrella protection against environmental stressors.

Juan Padilla

Research Experience Institution: University of Puerto Rico-Medical Sciences Campus

Research Mentors: Christian Bravo

Research Co-Author: Angelys Rivera Hernández

Project Title: Sex differences in reward approach/punishment avoidance conflict in mice

Project Abstract: Reward is often present in risky environments, requiring individuals to weigh the benefits of rewards against associated risks. Some individuals exhibit poor choices during risky reward opportunities and thus exhibit extreme avoidance or risky behaviors that can impair quality of life or endanger people. It is therefore necessary to characterize how neurons mediate reward approach and threat avoidance conflict. Here, we used a novel approach-avoidance conflict task to characterize differences in behavior and neuronal activity in mice. We adapted the platform-mediated avoidance conflict task (Bravo-Rivera et al 2021), such that water-deprived mice could nose-poke for a light-signaled water reward and avoid a tone-signaled (20 sec) foot-shock (0.2 mA, 2 sec co-terminating) by stepping onto a platform away from the reward port. Mice were trained in two different conflict contingencies; in low conflict, reward was available during safety periods and during the warning tone, whereas in high conflict, reward was available only during the warning tone. All mice learned to actively avoid the signaled shock in >90% of trials by the tenth day of low conflict training. Interestingly, females stepped on the platform earlier than males after tone onset and had a longer latency to leave the platform after tone offset in low conflict. Females also mounted the platform earlier than males after tone onset in high conflict. Males received more shocks than females and received more water reward than females by the end of high conflict training. Moreover, females exhibited more tone-induced freezing and exhibited more frequent darting than males. These results suggest that females exhibit more defensive behaviors at the expense of reward attainment compared to males, suggesting that conflict neural substrates are sexually dimorphic.

Leila Paige

Research Experience Institution: University of Nevada Reno

Research Mentors: Dr. Silvia Bunge, Ethan Willbrand

Project Title: Tertiary sulci and relational reasoning: How sulci structure relates to functional connectivity

Project Abstract: The lateral prefrontal cortex (LPFC) is responsible for many higher-level brain functions such as relational reasoning, which is a human-specific skill. Our research goal is to find a connection between relational reasoning and small, late-developing anatomical structures known as tertiary sulci.

Our work focused on the tertiary sulci because they are: the shallowest sulci and the last to appear gestationally in the LPFC, only identified in humans and humanoids, and are associated with the development of cognitive skills. The depth of the tertiary sulci could explain the variability of reasoning behavior in children and adolescents. We want to understand whether tertiary sulci relate to functional connectivity during reasoning tasks. However, to test functional connectivity, we need to define tertiary sulci in additional participants. In this project, we precisely identified tertiary sulci in additional participants for use in testing functional connectivity. Over the course of this project, we labeled approximately 950 sulci in 24 participants using the software FreeSurfer. To get this information, we had people between the ages of 6-18 solve a relational reasoning task and take note of the results. We also used fMRI to scan each of their brains which we would later label. Defining sulci in participants' brains provides insights into these brain structures in a developmental sample. Overall, this project will increase our understanding of how the structure of the lateral prefrontal cortex supports its functional organization at a more precise and individual level than previously considered.

Matthew Piniero

Research Experience Institution: Temple University

Research Mentors: Dr. Emily M. Black, Dr. Lisa A. Briand

Project Title: Examining the impact of social isolation on molecular signaling in the reward circuit

Project Abstract: Adolescence is a critical period for brain development. Stress during adolescence has been shown to lead to long-term problems affecting neural development and behavior. Social isolation is one example of adolescent stress that has been demonstrated to significantly increase the likelihood of developing substance abuse disorder. Previous data has shown sex differences in cocaine self-administration between group housed and isolated mice in which socially isolated female mice self-administered less than female group-housed mice, while no such differences were observed in males. Data from electrophysiology has also shown differences in glutamate signaling between group housed and isolated mice. This project aims to investigate these phenomena by looking at potential sex differences in oxycodone self-administration and sex differences in the glutamate signaling of these mice. We plan on running oxycodone self-administration of group housed and isolated male and female mice. We will then take sections from the nucleus accumbens, homogenize the tissue, and use them in a western blot analysis. The proteins of interest for the western blot analysis are GluA1 and GluA2, and GAPDH as our control. We expect that the data from the self-administration paired with the data from the western blot analysis will show any potential sex differences within the glutamate signaling of the nucleus accumbens in mice.

Trinidi Prochaska

Research Experience Institution: Washington University in St. Louis

Research Mentors: Dr. Rachel Lean, Dr. Cynthia Rogers

Project Title: Prenatal cannabis use is associated with decreased bilateral cerebellum and left lateral orbitofrontal cortex brain volumes in neonates

Project Abstract: Cannabis use has become increasingly common following its legalization in many states, and its use by pregnant mothers is particularly concerning for the infant. Δ^9 -tetrahydrocannabinol (THC) readily crosses the placenta and binds CB1 receptors abundantly found in the amygdala, hippocampus, cerebellum, and prefrontal cortex of the fetal brain. Prenatal cannabis use (PCU) has been linked with altered amygdala, hippocampal, cerebellum, and orbitofrontal cortex volumes in rodents, adolescents, and adults, but its effect on neonates is unclear. To examine the effect of PCU on neonatal brain volumes, mothers were recruited from Barnes Jewish Hospital Outpatient OB-GYN Clinic who used cannabis ≥ 2 times in the 2 years preceding pregnancy. Cases (N=44) were defined as having any self-reported frequency and/or duration of PCU and/or positive urine drug screening (UDS) during pregnancy. A neonatal structural MRI was obtained to analyze volumes. Analyses among cases highlight decreased bilateral cerebellum volume as the total number of positive UDS increases. Significant pairwise comparisons are present among only those with no positive UDS and those with 3 positive UDS throughout pregnancy when analyzing bilateral cerebellum volumes. Total positive UDS was associated with increased self-reported frequency of cannabis use and could serve as a proxy for heavier cannabis use. This suggests that there are differences in volumes between cases who are very light and very heavy users, but no significant differences overall between cases and controls. Significant relationships persist between both PCU and UDS analyses with volumes after covariate adjustments for maternal stress and depression, area deprivation index, income to needs ratio, total brain volume, and gestational age. These findings highlight the impaired structural integrity of the neonatal cerebellum and lateral orbitofrontal cortex due to PCU.

Fabiola Ramos

Research Experience Institution: Michigan State University

Research Mentors: Brooke Devries, Thu Duong, Duong Nguyen, Dr. Alexandra Yaw, Dr. Hanne Hoffmann

Project Title: Environmental and physiological changes impact suprachiasmatic nucleus function on female mice

Project Abstract: The suprachiasmatic nucleus (SCN) is a brain structure in the hypothalamus responsible for translating daylight information into the synchronization of physiological events to a 24h day. Disruptions to the day-night light cycle such as shiftwork are linked with increased reproductive deficits and reduced fertility. Studies have focused on understanding how the SCN in males adapts to environmental changes in light-dark cycles; however, how the female SCN adapts to such changes is

unknown. To understand this, we exposed female mice to rotating light shifts (RL), which advance and delay the 12h light-12h dark cycle for 6h every 4 days, designed to mimic lighting changes in shift workers. We found that RL reduced the percentage of females exhibiting estrous cycles, and further analysis revealed that ~50% of females are acyclic, while the other half exhibit estrous cycle lengths like controls. As vasoactive intestinal polypeptide (VIP) neurons are important for translating light cues into the timing of physiological processes, we hypothesize reduction of VIP expression and SCN tissue level circadian function in the RL acyclic females compared to both RL cyclic females and controls. To measure this, we conducted immunohistological staining to evaluate the levels VIP in control and RL females. To understand if RL alter SCN circadian timekeeping, we measured tissue level circadian rhythms in the SCN using a validated bioluminescent reporter mouse. The results from this work will help us understand the mechanisms by which RL disruption can reduce fertility, providing a foundation for potential treatments in the future.

Alexis Reed

Research Experience Institution: Drexel University

Research Mentor: Dr, Ramesh Raghupathi

Project Title: Astrocyte activation following closed head injury in neonate rats

Project Abstract: Traumatic brain injury (TBI) is a leading cause of long-term morbidity in children under the age of 4. Survivors exhibit deficits in learning and memory and develop problems in psychosocial behaviors as they age into adolescence and adulthood. The cellular basis for these functional deficits has been suggested to be neurodegeneration and axonal injury which occur within hours after the injury and are evident up to a month later. It is yet unclear if astrocyte activation is a consequence of or contributes to the reported degeneration of neurons. The present study used a well-established and clinically relevant model of closed head injury to test the hypothesis that TBI in the 11-day-old rat (neurologically equivalent in age to a child under the age of 4) resulted in activation of astrocytes in brain regions that have previously been reported to exhibit evidence of axonal injury (corpus callosum, cingulum) and neurodegeneration (cingulum and hippocampus). Brain-injured rats of both sexes were euthanized at 3, 7 and 14 days after injury along with uninsured age-matched control rats; brains were removed and prepared for immunohistochemical analyses using an antibody to the intermediate filament protein, glial fibrillation acidic protein (GFAP) which is enriched in astrocytes. Qualitative analysis of the intensity of staining of GFAP immunoreactivity revealed increased astrocyte reactivity in the hippocampus in 5 of 6 injured animals at 3 days which decreased to 33-50% at the later time points. Reactive astrocytes were evident in the cingulum and corpus callosum of only 1-2 brain-injured animals at each of the 3 time points tested. Our data suggest that astrocyte activation may not be an important contributor to or a meaningful consequence of axonal injury but may contribute to neurodegeneration in the hippocampus.

Joel Rejouis

Project Title: HD-tDCS in memory & memory awareness

Project Abstract: When people learn new information, they also subjectively assess whether they have learned that information. Individuals with Alzheimer's disease and schizophrenia have shown deficits in both memory and awareness of their memory. The goal of our research is to better understand the brain basis of these impairments, and to test whether memory and memory awareness can be improved with brain stimulation. Prior work using conventional 1x1 transcranial direct current stimulation (tDCS) over the frontal cortex in healthy young adults did not show any improvements in an associative encoding task or in judgments of learning. One potential explanation is that the low spatial resolution of conventional tDCS did not account for the specific roles of prefrontal sub-regions in memory and memory awareness. My current project uses high definition tDCS to test the roles of the anterior prefrontal cortex versus the dorsolateral prefrontal cortex in memory and memory awareness, and to see whether it can be improved with brain stimulation.

Wilma V. Richiez Mateo

Research Experience Institution: University of Puerto Rico-Medical Sciences

Research Mentors: Dr. Jennifer Barreto-Estrada

Project Title: BDNF expression in the mesolimbic reward system in the extinction of morphine place preference

Project Abstract: Opioid addiction is the leading cause of overdose in the United States, leading to 100,000 deaths in 2021 (CDC, 2021-22). Although addiction is not fully understood, studies suggest that aberrant learning patterns cause neuroplasticity changes in the corticomesolimbic dopaminergic system, resulting in the lack of extinction of drug-seeking. Previously, we showed that male rats that extinguished their morphine-induced conditioned place preference (CPP) exhibited a higher transcript of brain derived neurotrophic factor (BDNF) in the ventral striatum/nucleus accumbens (VS/NAc). Therefore, this research will 1) evaluate the correlation between BDNF transcript and BDNF protein expression, 2) determine BDNF expression in the amygdala (AMY) and the hippocampus (HPC), 3) compare morphine CPP between males and females, and 4) determine frequency of anxiety-induced withdrawal symptoms. Three behavioral phenotypes were identified: sham- extinction, extinction, and extinction-resistant. Results showed similar conditioning patterns between both sexes, however, thirteen percent of females extinguished their morphine CPP, compared to fifty percent of males. Withdrawal symptoms like rears and side-changes in males and females decreased in animals that received extinction training. However, females preliminary show less withdrawal symptoms. In males, BDNF expression in the HPC was significantly increased in the extinction group, while BDNF expression in AMY was increased in both extinction and extinction- resistant groups. BDNF in female rats will be determined. Overall, our data shows that although increased BDNF expression in the AMY might be

responsible for contextual learning during extinction training, the increased BDNF expression in the HPC plays a key role in the extinction of opioid seeking behavior.

Natalia Rincon

Research Experience Institution: University of Maryland School of Medicine

Research Mentors: Dr. David Martin, Angel Delgado; Dr. Donna Calu

Project Title: Investigating discriminative and conditioned stimulus modulation of cocaine seeking after conflict in sign- and goal-tracking rats

Project Abstract: Addiction is a chronic neuropsychological disorder characterized by a persistent and intense urge to use a substance, despite harmful consequences. Activity in specific brain regions foster strong maladaptive associations between drug use and environmental stimuli which can prompt future cravings and relapse behaviors. Conditioned stimuli (CS) are cues that gain association once paired with a reward, but not all CS are equivalent. For example, discriminative stimuli (DS) are cues that signal drug availability, whereas contingent stimuli are only present once the reward is taken. Previous research has demonstrated differences in sign tracking (ST) and goal tracking (GT) approach to Pavlovian food stimuli predict distinct vulnerabilities to reinstatement of cocaine seeking. The goal of this study is to investigate how DS and contingent stimuli differentially modulate reinstatement of drug seeking behaviors after negative consequences are imposed. The study also aims to examine whether ST and GT rats have preferences for which stimuli will trigger reinstatement after electric barrier-induced abstinence. Pavlovian lever autoshaping (PLA) was used to determine sign-, goal-, and intermediate tracking groups in male and female Sprague Dawley rats. The rats were trained to intermittently self-administer cocaine on a within-subject rotating schedule using contingent and DS+/DS- conditions. Drug seeking behaviors were extinguished by implementing an electric barrier of increasing intensity. The level of reinstatement to each condition (contingent and DS) was measured in the presence of reduced conflict. GT rats are expected to demonstrate heightened reinstatement to DS+, while ST rats are expected to show heightened reinstatement to contingent stimuli.

Shamauri Rivera

Research Experience Institution: New York University

Research Mentors: Dr. Diego Reiner, Dr. Philip Parnamets, Dr. Maya Zoe Rossignac-Milon

Project Title: The role of conversation in shared moral judgment: A neuropsychological perspective of shared reality theory and the alignment of moral evaluation

Project Abstract: Conversation is one way we can express our inner states to one another. Language allows us to share our personal perceptions of the world with those around us, and at times share the same inner states (e.g., beliefs, feelings, etc.) as others, building a sense of a shared reality. Yet our subjective realities are not always aligned. When it comes to questions of right or wrong, people may

hold different moral values or political views that prevent their realities from aligning. In this research we explore how linguistic aspects of conversation can elicit shared realities of moral scenarios. Specifically, we recruit strangers to have conversations over Zoom video calls and examine how these conversations shape their own private moral views and their sense of shared reality. We explore this through speech dynamics, vocal synchronicity, language content, perceived interpersonal coherence, evaluation change, and shared reality theory. We will further interpret these results in line with the emerging research in both social psychology and neuroscience. Implications to future research and societal application are discussed.

Angelys Rivera Hernández

Research Experience Institution: University of Puerto Rico-Medical Sciences

Research Mentor: Dr. Christian Bravo-Rivera

Research Co-Author: Juan Padilla

Project Title: Sex differences in reward approach/punishment avoidance conflict in mice

Project Abstract: Reward is often present in risky environments, requiring individuals to weigh the benefits of rewards against associated risks. Some individuals exhibit poor choices during risky reward opportunities and thus exhibit extreme avoidance or risky behaviors that can impair quality of life or endanger people. It is therefore necessary to characterize how neurons mediate reward approach and threat avoidance conflict. Here, we used a novel approach-avoidance conflict task to characterize differences in behavior and neuronal activity in mice. We adapted the platform-mediated avoidance conflict task (Bravo-Rivera et al 2021), such that water-deprived mice could nose-poke for a light-signaled water reward and avoid a tone-signaled (20 sec) foot-shock (0.2 mA, 2 sec co-terminating) by stepping onto a platform away from the reward port. Mice were trained in two different conflict contingencies; in low conflict, reward was available during safety periods and during the warning tone, whereas in high conflict, reward was available only during the warning tone. All mice learned to actively avoid the signaled shock in >90% of trials by the tenth day of low conflict training. Interestingly, females stepped on the platform earlier than males after tone onset and had a longer latency to leave the platform after tone offset in low conflict. Females also mounted the platform earlier than males after tone onset in high conflict. Males received more shocks than females and received more water reward than females by the end of high conflict training. Moreover, females exhibited more tone-induced freezing and exhibited more frequent darting than males. These results suggest that females exhibit more defensive behaviors at the expense of reward attainment compared to males, suggesting that conflict neural substrates are sexually dimorphic.

Yanilis Rodriguez

Research Experience Institution: Michigan State University

Research Mentor: Dr. Marcia N. Gordon

Project Title: Determining the effects of tau protein on the memory of novel odors

Project Abstract: Our main goal is to determine if tau has a significant impact on the memory. Our hypothesis is that tau protein is going to affect the memory of mice and will negatively impact the learning process. I will use the novel object recognition test (NOR) to compare the behavior of non-transgenic mice and with transgenic mice that over-express a tau protein mutation associated with frontotemporal dementia (PS19). The NOR test consists of evaluating the recognition memory of mice when they are exposed to a familiar object and a novel object. Mice have an innate preference for the new, for that reason, we expect that the non-transgenic mice will recognize the novel object and spend more time with it. On the contrary, we expect that transgenic mice will have impairments in memory, so will be unable to distinguish familiar and new objects. One problem with the NOR test is that mice are uninterested in the objects and spend little time interacting with them. I will develop a new memory test based on odor recognition. First, I will identify food-based smells that mice like equally. I will then adapt the NOR test using odors as cues more salient to the mice. I will compare the traditional NOR with the new odor recognition task to determine which test more accurately measures memory impairments. It is hypothesized that this new odor recognition task will provide superior identification of memory impairments and could be used to assess positive effects of potential treatments for Alzheimer's disease.

Jesús Rosario-Claudio

Research Experience Institution: Michigan State University

Research Mentor: Dr. Geoffroy Laumet

Project Title: Interleukin-10 signaling on sensory neurons regulates inflammation

Project Abstract: Inflammation is a beneficial process designed to suppress threats to the host organism. However, dysregulated inflammation is a central pathological process in diverse diseases including neurological and psychiatric diseases, stating the importance of understanding the mechanisms that regulate inflammation. One master regulator of inflammation is the anti-inflammatory molecule interleukin (IL)-10. The common view is that IL-10 regulates inflammation by signaling to its receptor (IL-10R1) on immune cells. We and others have demonstrated that sensory neurons also expressed IL-10R1, opening the possibility that IL-10 regulates inflammation by signaling to sensory neurons. Preclinical works have shown that some sensory neurons regulate joint, skin, lung, and gastrointestinal inflammation. Therefore, we hypothesize that IL-10 receptors on sensory neurons regulate inflammation. To test this, inflammation was induced in wild type and sensory neurons IL-10R1 knock out (KO) mice by intraperitoneal injection of lipopolysaccharide (LPS). The IL-10R1 KO mice

result from crossing AvilCre (Avil-positive cells are sensory neurons) with Il10raflox mice, therefore recombinase removed the gene Il10ra only on sensory neurons. Inflammation was assessed by expression of tumor necrosis factor (TNF) and IL-1 β by RT-qPCR in the brain, spinal cord, liver, and distal colon to compare the expression of cytokines in the central nervous system and the periphery and associated sickness behaviors. Our results indicate that inflammation was exaggerated by the lack of IL-10R1 on sensory neurons. The data reveals a novel neuroimmune mechanism involved in inflammation control and, suggests that targeting sensory neurons may help regulate inflammation locally and prevent systemic immunosuppression.

Caleb Ryce

Project Title: Polyglutamine (PolyQ)-related diseases

Project Abstract: Polyglutamine (PolyQ)-related diseases are caused by the abnormal expansion of a CAG trinucleotide repeat that are translated into an expanded polyQ stretch in the disease-causative protein, leading to behavioral and physical impairments. In addition, sensory perception has been recognized as a prodromal manifestation of multiple neurodegenerative diseases. Therefore, to further understand the relationship between aging and sensory perception, we investigated whether age-dependent protein aggregation in muscle cells affected behavioral response to different repellents. We found that the *C. elegans* model AM141 that expresses aggregation-prone polyQ repeats fused to YFP maintained aversive behavior toward repellents. This suggests that polyQ:YFP expression in muscles does not interfere with sensory perception.

Axelle Salazar

Research Experience Institution: University of Washington

Research Mentors: Jovana Navarrete, Dr. Sam Golden

Project Title: Using simple behavioral analysis (SimBA) to assess behavioral motifs following social stress

Project Abstract: Using simple behavioral analysis (SimBA) and Deep Lab Cut (DLC), we can create predictive behavior classifiers using pose estimation (PE) data obtained through DLC. PE is a computerized technique to track and predict the location of mice by training the video dataset with labeled frames using specific regions of interest (ROIs). With this, we can create machine-learning (ML) predictive classifiers of complex social behavior in SimBA. Social behaviors and interactions are difficult to manually track due to their rapid successions. To overcome this, I plan to use ML classification using our SimBA pipeline for behavioral classification allowing us to exceed human performance and increase throughput and consistency. I plan to create accurate classifiers for social behaviors that I will use to analyze the behavioral motifs of mice undergoing an operant social stress procedure. First, we train male and female C57BL/6J mice to self-administer (SA) their same sex cage mate. Experimental mice are then subjected to either physical stress for

males or witness stress for females. Following social stress, non-reinforced SA is used to assess social reward seeking. Next, social interaction (SI) tests are performed to document time spent approaching the familiar same-sex conspecific cage mates and the aggressive CD-1 mice. Using these frames, we trained the operant behavioral dataset to track the orientation of the mice. Next, we evaluate the dataset for a low error margin as observed by a continuous plateau of iteration loss. Although not complete, I expect to create behavioral classifiers for mice during social decision making in a social reward context following social stress inclusive of sex differences.

Taliana Salcedo

Research Experience Institution: University of a Puerto Rico-Medical Science Campus

Research Mentor: Dr. Demetrio Sierra Mercado

Project Title: Evaluating the effects of herbicide exposure on cellular activity in the amygdala

Project Abstract: Glyphosate is the active ingredient in several commercial herbicides. Recent reports suggest that glyphosate increases anxiety-like behaviors. However, few studies have evaluated the neurobehavioral effect of glyphosate on ethologically relevant behaviors such as grooming and rearing. Preliminary results from our group (González-Pedraza et al., SfN Abstracts, 2022) have shown that prolonged exposure to 2.0 mg/kg daily (dose established as safe the by Environmental Protection Agency) of glyphosate decreases grooming and rearing behavior in a familiar context. Hence, as part of this study, a subset of animals was used to evaluate cellular activity in subregions of the amygdala, a brain region involved in the expression of anxiety. For this, rats were sacrificed, and brain tissue was extracted. C-Fos immunohistochemistry was performed on brain slices containing central amygdala (CeA), lateral amygdala (LA), and basal amygdala (BA). Our preliminary results demonstrate that glyphosate decreases cellular activity in the lateral amygdala ($p=0.0303$) and shows a tendency to decrease cellular activity in the central amygdala ($p=0.1519$) and basal amygdala, ($p=0.0584$). The results of this study will allow us to elucidate the potential neurotoxic effects that glyphosate consumption may have on the brain, and how these effects could manifest as aberrant behaviors in rats. Future directions include evaluating these brain regions for neuronal death using TUNEL immunohistochemistry, as well as evaluating other brain regions such as the bed nucleus of the stria terminalis for cellular activity.

Samir Samadov

Research Experience Institution: SUNY Downstate Medical Center

Research Mentor: Dr. Mark Stewart

Project Title: Causes and effects contributing to sudden death in epilepsy and the rationale for prevention and intervention

Project Abstract: Sudden unexpected death in epilepsy (SUDEP) is the leading cause of mortality in

patients with refractory epilepsy, and as such has been a major research focus over the last 25 years. People with epilepsy have an increased risk of premature death, and their life expectancy may reduce by 2-10 yrs. In other cases, death occurs due to autonomic deregulation of cardio- respiratory pathways because of seizures. SUDEP has a reported incidence of 1 to 2 per 1000 patient years and represents the most common epilepsy-related cause of death. First aid guidance to prevent SUDEP, though, has not been previously published because the rarity of monitored cases has made the underlying mechanism difficult to define. This starkly contrasts with the first aid guidelines for sudden cardiac arrest that have been developed based on retrospective studies and expert consensus and the discussion of resuscitation challenges in various American Heart Association certificate courses. This research will involve work with animal models of seizures and obstructive apnea. In a rat model, urethane anesthetized animals are studied during periods of controlled airway occlusion to simulate laryngospasm-induced obstructive apnea. Dr. Mark Stewart and his colleagues planned experiments that will address the time course of brainstem failure following respiratory arrest. As we move on, we will make multiple measures of brainstem function to define the time window after respiratory arrest within which animals can be successfully resuscitated.

Koralee Santiago Rivera

Research Experience Institution: Michigan State University

Research Mentors: Rabail Khan, Raluca Bugescu, Dr. Gina Leininger

Project Title: Role of leptin receptor expressing neurotensin neurons in the lateral hypothalamic area on body weight

Project Abstract: Obesity is caused by excess food intake and reduced physical activity, behaviors that are modulated by heterogeneous neurons within the lateral hypothalamic area (LHA) of the brain. Interestingly, our lab has identified a large population of LHA neurons expressing the neuropeptide neurotensin (Nts, LHANts neurons), whose activation temporarily increases body weight due to water consumption, but later reduces feeding and increases moving that reduces weight. Since LHANts neurons are a molecularly and functionally heterogeneous population of cells it is possible that there could be subsets of LHANts neurons that mediate feeding restraint vs. drinking behavior. One such candidate are the LHANts neurons co-expressing the leptin receptor (LepRb), since LepRb is necessary for the anorectic response to leptin and proper body weight (LHANts+LepR neurons). Taken together, we hypothesize that selectively activating LHANts+LepRb neurons will reduce food intake and body weight without invoking the drinking observed with bulk LHANts neuronal activation. To test this, we will inject NtsFlpO: LepRCre mice in the LHA with AAVs to express dual-recombinase excitatory designer receptors exclusively activated by designer drugs (DREADDs) in LHANts+LepR neurons. Mice are analyzed in metabolic cages while treated with vehicle (control) or the DREADD ligand Clozapine-N-Oxide (to activate LHANts+LepR neurons on command), and we measure the effect on food and water intake, locomotor

activity and metabolism. This study will reveal if LHANts+LepR neurons selectively promote weight loss without invoking drinking. If true, approaches to augment this neural subset might suggest new cell targets to treat obesity.

Safa Sheik

Research Experience Institution: Vanderbilt University

Research Mentors: Dr. Lauren Bailes, Dr. Kathryn Humphreys

Project Title: Changes in cognitive processes across pregnancy

Project Abstract: Pregnancy is a time of rapid development for the fetus, but it is also a time of developmental change for the pregnant person. This study investigated how pregnancy was related to changes in three cognitive processes: cognitive flexibility, processing speed, and episodic memory. Teen pregnant people completed measures of cognitive functioning from the NIH Toolbox multiple times throughout pregnancy. Results indicated that participants improved in performance on the episodic memory and processing speed tasks throughout pregnancy and showed declines in performance in cognitive flexibility throughout pregnancy. One possible mechanism explaining declines in cognitive flexibility is the documented decrease in grey matter that occurs throughout pregnancy. Future research should explore the degree to which brain changes are related to changes in task performance throughout gestation.

Annabelle Tangen

Research Experience Institution: University of Colorado- Denver, University of Colorado Anschutz Medical Campus

Research Mentors: Dr. Daniel Denman, Juan Santiago-Moreno

Project Title: Targeting retinotopic alignment of neurons in the lateral geniculate nucleus and the primary visual cortex

Project Abstract: In the visual system, light hits the retina and is transduced into a neural signal that travels from the optic nerve to the lateral geniculate nucleus (LGN) of the thalamus, then to the primary visual cortex (V1) and onto higher visual areas (HVAs), where visual features are integrated. Receptive fields are areas of visual space in which individual neurons respond to. Neurons with receptive fields close together in visual space will be close together in the brain: this spatial relationship is referred to as retinotopy. Our project requires recording from neurons in both LGN and V1 with aligned receptive fields using Neuropixels probes. The goal of this project is to describe linear integration of features in visual space within the early visual system. Current stereotaxic methods for targeting retinotopy have limited accuracy due to anatomical and functional variation of the brain. Therefore, we aim to use imaging to map retinotopy before placing the probes into V1 and LGN. Three methods were used: Intrinsic Signal Imaging (ISI), genetically encoded calcium indicator GCaMP, and Wheat Germ Agglutinin (WGA)

injections. ISI and GCaMP were used to map visually responsive areas in V1. WGA injections were used to fluorescently label synaptically connected neurons from LGN to V1. Early experiments did not produce expected results with any method. However, successful use of imaging for retinotopic mapping at other institutions provides a guideline for how we can modify our experimental approach for more consistent retinotopic alignment during recordings.

Maria Tello Borja

Research Experience Institution: Washington University in St. Louis

Research Mentors: Dr. Ben Palanca, Dr. Mehdi Kafashan

Project Title: Correlating central positive complexes and depression: Sub study of CET-REM

Project Abstract: Depression is one of the most debilitating diseases worldwide. One potential treatment is electroconvulsive therapy (ECT) which induces generalized seizures which are thought to affect neural plasticity. Our lab identified central positive complexes (CPCs); a high amplitude wave forms specific to seizures induced by ECT. The relationship between CPCs and ECT efficacy remains unknown. Our lab gathered qualitative surveys and quantitative CPC duration on 15 patients undergoing ECT treatment over 7 weeks. Preliminary results indicate that the rate at which CPCs accumulate tends to be different for respondent and non-respondent patients, with the former having a higher concentration in early treatment sessions. Further analysis must be conducted to account for missing data.

Tyara Thompson

Research Experience Institution: Washington University in St. Louis

Research Mentors: Dr. Wambura Fobbs, Dr. Alexxai Kravitz

Project Title: 3-day exposure to a high fat diet reduces motivation to seek a less palatable food option and may be associated with lower dopamine activity

Project Abstract: Obesity is a rising epidemic in the United States affecting over one third (37.7%) of Americans. Individuals with obesity are at higher risk for developing a multitude of diseases, such as cardiovascular disease, stroke, and diabetes. While dieting is an effective way to lose weight and avoid developing obesity and its comorbidities; long-term diet adherence can be difficult to maintain. Two factors that likely prevent diet adherence are 1) the abundance of highly palatable, calorie dense food options in our modern food environment that are easy to obtain and overeat and 2) altered motivation that is associated with altered dopamine activity. We previously explored the impact of high fat diet exposure on ad libitum consumption of a standard chow diet and found that 3-day palatable diet exposure caused mice to decrease consumption of the less palatable chow. While the decreased chow consumption reflects decreased preference for the less- palatable diet, it is unclear if it also reflects decreased motivation to seek the less palatable diet. To test whether decreased motivation to seek chow accompanies decreased consumption, we used a home cage progressive ratio task and compared

a measure of motivation (highest number of nose pokes for chow pellets) before and after 3-day high fat diet exposure. Consistent with our prediction, we found that the number of nose pokes mice perform after palatable diet exposure was lower than the number of nose pokes performed before palatable diet exposure. Finally, we also used immunohistochemistry to assess whether the decreased motivation is accompanied by decreased dopamine cell activity (cfos protein expression in dopamine containing cells) but were not able to observe enough cfos to measure differences.

Iliana Todorovski

Research Experience Institution: Temple University

Research Mentors: Drs. Lisa A Briand, Ingrid Olson, Vishnu P Murty

Project Title: Sex differences in dose preference between socially isolated vs. group-housed C57 mice

Project Abstract: Adolescence is known to be a critical period for brain development. Social isolation and loneliness during this time can increase vulnerability to substance use disorder in adulthood. Previously, our lab has demonstrated that following adolescent social isolation (ASI) both male and female mice show an increase in cocaine seeking. During oxycodone self-administration, preliminary data suggests that following ASI female mice receive less infusions than their group-housed counterparts at some doses. We have hypothesized that there is a difference in dose preference between males and females. Furthermore, female mice may have an aversion towards oxycodone or need a lower concentration to feel its rewarding effects. In the current study we use conditioned place preference (CPP) to observe if there are differences in dose-response between socially isolated and group-housed C57 mice. If the ASI female mice spend more time on the saline- paired side of the CPP apparatus, then they would have developed a conditioned-place aversion (CPA). Two experiments were performed in the current study. In the first pilot, WT group-housed (GH) mice ran CPP on either 20mg/kg or 10mg/kg. In the second experiment, female C57s were either isolated or GH after weaning, then ran CPP on just 10mg/kg. Results show the development of CPA in female mice when administered 20mg/kg of drug, while CPP developed at 10mg/kg. Also, female mice prefer lower doses of oxycodone regardless of housing condition. We suspect sex differences in dose-response could be due to an increase in sensitivity to oxycodone. More data is needed to determine how ASI might be impacting oxycodone reward in male mice. Understanding potential sex differences in oxycodone taking after ASI could help further our understanding of interactions between stress and substance use disorder.

Citlalli Tomas Baltazar

Research Experience Institution: Temple University

Research Mentors: Drs. Andre Toussaint, Dana Zeid, Mathieu Wimmer

Project Title: Adolescent morphine exposure perturbs object recognition memory in female but not male rats

Project Abstract: Although the impacts of drug exposure on cognition and behavior within the lifespan of the individual are well studied, much less is known about how parental drug exposure can impact offspring. We previously found that first generation (F1) female offspring of male rats exposed to morphine exhibited impaired object recognition learning. Adolescent opioid exposure has been shown to impair adulthood learning in rodent and human models. These findings separately establish the roles of paternal and early-life opioid exposure in impairment of adulthood cognition; however, it is unknown whether these factors stunt novel object recognition (NOR) in the F1 generation. To model this exposure in rats whose fathers self-administered either morphine (morphine-sired F1) or saline (saline-sired F1), morphine was administered over 5 days to all tested F1 offspring during adolescence. F1 rats then underwent the NOR test in adulthood. All F1 males treated with morphine during adolescence showed typical object recognition memory. Whereas all adolescent morphine treated F1 females showed stunted object recognition memory. Comparison with data from a prior F1 NOR experiment, which found normal recognition memory in morphine- naïve saline-sired females, suggested that adolescent morphine exposure alone produces object recognition deficits like those induced by paternal morphine exposure in females. Future experiments will include a no-adolescent-morphine control as a solidified control. Our findings suggest female-specific sensitivity to morphine's effects on recognition learning, whether the exposure was indirect, through parental use, or direct, through adolescent administration. This points to potential overlap between mechanisms underlying impacts of intergenerational and developmental morphine exposure.

Alondra Torres

Research Experience Institution: University of Washington

Research Mentors: Dr. Garrett D. Stuber, Dr. Brandy Briones

Project Title: Characterizing outgroup aggression in male mice

Project Abstract: It is well-established that humans and mice require social interactions to maintain good mental health (Umberson & Montez, 2010, Breton et al., 2022); so, what motivates aggressive behaviors? Survival, fitness, territoriality, and likely heritability drive aggressive behaviors (Takahashi & Miczek, 2015). Whether a social conspecific is perceived as an ingroup, or outgroup member can also greatly influence one's social interactions. In our study, we investigate male outgroup aggression in a mouse resident-intruder assay and focus on the paraventricular thalamus (PVT), a brain region important for modulating arousal and responses to negative stimuli (Choi et al., 2019). Male adult C57BL/6 mice (7 weeks old) were pair-housed with a female adult mouse for a minimum of 3 weeks to increase aggressive behaviors through sexual experience (Yamaguchi, 2022). Each 6- minute trial was conducted under bright white light in the male B6's home cage and video recorded. Trials were run on day 1 and 5 where the B6 mice were introduced to either a novel "ingroup" (B6) or novel "outgroup" (albino B6) male (7 weeks old), order counterbalanced. When observing attacks, male mice displayed

increased signs of aggression bias towards the outgroup compared to the ingroup. The B6 mice also spent significantly more time investigating the outgroup albino mice. We hope that by interrogating the neurobiology of aggressive behavior we can provide human applications towards better understanding outgroup/ingroup bias.

Cristal M. Torres Rodriguez

Research Experience Institution: University of Puerto Rico-Medical Sciences

Research Mentor: Dr. Jennifer Barreto

Project Title: The effect of ANA-12, a TrkB antagonist, on DBS-induced extinction of morphine place preference

Project Abstract: Drug addiction is a neuropsychological disorder characterized by a persistent use of a substance despite its negative consequences. Drug misuse can lead to mental, emotional, physical, and behavioral problems. The CDC's National Center for Health Statistics provides an estimate of 107, 622 opioid overdose deaths in the United States during 2021. Deep brain stimulation (DBS) in the ventral striatum/nucleus accumbens (VS/NAc) has demonstrated that it can help decrease symptoms of addiction in treatment-refractory patients. Using preclinical models of addiction, we have previously shown that low frequency DBS (20 Hz, 1h/day) aimed to the VS/NAc, during extinction training, strengthened the extinction memory by reducing morphine place preference. Also, the expression of brain derived neurotrophic factor (BDNF) increases in the hippocampus of DBS-treated animals. Therefore, in this study we will determine whether antagonizing with Ana-12, a TrkB receptor antagonist, will affect morphine place preference in DBS-treated animals. After electrode implantation in the VS/NAc, animals will be morphine (5mg/kg) conditioned for 4 alternate days, followed by extinction training. Ana-12 (0.5 µg/kg) will be injected subcutaneously 20 min before the extinction trials. DBS will be delivered subsequently in a period of 1h. We hypothesized that when injected with Ana-12, animals will 1) increase the time spent in their drug paired side, and 2) will decrease BDNF expression in the hippocampus. This study will help understand the neurobiological pathways involved in opioid addiction. Supported by: MBRS-SCORE- 1SC2DA047809, NIGMS-RISE-R25GM061838 and NeuroID.

Isaac Toscano

Research Experience Institution: Washington University in St. Louis

Research Mentors: Dr. Rachel Hendrix, Dr. John Cirrito

Project Title: Orexin receptor antagonism in an Alzheimer's disease mouse model does not alter amyloid beta (Aβ) peptide production

Project Abstract: One of the signature biomarkers Alzheimer's diseases is accumulation of amyloid beta peptide (Aβ). The amyloid hypothesis suggests the accumulation of Aβ plaques are the primary cause of Alzheimer disease and responsible for launching the development of this disease. Our previous work

demonstrated that sleep deprivation prevents the decrease of A β in the interstitial fluid, an important mechanism of reducing brain amyloid levels. The neuropeptide orexin increases wakefulness. Orexin receptor activation results in downstream phosphorylation of ERK, which can also increase α -secretase enzymatic activity and prevent the formation of A β . However, a clear pathway between orexin receptor signaling on A β peptide is unknown. Given orexin has been implicated as a key modulator of the sleep-wake cycle, mice were administered a single dosage of either suvorexant, an orexin receptor antagonist, or vehicle at the start of the wake period and mice were sacrificed 6 hours later at the peak of wake period. Suvorexant treatment did not alter levels of soluble amyloid or the activity of α - or β -secretases. Our results demonstrated significantly higher production of soluble A β -40 in female mice. Overall, only sex specific differences, rather than a single acute dose of the orexin receptor antagonist suvorexant, altered A β protein levels. Considering the chronic nature of Alzheimer's disease, future investigation of the sleep-wake cycle's potential influence on A β production will include a chronic dosing paradigm and an older set of mice. Disruptions and sleep-wake irregularities have been linked to increased A β and tau secretion, accumulation, and clearance complications. Continued research into the dynamics of the sleep-wake cycle on A β production may increase the understanding of A β and Alzheimer's disease pathology.

Zixian Wang

Research Experience Institution: Yale University

Research Mentor: Yao Xue

Project Title: Reward seeking during punishment risk in naloxone-precipitated fentanyl withdrawal

Project Abstract: The cornea is innervated by nerve endings of sensory neurons in the Trigeminal Ganglion (TG). Being the most sensitive tissue in our body, the cornea is associated with a wide range of ocular diseases such as dry eye disease (DED). Previous TG neuron physiology research identified its three branches: V1, V2, and V3. V1 is the ophthalmic branch that is innervated into the cornea. Nerve endings in the cornea have been identified to respond to a wide range of stimulation modalities such as chemical, pH, temperature, and mechanical. C-type low threshold mechanoreceptors (C-LTMRs) have been demonstrated to be associated with pain in the spinal cord. Our previous research demonstrated a type of C-LTMR branching in the cornea. In the current research, we developed an intact eyeball-trigeminal ganglion (TG) preparation to study the function and physiology of corneal brain signaling. Using Channelrhodopsin-2 transgenic mice and optogenetic stimulation, we record spike responses of neurons in the TG whole mount preparation. Then, we want further to study the whole intact eyeball-TG preparation's signal response.

Zuzanna Warchol

Research Experience Institution: Brooklyn College CUNY

Research Mentor: Paul Forlano

Project Title: Hormone regulation of dopamine signaling in the inner ear

Project Abstract: I have just begun working in the Forlano Lab which focuses on the neural and hormonal mechanisms underlying vocal acoustic communication using the plain fin midshipman fish as a model system. Advertisement calls, or “hums” are produced by the male fish to attract a mate. Females undergo a seasonal and hormone- driven improvement in hearing at the level of the inner ear that allows them to better detect the male hum. The Forlano lab recently demonstrated that dopamine neurons in the forebrain directly innervate the inner ear of female midshipman and contribute to the seasonal increase in auditory sensitivity by a release of inhibition. I plan to investigate how hormones seasonally regulate dopamine and its receptors in the inner ear using immunohistochemistry combined with confocal microscopy as well as quantitative gene expression techniques. Other possible studies include the interaction of dopamine with other auditory efferent neurons that express acetylcholine and calcitonin gene-related peptide. These studies will provide important insight on the regulation and function of dopamine in the inner ear of vertebrates in the context of social communication, for which little is known from studies in rodents.

Glen Miguel Angel Wickersham Garcia

Research Experience Institution: University of Puerto Rico-Río Piedras

Research Mentors: Dr. José Garcías-Arrarás

Project Title: Identification of neurotrophic factors and their putative receptors in the sea cucumber *H. glaberrima*

Project Abstract: The field of regenerative medicine and precision medicine aims to use growth factors, transcription factors, and other regulators to target specific cellular mechanism to regenerate tissues and organs. In humans, the ability to regenerate their nervous system is highly limited by many issues that are not yet fully understood. In contrast, other animal species have amazing regenerative capacities. *H. glaberrima*, like other echinoderms, has been shown to be a potential model to understand nervous system regeneration. One of the components we are exploring is the reinnervation of the regenerated intestinal tissue. Exploration of putative factors identified from regeneration transcriptomes has allowed the identification of several vertebrate orthologues. Using in silico methods, we were able to identify two different putative neurotrophic factors and at least one receptor from *H. glaberrima* transcriptomes. The encoded proteins, obtained from both neural and intestinal transcriptomes, show a high sequence similarity to members of the neurotrophin family and their receptors. Specific conserved regions for these genes were compared with other homologues from echinoderms and humans. Further studies of these genes could lead to the determination of their roles

in regenerating tissue and their possible importance in the regeneration of the organs.

Justin Woods

Research Experience Institution: Washington University in St. Louis

Research Mentors: Dr. Ream Al-Hasani, Marwa Mikati

Project Title: T cells alter anxiety-like behaviors during fentanyl withdrawal, in a sex dependent manner

Project Abstract: Long term use of opioids followed by a period of abstinence results in a state of withdrawal, a condition which includes heightened states of anxiety. Data has shown that withdrawal also results in compromised immune system functionality. While it may be understood that opioids interact with the immune system, the actual immunomodulatory effects of opioids are not well understood. Given that depressive and anxious states are also a common phenotype in opioid withdrawal, T-cells are a site of interest for the interaction of opioids with the immune system. Data from our lab demonstrates a decrease in the percentage of CD4+ and CD8+ T cells found in the cortex following withdrawal from fentanyl, a commonly abused and highly potent synthetic opioid. The aim of this study was to determine how the absence of these T-cell subtypes affect the etiology of withdrawal from fentanyl. Our procedure utilized an acute and chronic withdrawal paradigm followed by either a naloxone (opioid antagonist) injection to precipitate withdrawal or saline injection for spontaneous withdrawal. To measure anxiolytic effects of the treatment, mice were placed into the Open Field Test (OFT) behavioral assay. We compared T-cell receptor knockout mice (TCRKO) to wild type (C57Bl) mice to determine the role of T-cells in behavior. We saw an absence of anxiety-like behavior 24-hours post (spontaneous withdrawal) from fentanyl in TCRKO mice, as compared to our wild type controls that exhibit anxiogenic behavior during withdrawal. Interestingly, we saw anxiolytic behavior immediately following precipitated withdrawal in wildtype females but not in males. In TCRKO mice however, anxiolytic behavior following precipitated withdrawal was observed in males, but not in females. This data illustrates that naloxone drives a cross-over interaction between sex and genotype.

Solomon Wossene

Research Experience Institution: Fred Hutchinson Cancer Center

Research Mentors: German Rojas, Dr. Aakanksha Singhvi

Project Title: Experimenting with phosphatidylserine as an “eat me” signal in a Parkinson's disease model in *C. Elegans*

Project Abstract: Parkinson's disease (PD) is the second most common neurodegenerative disorder disrupting basic cognitive function. These disruptions become exacerbated over time leading to its most prominent effects in lack of motor function and memory loss. PD is caused by degenerating dopaminergic (DA) neurons in the substantia nigra. However, what is triggering neuron death is still widely unknown. We understand that non-neuronal cells like glia—which are responsible for the removal

of dead neurons—may be involved, however, how engulfment contributes to PD remains a mystery. The purpose of our research is to focus on identifying the “eat me” signal, which dying dopamine neurons put out. We hypothesize that phosphatidylserine (PS), a canonical “eat me” signal, becomes expressed on the outside of dying neurons, initiating the engulfment process. Using our model animal, *Caenorhabditis elegans*, we examined the death of 4 dopamine neurons. We test our hypothesis by creating a DNA plasmid containing a PS-binding protein, Annexin V, tagged with the fluorescent reporter, mScarlet. When injected into *C. elegans* worms, Annexin V will bind to PS and under fluorescent microscopy, we can visualize its localization. Worms expressing Annexin V are isolated and later progeny are examined. We then place them under 6- hydroxydopamine (6-OHDA) exposure, which will cause oxidative stress and kill the dopamine neurons. Placing exposed *C. elegans* under fluorescent imaging, we can tell where PS is being expressed in relation to dying CEP neurons. If Annexin V is localized around the dying CEP neurons, we can conclude that PS is an underlying mechanism for the engulfment process and dopamine neuron removal.

Hanan Yafai

Research Experience Institution: Weill Medical College of Cornell University

Research Mentor: Dr. Conor Liston

Project Title: Intermittent theta-burst stimulation in the pre-limbic cortex drives brain-wide circuit reorganization and rescues stress-induced spine elimination

Project Abstract: Loss of dendrites and spines in the prefrontal cortex (PFC) has been attributed to chronic stress. Prolonged stress exposures can significantly disrupt the signaling events and cause the neural circuit activity to be out of sync, leading to the loss of spines and a marked reduction in cognitive performance. We hypothesize that intermittent theta-burst stimulation (iTBS) of the prelimbic cortex (PL) will inhibit dendritic spine elimination in the PFC and thereafter result in changes to dendritic spine reconfiguration across the brain. Moreover, iTBS will increase mice's motivational behavior and decrease their defensiveness. To achieve this, we employed an optogenetics technique to stimulate the dorsal medial (PFC) neurons after 14 days of exposure to corticosterone or vehicle control, a common endocrine stress model. Following iTBS, a subset of mice was assessed in a behavioral assessment and were used for Golgi staining and imaging. Furthermore, the Golgi stain data suggests an increase in dendritic spine count after TMS treatment, in contrast to the mice that endured stress without TMS stimulation.

RECRUITMENT FAIR PARTICIPANTS

Booth	INSTITUTION & Program	Program Representative(s)
1	BAYLOR COLLEGE OF MEDICINE Neuroscience Graduate Program	Matthew Rasband, Ph.D. Professor and Vivian L. Smith Endowed Chair in Neuroscience, Director, Graduate Program in Neuroscience Jeff Yau, Ph.D. Associate Professor; Associate Program Director, Neuroscience Graduate Program
2	BRANDEIS UNIVERSITY Neuroscience Program	Susan Birren, Ph.D. Zalman Abraham Kekst Professor of Neuroscience; Director of Graduate Studies, Neuroscience Ph.D. Program Norelis Dias-Rodriguez Graduate Student; ENDURE Alum Leslie Griffith, M.D., Ph.D. Nancy Lurie Marks Professor of Neuroscience; Director of the Volen National Center for Complex Systems; Admissions Chair, Neuroscience Ph.D. Program
3	BROWN UNIVERSITY Neuroscience Graduate Programs	Kelvin De Leon Graduate Student; ENDURE Alum Meghan Gonsalves Graduate Student David Sheinberg, Ph.D. Professor of Neuroscience, Graduate Program Director for the Neuroscience Graduate Program
4	CARNEGIE MELLON UNIVERSITY Program in Systems Neuroscience and Program in Neural Computation	Aryn Gittis, Ph.D. Professor of Biological Sciences
5	DREXEL UNIVERSITY COLLEGE OF MEDICINE Graduate Program in Neuroscience	TBD

6	EMORY UNIVERSITY Graduate Program in Neuroscience	Jarildy Javier Graduate Student Yoland Smith, Ph.D. Professor of Neurology; Program Director
7	GEORGETOWN UNIVERSITY Interdisciplinary Program in Neuroscience	Maya Sapiurka, Ph.D. Associate Director of Administration
8	HARVARD MEDICAL SCHOOL Ph.D. Program in Neuroscience	John Assad, Ph.D. Professor of Neurobiology; Director of Ph.D. Program in Neuroscience Taralyn Tan, Ph.D. Lecturer on Neurobiology; Director of Education; Associate Director of Ph.D. Program in Neuroscience
9	ICAHN SCHOOL OF MEDICINE AT MOUNT SINAI Ph.D. in Neuroscience Program	Ashley Cunningham Graduate Student George Huntley, Ph.D. Professor of Neuroscience; Director of Neuroscience Ph.D. Program
10	JOHNS HOPKINS UNIVERSITY Neuroscience Training Program	Dionna Williams, Ph.D. Assistant Professor of Neuroscience
11	LOUISIANA STATE UNIVERSITY HEALTH SCIENCES CENTER NEW ORLEANS Biomedical Alcohol Research Training Program	Allison Augustus-Wallace, Ph.D. Associate Professor of Medicine & Office of Diversity and Community Engagement; Director of Undergraduate Academic Pathway Programs for Diversity and ENDURE
12	MASSACHUSETTS INSTITUTE OF TECHNOLOGY Brain and Cognitive Sciences Graduate Programs	Julianne Ormerod Graduate Program Administrator
13	NATIONAL INSTITUTE OF NEUROLOGICAL DISORDERS AND STROKE Graduate Programs at NINDS	Yvette Pittman, Ph.D. Director for the Office of Research Training and Career Development in the Division of Intramural Research
14	NORTHWESTERN UNIVERSITY Northwestern Interdepartmental Neuroscience Program	Jena Pitman-Leung, Ph.D. Assistant Program Director

15	OREGON HEALTH & SCIENCE UNIVERSITY Neuroscience Graduate Program	Omar Koita Graduate Student Jessica Parks Graduate Program Coordinator Kelly Monk, Ph.D. Director, Neuroscience Graduate Program; Co-Director and Senior Scientist of Vollum Institute
16	THE PENNSYLVANIA STATE UNIVERSITY Cross Disciplinary Neural Engineering Training Program	Bruce Gluckman, Ph.D. Professor of Engineering Science and Mechanics, Neurosurgery, and Biomedical Engineering; Director of Cross Disciplinary Neural Engineering Predoctoral Training Program
17	PRINCETON UNIVERSITY Princeton Neuroscience Institute	Edwin Clayton, Ph.D. Assistant Director Jorge Iravedra Graduate Student Catherine Peña, Ph.D. Assistant Professor of Neuroscience
18	STANFORD UNIVERSITY Neurosciences Interdepartmental Program	Justin Gardner, Ph.D. Associate Professor of Psychology; Co-Director of Neurosciences Interdepartmental Graduate Program Marrium Fatima Student Services Officer, Neurosciences Graduate Program
19	TEMPLE UNIVERSITY Neuroscience Graduate Training Programs	Lisa Briand, Ph.D. Associate Professor of Psychology; Director of Graduate Studies Andre Toussaint, Ph.D. Postdoctoral Fellow at Columbia University Zuckerman Institute; Temple Neuroscience Graduate Training Program Alum Carolina Caban Graduate Student
20	UNIVERSITY OF CALIFORNIA BERKELEY Neuroscience Ph.D. Program	Leleña Avila, Ph.D. Graduate Program Manager Dan Feldman, Ph.D. Professor of Neurobiology; T32 Director

		Michael Silver, Ph.D. Professor of Vision Science, Optometry, and Neuroscience; Director of Neuroscience Ph.D. Program
21	UNIVERSITY OF CALIFORNIA DAVIS Neuroscience Graduate Program	Kristine Donis-Cox, D.V.M. Academic Coordinator
22	UNIVERSITY OF CALIFORNIA SAN DIEGO Neuroscience Training Program	Brenda Bloodgood, Ph.D. Associate Professor of Neurobiology; Program Director of Neurosciences Graduate Program Jillybeth Burgado Graduate Student; ENDURE Alum
23	UNIVERSITY OF CALIFORNIA SAN FRANCISCO Neuroscience Ph.D. Program	Yanilka Soto-Muniz Graduate Student; ENDURE Alum
24	UNIVERSITY OF COLORADO ANSCHUTZ MEDICAL CAMPUS Neuroscience Graduate Program	Aleezah Balolia Graduate Student Diego Restrepo, Ph.D. Professor and Co-Director of Center for Neuroscience Jose Vigil Graduate Student
25	UNIVERSITY OF IOWA Neuroscience Graduate Program	Gabriela Gryc Graduate Student Yassine Filali Graduate Student
26	UNIVERSITY OF MARYLAND SCHOOL OF MEDICINE Program in Neuroscience	Daniela Franco Graduate Student Jennifer McFarland, Ph.D. Academic Services Specialist
27	UNIVERSITY OF MICHIGAN Neuroscience Graduate Program	Carol Elias, Ph.D. Professor of Molecular & Integrative Physiology, Obstetrics & Gynecology Audrey Seasholtz, Ph.D. Professor of Biological Chemistry; Program Advisor
28	UNIVERSITY OF PENNSYLVANIA Penn Neuroscience Graduate Group	Mariel Featherstone Coordinator of Penn Neuroscience Graduate Group

29	UNIVERSITY OF PITTSBURGH Center for Neuroscience	Silas Buck Graduate Student Nick Chehade Graduate Student Sydney Lamerand Graduate Student Robert Turner, Ph.D. Professor of Neurobiology
30	UNIVERSITY OF TEXAS HEALTH SCIENCE CENTER AT SAN ANTONIO Neuroscience Graduate Program	Dan Lodge, Ph.D. Professor of Pharmacology; Assistant Program Director David Morilak, Ph.D. Professor of Pharmacology; Director of the Center for Biomedical Neuroscience; Graduate Program Director
31	UNIVERSITY OF UTAH Neuroscience Ph.D. Program	Erin Bigus Graduate Student Megan Williams, Ph.D. Associate Professor of Neurobiology; Neuroscience Program Director
32	UNIVERSITY OF WASHINGTON Graduate Program in Neuroscience	Horacio de la Iglesia, Ph.D. Professor of Biology; Graduate Program Co- Director
33	VANDERBILT UNIVERSITY Neuroscience Graduate Program	Dr. Erin Calipari, Ph.D. Assistant Professor of Pharmacology Michelle Piazza Graduate Student
34	WAKE FOREST UNIVERSITY SCHOOL OF MEDICINE Neuroscience Program	Carol Milligan, Ph.D. Professor of Neurobiology and Anatomy; Program Director
35	YALE UNIVERSITY Interdepartmental Neuroscience Program	Jensine Coudriet Graduate Student April Pruitt Graduate Student Lester Rodriguez Graduate Student Elizabeth Woo Graduate Student

GRADUATE PROGRAM DESCRIPTIONS

BAYLOR COLLEGE OF MEDICINE

Neuroscience Graduate Program | <https://www.bcm.edu/education/graduate-school-of-biomedical-sciences/programs/neuroscience>

Program Description: The goal of our program is to provide an interdisciplinary training program that prepares students to be future leaders in neuroscience. Our program spans a diverse range of research areas in modern neuroscience from molecular and cellular to systems, cognitive, computational, and theoretical. The program includes over 75 faculty from 10 departments at Baylor College of Medicine with research interests in basic, translational, and clinical neurosciences. The Neuroscience Graduate Program has a rigorous and broad core curriculum that is supplemented with elective courses in more specialized areas to prepare students for the diverse research topics they pursue. The core curriculum builds competency in both practical and theoretical aspects of neuroscience, including modern laboratory techniques, genetics, cell biology, developmental neuroscience, neurophysiology, neuroanatomy, systems and computational neuroscience, and neurological disease. The strength of our Neuroscience Graduate Program is reflected in the publication rates of our graduates (more than 4 publications per student with an average of 2 as first author) and the national recognition of our training faculty. Baylor College of Medicine is regularly ranked as one of the top institutions receiving neuroscience funding from the National Institutes of Health.

For more information, email Wanda Kubeczka, Program Administrator (wandaw@bcm.edu)

Application deadline: Applications for Fall 2023 enrollment are due by January 1, 2023. Applications received by December 1, 2022, will be considered for early review, and are strongly encouraged. Late applications will be considered on a space-available basis.

Application fee waivers: There is no application fee! Candidates may apply electronically for free on the Graduate School home page (APPLY FOR FREE!) by selecting the option "Neuroscience" in the field, "Program to which you are applying."

GRE: GRE NOT required. GRE scores are optional for those applying to the Neuroscience or Quantitative & Computational Biosciences programs.

Information regarding COVID-19: The Baylor College of Medicine Graduate School of Biomedical Sciences is aware of the severe challenges and impacts the COVID-19 pandemic has caused for students learning in higher education settings. BCM confirms its mission to foster diversity among its students, faculty, and staff. We encourage students with all backgrounds and a passion for science to apply.

BRANDEIS UNIVERSITY

Neuroscience Program | <https://www.brandeis.edu/neuroscience/>

Program Description: The human brain has roughly as many neurons as there are stars in our galaxy, making it an enormously complex adaptive system. Making sense of this complexity increasingly requires neuroscientists who are both broadly trained critical and creative thinkers, and who have extensive analytic and computational skills. The Interdepartmental Neuroscience graduate program at Brandeis comprises a comprehensive training program designed to give the next generation of outstanding neuroscientists the cognitive and technical skills they need to make important breakthroughs in understanding nervous system function and health. Our program is characterized by a diverse and highly collaborative set of internationally renowned faculty, with research programs that incorporate all the major subdisciplines of the field. Collaboration is part of the air we breathe: being a vibrant program embedded in a small and intimate research university naturally encourages interactions across model systems and at the interfaces between disciplines. During laboratory rotations students are encouraged to explore intellectual frameworks and acquire a range of skills, and throughout their Ph.D. will interact with and receive mentoring from a diverse group of faculty, as well as near-peer mentoring from a strong cohort of interdisciplinary graduate students and postdocs. Our trainees are highly successful in a range of pursuits after graduation, including academic and industrial science, science policy, and science communication.

For more information, email jtheriault@brandeis.edu.

Application deadline: December 1

Application fee waivers: Participants in ENDURE can use “ENDURE22” for an application fee waiver.

GRE: The GRE is not required.

BROWN UNIVERSITY

Neuroscience Graduate Programs | <https://www.brown.edu/academics/neuroscience/graduate/>

Program Description: Our Neuroscience Graduate Program strives to provide individualized, high-quality training to predoctoral students. Providing a diverse and inclusive environment are central to our goals. Students receive broad, multi-disciplinary training in neuroscience, spanning many levels of inquiry, from genes through cognition and computation. We emphasize concepts, methodologies, quantitative skills, and sophisticated analysis of the primary literature. Our curriculum includes core courses, seminars, and workshops for developing skills that are essential for successful, independent research careers in neuroscience. We foster an environment unconstrained by traditional discipline boundaries.

For more information, email nsgrp@brown.edu.

Application deadline: December 1, 2022

Application fee waivers: Fee waivers are available for U.S. citizens or permanent residents applying to NSGP who are members of SACNAS, MARC, BP-ENDURE, Leadership Alliance, RISE programs or

similar programs; under-represented groups or can demonstrate financial need.

GRE: The GRE is not required.

CARNEGIE MELLON UNIVERSITY

Neuroscience Institute Programs | <https://www.cmu.edu/ni/academics/index.html>

Program Description: The Program in Systems Neuroscience (PSN) trains students with backgrounds in biology and neuroscience disciplines in the growing field of quantitative systems neuroscience and also provides them the essential background in experimental neuroscience. The Program in Neural Computation (PNC) trains students with strong quantitative backgrounds in quantitative disciplines relevant to neuroscience and also to provide them the essential background in experimental neuroscience.

For more information, email: Melissa Stupka, mstupka@cnbc.cmu.edu.

Application deadline: December 1

Application fee waivers: None

GRE: The GRE is not required.

Information regarding COVID-19: Students, staff, and faculty are required to be vaccinated.

DREXEL UNIVERSITY COLLEGE OF MEDICINE

Graduate Program in Neuroscience | <https://drexel.edu/medicine/academics/graduate-school/neuroscience/>

Program Description: The Graduate Program in Neuroscience is a collaborative training community centered in the Drexel University College of Medicine. Our students come from around the country and the world and typically have undergraduate degrees in biology, biochemistry, neuroscience, psychology, or physiology. With a commitment to excellence, we prepare students for success in various careers across academia and industry. Our graduates are employed as faculty, policy advisors, federal government researchers and medical/scientific writers. Our graduate program offers a research-intensive training experience that emphasizes critical thinking, state-of-the-art techniques and communication. We offer both M.S. and Ph.D. degrees.

For more information, email rr79@drexel.edu.

Application deadlines: Dec 15 for Ph.D.; rolling until July 15 for M.S.

Application fee waivers: Waived on request to the program director. GRE: The GRE is not required.

Information regarding COVID-19: All incoming students need to show proof of vaccination. Current students, faculty, and staff are required to be vaccinated. COVID tests are offered on site. Classes are held in person with the option of remote synchronous sessions.

EMORY UNIVERSITY

Graduate Program in Neuroscience | http://www.biomed.emory.edu/PROGRAM_SITES/NS/

Program Description: The Graduate Program in Neuroscience at Emory University provides a broad interdisciplinary training in a wide spectrum of neurobiological issues spanning several basic and clinical neuroscience-related disciplines. A total of 101 Ph.D. students including 25% from under-represented minority groups, are currently enrolled in the Emory Graduate Neuroscience program. As a community, we recognize that students from underrepresented groups in the university bring new perspectives that enrich the program and enhance the educational experience of all students. Over 90% of trainees who completed their Ph.D. during the past ten years have successfully developed research-related careers. The attrition rate of the program has been below 10% for the past ten years. A total of 130 faculty spread across 22 university departments and centers are members of the Emory Graduate Neuroscience Program, which provides a broad range of training opportunities in various fields of neuroscience. Students in the program receive a broad curriculum of molecular, cellular and systems neuroscience courses in their first two years. A required hypothesis design and grant writing course helps students prepare their thesis proposal (with oral defense) in the form of a National Research Service Award (NRSA) predoctoral fellowship application. The Emory Neuroscience Program is currently ranked 4th in the nation for the total number of NRSA's. Training in quantitative literacy, scientific rigor and reproducibility has been integrated in these core courses. Trainees are also required to participate in 3 laboratory rotations before they pick their advisor (usually at the beginning of year 2). A wide variety of elective courses ranging from Basic Mechanisms of Neurological Diseases, Brain imaging, Computational Neuroscience and Neuropharmacology are available to advanced trainees. Finally, students actively participate in various seminar series and receive significant training in teaching, neuroethics and scholar integrity. For more information, email ysmit01@emory.edu.

Application deadline: December 1

Application fee waivers: Application fees can be waived for students historically underrepresented in the sciences.

GRE: The GRE is not required.

Information regarding COVID-19: The safety of Emory students and faculty is a top priority for the institution. Policies have been put in place to ensure that students can pursue their graduate training while following basic rules to ensure their safety and that of others (required mask, vaccination, regular COVID19 testing, etc.). For more details about Emory policies regarding COVID-19, see <https://www.emory.edu/forward/>.

GEORGETOWN UNIVERSITY

Interdisciplinary Program in Neuroscience | <https://neuroscience.georgetown.edu/>

Program Description: The Ph.D. in Interdisciplinary Program in Neuroscience (IPN) has existed since 1994. With faculty from more than 10 departments across Georgetown, the IPN program encourages interdisciplinary collaboration and approaches toward research. IPN is highly ranked in the National Research Council's rankings of U.S. graduate programs in Neuroscience.

IPN has ~50 Ph.D. students investigating topics ranging from glial activation, neuron signaling, and dendritic spine plasticity, to mechanisms of Parkinson's disease, Alzheimer's disease, and traumatic brain injury, to systems of face recognition, word reading, and interpretation of sounds. Our Ph.D. students actively participate in organizing our program and teaching courses, and they have an excellent record of publishing manuscripts and receiving grants. Georgetown University also offers a MS in Integrative Neuroscience, providing students with a comprehensive neuroscience education. Our faculty members are from various departments at Georgetown University and neighboring institutions. We have strong programs in neurodegeneration, examining molecular mechanisms of pathogenic processes, and cognitive neuroscience, investigating development, language, memory, social interactions, and impairments of these systems. Several specific training programs are available for students, including in neural injury and plasticity, language, and translational biomedical science. It is also possible for our students to apply for a concentration in cognitive science.

Our mission is to educate students to be excellent neuroscientists, lifelong learners, and responsible, active participants in the global scientific community. The success of our alumni in diverse scientific career paths gives us great pride and demonstrates their commitment to be stewards of the discipline of neuroscience while living generously in service to the community.

For more information, email ms4906@georgetown.edu.

Application deadline: December 1, 2022

Application fee waivers: Contact the Biomedical Graduate Education for information on fee waivers.

GRE: The GRE is not required.

Information regarding COVID-19: We are complying with all of [Georgetown's COVID-19 measures](#); this Fall semester, we are in-person and require masks in the classroom. We offer free COVID-19 testing and vaccines.

HARVARD MEDICAL SCHOOL

Program in Neuroscience (PiN) | <https://pinphd.hms.harvard.edu/>

Program Description: The Harvard Ph.D. Program in Neuroscience (PiN) is centered in the Harvard Medical School Department of Neurobiology, founded in 1966 as the first research department in the world to take an interdisciplinary systemic approach to studying the brain as an organ, and spans the neuroscience community across the University. The program provides mentoring and advising to

a close and supportive community of students who carry out Ph.D. research in laboratories on the Harvard Medical School Quadrangle (the Quad), in Harvard-affiliated hospitals, and at Harvard's Center for Brain Science under the Faculty of Arts & Sciences in Cambridge. PiN students come from a wide range of scientific, personal, and cultural backgrounds. More than 150 faculty members provide exciting and rigorous research training in all areas of neuroscience to our 120+ students, preparing them for careers across many sectors from academic research to science policy, biotech, pharmaceuticals, consulting, K-12 and community education, science writing and outreach, "big data," and other developing fields. We are dedicated to educating students so they develop as neuroscientists who will change science in the 21st century and beyond.

For more information about Harvard PiN, the application process, and recruitment events for 2022, visit <https://tinyurl.com/yda5mj9j>.

Application deadline: December 1, 2022

Application fee waivers: Waiver requests are built into the online application.

GRE: The GRE is not required.

Information regarding COVID-19: We do not expect COVID-19 to affect our admitted class size for fall 2023.

ICAHN SCHOOL OF MEDICINE AT MOUNT SINAI

Ph.D. in Neuroscience Program | <https://icahn.mssm.edu/education/phd/neuroscience> Program

Description: Mount Sinai's Neuroscience Ph.D. program provides multidisciplinary and highly collaborative research training in basic, translational, and clinical neuroscience. Ranked 2nd nationally in NIH funding, the Neuroscience department and Graduate program leverage partnerships with the School of Medicine, the Mount Sinai Hospital and Health System, and other Institutions to provide extraordinary diversity of scientific and clinical strengths ranging from structure/function analysis of individual synapses, to computational modeling of gene, protein and connectivity networks in healthy and diseased brains, to behavioral, electrophysiological and imaging studies of a variety of organisms, including humans. Graduate students participate in an integrated program of Core and advanced courses and includes a course with direct patient contact. Trainees in our program are fully supported financially, and benefit from numerous activities that enhance their research and training experience, including science theme-based Clubs, seminars, career development opportunities, teaching and peer-mentoring activities, an annual retreat, and other cohesion-building events.

For more information, email george.huntley@mssm.edu.

Application deadline: December 1

Application fee waivers: Fee waivers for veterans and applicants participating in underrepresented student educational programs (e.g., McNair Scholars, HEOP, etc.). Waiver for need-based financial hardship also eligible-contact admissions@mssm.edu.hardship.

GRE: The GRE is neither required nor accepted.

Information regarding COVID-19: We are planning for in-person admission events in Feb 2023 (for Fall, 2023 matriculation).

JOHNS HOPKINS UNIVERSITY SCHOOL OF MEDICINE

Neuroscience Training Program | <http://neuroscience.jhu.edu/graduate>

Program Description: The Department of Neuroscience is committed to providing a welcoming and nurturing environment for all students. Please visit our website for more information or email Hita Adwanikar, hita@jhu.edu.

Application deadline: December 1

Application fee waivers: Liberal application fee waiver policy – please see website for details.

GRE: The GRE is not required.

LOUISIANA STATE UNIVERSITY HEALTH SCIENCES CENTER NEW ORLEANS

Biomedical Alcohol Research Training Program |

https://www.medschool.lsuhscc.edu/physiology/biomedical_training_description.aspx

Program Description: The NIAAA-sponsored Biomedical Alcohol Research Training Program prepares graduate students seeking a Ph.D. degree and postdoctoral fellows interested in careers as independent scientists. We have accomplished faculty with extensive experience in mentoring aspiring scientists that have academic appointments across the LSU Health Sciences Center in New Orleans. Alcohol research opportunities that trainees are pursuing include but are not limited to the following: molecular and behavioral neuroscience of alcohol use disorder (AUD), pain, and stress-induced drinking; innate and acquired immune system function and dysfunction; HIV/AIDS (prevention, transmission, pathogenesis, progression, therapy); neuroendocrine mechanisms in the regulation of AUD-related neurobiology and pathophysiology; stem cell biology in infection and tissue repair; psychosocial determinants of health and epidemiology. Trainees also participate in didactic sessions designed to develop their knowledge base in the alcohol research field as well as their written and oral communication skills. The goal of the program is to provide mentorship and focused training so that young M.D. and Ph.D. scientists can become familiar with the biomedical problems related to excessive alcohol consumption and acquire the tools to perform high quality, competitive research. Successful applicants will work in a highly collaborative environment located within the heart of New Orleans and receive an NIH-level stipend.

For more information, email sedwa5@lsuhsc.edu.

Application deadline: Rolling deadlines

Application fee waivers: Please contact us for fee waiver.

GRE: The GRE is not required.

Information regarding COVID-19: We are following all CDC guidelines.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Brain and Cognitive Sciences Graduate Programs | <https://bcs.mit.edu/academic-program>

Program Description: The Department of Brain and Cognitive Sciences offers programs of study leading to the doctoral degree in neuroscience or cognitive science. Areas of research specialization include cellular and molecular neuroscience, systems neuroscience, computation, and cognitive science. The graduate programs are designed to prepare students to pursue careers in research, teaching, or industry.

The Ph.D. program is normally completed in approximately six years of full-time work, including summers. Formal coursework for the departmental program consists of six classes intended to prepare the student to pass the general examinations and do original thesis research.

NIH-funded Computationally-Enabled Integrative Neuroscience (CEIN) program for doctoral students reflects our commitment to train future leaders in neuroscience in multiple experimental methods and concepts of neuroscience (“integrative neuroscience”), and in the use of computation at multiple levels of analysis including experimental design, data analysis, computational modeling, and theorizing. With comprehensive training in integrative neuroscience and computation trainees will be well prepared to make fundamental discoveries about the brain and to advance our understanding of neurological and psychiatric disorders.

For academic program or student life questions, please contact: Sierra Vallin svallin@mit.edu; Julianne Ormerod jugale@mit.edu. For questions related to diversity, equity, inclusion and belonging, please contact: Farrah Belizare farrahb@mit.edu.

Financial Support: Financial assistance is provided to qualified applicants in the form of traineeships, research assistantships, teaching assistantships, and a limited number of fellowships, subject to availability of funds. Prospective students are encouraged to apply for individual fellowships such as those sponsored by the National Science Foundation and the National Defense Science and Engineering Graduate Fellowship Program to cover all or part of the cost of their education.

Application deadline: December 1

Application fee waivers: Fee waivers are available to all attendees upon request by emailing jugale@mit.edu.

GRE: The GRE is not required.

NATIONAL INSTITUTE OF NEUROLOGICAL DISORDERS AND STROKE

Graduate Programs at NINDS | <https://research.ninds.nih.gov/employment-training/training-programs-ninds/graduate-student-programs>

Program Description: Our graduate programs are designed to support Ph.D. students for a period of their research training in laboratories at the NIH Bethesda campus. Successful candidates will have an opportunity to conduct their doctoral thesis research in an NINDS intramural laboratory under the guidance and direction of an investigator who will serve as the trainee's mentor. The many graduate programs at NIH

are available to students who are enrolled in doctoral programs in the biomedical sciences in accredited U.S. universities. The NINDS research experience is an integral part of the graduate student's academic progress and will involve a close partnership between NIH and the candidate's academic institution. All NINDS predoctoral fellows are participants of the [NIH Graduate Partnership Program](#). Participants enjoy the academic environment of a university, the extensive research resources of the NIH, and the breadth and depth of the research programs of both the host university and the NIH Intramural Research Program. The goal is to create a different kind of graduate experience, one that focuses on training the next generation of scientific leaders by emphasizing communication and collaboration skills, integration of information, and interdisciplinary investigation. Graduate students come to the NIH in one of two ways: [Institutional Partnerships - the pathway for students wishing to enroll in a Ph.D. program](#) and [Individual Partnership - the pathway for students already enrolled in a Ph.D. program](#), and there are two graduate programs in the neurosciences at NIH: University College London-NIMH Joint Doctoral Training Program in Neuroscience and [Brown University-NIH Program](#).

For more information, email Dr. Yvette Pittman, dirtraining@ninds.nih.gov

Application deadline: Rolling deadlines for NIH individual partnerships, and December 1, 2022, for NIH institutional partnerships. Application fee waivers: N/A. GRE: The GRE is not required.

NORTHWESTERN UNIVERSITY

Northwestern Interdepartmental Neuroscience Program | <https://www.nuin.northwestern.edu/>

Program Description: Northwestern University offers world-class advanced training in neuroscience via its Interdepartmental Neuroscience (NUIN) Ph.D. program. NUIN is anchored in the Feinberg School of Medicine, Shirley Ryan Ability Lab and Ann & Robert H. Lurie Children's Hospital of Chicago on the university's Chicago campus and the Weinberg College of Arts and Sciences, McCormick School of Engineering and School of Communication on its Evanston campus. NUIN is a highly interdisciplinary and collaborative program with numerous and diverse foci of research excellence.

For more information, email NUIN@northwestern.edu.

NIH T32 Training Programs: The NUIN Ph.D. Programs hosts the following NIH Training Programs supporting predoctoral and postdoctoral trainees: Neuroscience of Human Cognition, Mechanisms of Aging and Dementia, Neurobiology of Information Storage, General Motor Control Mechanisms and Disease. For more information, email NUIN_T32s@northwestern.edu

Application deadline: December 1

Application fee waivers: The Graduate School (TGS) provides fee waivers on a first-come, first serve basis to eligible applicants who meet. For more information, visit

<https://www.tgs.northwestern.edu/admission/application-procedures/application-requirements/fee.html>.

GRE: The GRE is not required.

OREGON HEALTH & SCIENCE UNIVERSITY

Neuroscience Graduate Program | <https://www.ohsu.edu/school-of-medicine/neuroscience-graduate-program>

Program Description: Founded in 1992, the Neuroscience Graduate Program (NGP) at OHSU has 56 predoctoral students and more than 140 faculty in a broad range of subdisciplines. The program provides a strong foundation for students planning a career in academic or industry research, but we encourage students to explore the career path that matches their ambitions and expertise. The program is particularly strong in cellular neuroscience, biophysics of channels and transporters, glial biology, sensory systems, developmental neuroscience, and disease-oriented neuroscience research. Faculty members are located within research institutes at OHSU including the Vollum Institute, Oregon Hearing Research Center, Jungers Center, the Oregon National Primate Research Center (ONPRC), and the Oregon Institute for Occupational Health Sciences, as well as the basic and clinical departments in the OHSU School of Medicine.

For more information, email parksjes@ohsu.edu.

Application deadline: December 1

Application fee waivers: Application fees can be waived upon request and are available for attendees of ABRCMS, SACNAS, and summer programs.

GRE: The GRE is not required.

Additional information: We understand that COVID-19 has created significant and unique challenges for prospective students. Our admissions committee reaffirms its commitment to a holistic application review process. Most importantly, we will respect decisions regarding the adoption of Credit/No Credit and other grading options during the period of COVID-19 disruption, whether they are made by institutions or by individual students. Our goal remains to form an NGP cohort from a diversity of perspectives, backgrounds, and experiences that enrich the graduate educational experience. For more information on our philosophies related to equity and inclusion, please see: <https://www.ohsu.edu/school-of-medicine/neuroscience-graduate-program/racial-equity-statement> To learn more about the program, the application process, and what the committee is looking for in a good application, consider attending one of two Neuroscience Graduate Program Admissions Sessions.

THE PENNSYLVANIA STATE UNIVERSITY

Cross Disciplinary Neural Engineering (CDNE) Training Program | <https://cne.psu.edu/cdne-training-program/>

Program Description: The Penn State Center for Neural Engineering (CNE) has positioned itself at this boundary with faculty whose core expertise primarily falls in one realm – Materials and Devices; Theory and Computation; Brain Physiology; and Brain Human Health – and who recognize that with collaborations across the boundaries they can achieve together far more than they can on their own. The output of such work benefits not only from the deep knowledge and understanding each member brings

to collaborations, but also from the effort put forward by each to communicate and understand the science and technologies brought by the other. Functionally, the CNE was founded to enable such collaborations among faculty who would value and leverage such interactions, and to bridge neuroscience and brain health research efforts between the University Park and Hershey campuses. At the CNE, we invite bright and ambitious graduate students to join the Cross Disciplinary Neural Engineering (CDNE) training program funded by NIH. Through the program the graduate students will learn to work across the disciplinary boundaries of engineering, sciences, mathematics, and human brain health, with the ability to communicate and understand deeply the needs of their collaborators, and thereby able to produce lasting advances in both basic neurosciences and human brain health. For more information, email cdne@engr.psu.edu.

Application deadline: May 1. Students interested in coming to Penn State for graduate school with the aim of participating in the CDNE training program need to enroll through one of the CDNE participating departmental graduate programs.

GRE: The GRE is not required.

PRINCETON UNIVERSITY

Princeton Neuroscience Institute | <https://pni.princeton.edu/graduate-program/ph.d.-neuroscience>

Program Description: How do millions of individual neurons work together to give rise to behavior at the level of a whole organism? How do our brains work?

Training researchers to answer these fundamental, unanswered questions is the goal of the Princeton Neuroscience Institute graduate program. Students in this program learn to use the latest techniques and approaches in neuroscience and are trained how to think and how to develop new techniques and approaches. Creativity and originality in research are essential to cracking the puzzle of the brain. Ph.D. neuroscience students take lecture and laboratory courses; learn to read, understand, and present current scientific literature; develop and carry out substantial original research, and present their research at meetings and conferences, including the annual Neuroscience retreat each spring.

For more information, email ec12@princeton.edu.

Application deadline: November 21

Application fee waivers: Visit <https://gradschool.princeton.edu/admission/applying-princeton/deadlines-and-fees/application-fee-waivers>.

GRE: The GRE is not required.

STANFORD UNIVERSITY

Neurosciences Interdepartmental Program | <https://med.stanford.edu/neurogradprogram.html>

Program Description: The Stanford Neurosciences Interdepartmental Program (IDP) offers interdisciplinary training leading to a Ph.D. in Neuroscience. The primary goal of the program is to

train students to become leaders in neuroscience research, education and outreach. Graduates of the program will be innovators, investigators, and teachers whose programs and pursuits are founded on research. The signature feature of the Stanford Neurosciences IDP is the combination of outstanding faculty researchers and exceedingly bright, energetic students in a community that shares a firm and longstanding commitment to understanding the nervous system at all its levels of function.

Application deadline: November 29, 2022, at 11:59:59 pm (PST)

Application fee waivers: Applicants who need assistance with the application fee are encouraged to apply for a fee waiver. Preference is given to low-income, first-generation, and underrepresented minority students who are U.S. citizens or permanent residents. Applicants who are part of a group that the NIH considers to be in need of a special recruitment and retention plan to diversify the biomedical sciences workforce are invited to apply, as well as any additional applicants for whom the application fee would be a substantial burden. Applying to more than one fee waiver option will not increase your opportunity of receiving a fee waiver. International applicants applying to the Biosciences Ph.D. programs who need assistance with the application fee are eligible to apply for the School-Based fee waiver. For a complete list of fee waiver options and eligibility requirements, please visit the Graduate Admissions website

(<https://gradadmissions.stanford.edu/apply/application-fee>). Please note that fee waiver requests are required to be submitted 10 or 15 business days prior to the application deadline.

GRE: The GRE is not considered.

Information regarding COVID-19: In light of the current situation with the COVID-19 pandemic, Stanford reaffirms its commitment to perform individualized, holistic review of each applicant to its graduate and professional programs. We recognize that students may have faced significant challenges during the period of disruption caused by the pandemic, and we will take such individual circumstances into account during application review. Importantly, we will respect decisions regarding the adoption of Credit/No Credit and other grading options during this unprecedented period of COVID-19 disruption, whether they are made by institutions or by individual students. Our goal remains to form graduate student cohorts that are excellent and encompass a diversity of perspectives, backgrounds, and experiences that enrich the graduate educational experience.

TEMPLE UNIVERSITY

Neuroscience Graduate Training Programs | <http://www.temple.edu/neuroscience/>

Program Description: Temple scientists are at the forefront of research and teaching in the rapidly expanding world of neuroscience. We support an interdisciplinary approach to this exciting field of study, with our neuroscience programs spanning multiple Schools, Colleges, and research centers. The College of Liberal Arts Neuroscience Program offers psychology & neuroscience Ph.D. and MS programs with research labs studying both cognitive neuroscience using human

neuroimaging and behavioral neuroscience using animal models. Our students study neural basis of addiction, ADHD, age-related disorders, anxiety, depression, developmental disorders, memory, spatial learning and much more. The Neuroscience Cluster at the Lewis Katz School of Medicine is an educational working group, supporting Ph.D., M.D./Ph.D., and M.S. educational/research programs within Lewis Katz School of Medicine at Temple University's Biomedical Sciences Graduate Program. This cluster provides thematic courses, research opportunities, and educational activities related to neuroscience, bringing together faculty members from basic science and clinical departments, as well as research centers—Center for Substance Abuse Research, Shriners Hospitals Pediatric Research Center, and the Alzheimer's Center at Temple. The Neuroscience Cluster offers graduate students exposure to a number of areas of basic neuroscience research and education with the goal of translating basic research advances into treatments for neurological and neuropsychiatric disorders. Indeed, the breadth and depth of the faculty members encourages an interdisciplinary approach to neuroscience education and research.

Application deadline: December 1, 2022, for the College of Liberal Arts Neuroscience Program; February 15, 2023 for the Lewis Katz School of Medicine Biomedical Sciences Program with Neurosciences Concentration

GRE: The GRE is not required.

UNIVERSITY OF CALIFORNIA BERKELEY

Neuroscience Ph.D. Program | <http://neuroscience.berkeley.edu/phd-program/>

Program Description: The Berkeley Neuroscience Ph.D. Program offers intensive, integrated training in multiple areas of neuroscience research. The program includes 64 faculty members from many different campus departments, with expertise ranging from molecular and cellular neuroscience to systems and computational neuroscience to human cognitive neuroscience. Our community is proud of our creative graduate student and postdoctoral researchers, faculty and staff, and cutting-edge research and technology centers. Together, we harness Berkeley's world-class strengths to build new experimental, analytical, and theoretical approaches to probe brain function, development, aging, and disease. Our Neuroscience Ph.D. program provides a highly interdisciplinary training environment of coursework, research training, professional development, and mentoring, within a strong research program that produces fundamental advances in knowledge and novel techniques. Our program has 67 students. Graduates of the Neuroscience Ph.D. Program have been extremely successful in both academia and industry. Since awarding our first Ph.D. in 2005, a total of 130 students have graduated from the program. Our alumni currently hold academic faculty positions (about 25%), postdoctoral research positions (about 25%), and positions in industry, including neuroscience, biotechnology, and Silicon Valley companies (about 25%). We provide extensive professional training as part of the Ph.D. program. We strive to provide an inclusive and supportive training community for students with a wide variety of backgrounds.

For more information, email neuro-grad-program@berkeley.edu.

Application deadline: November 30

Application fee waivers: BP-ENDURE program; ABRCMS; AISES; Ciencia Puerto Rico; Meyerhoff Program; PREP; RISE; MARC, and more.

GRE: The GRE is not required.

Information regarding COVID-19: We will hold virtual interviews in late January and early February, and an in-person visit for accepted applicants in mid-March if the public health situation permits.

UNIVERSITY OF CALIFORNIA DAVIS

Neuroscience Graduate Program | <https://grad.neuroscience.ucdavis.edu/>

Program Description: The UC Davis Center for Neuroscience (CNS), home to the Neuroscience graduate program, is dedicated to understanding brain function in health and in illness. Our teams of internationally recognized scientists study areas ranging from cellular and molecular neurobiology, through systems and developmental neuroscience, to studies of human perception, attention, memory, language and the nature of consciousness. Their discoveries provide the raw material and building blocks that translate into advances in the clinic through close collaboration between bench scientists and physicians. In addition to discovery-driven research, CNS is home to three premier NIH T32 training programs for predoctoral researchers. The Neuroscience Graduate Program provides students with unparalleled opportunities for research at the cutting edge of neuroscience, offering a comprehensive program of courses and outstanding research opportunities leading to the Ph.D. degree. The group is composed of over 80 faculty members drawn from 20 departments, divisions, and sections, including the School of Medicine, the School of Veterinary Medicine, the College of Biological Sciences, the College of Agriculture and Environmental Sciences and the College of Letters and Sciences.

For more information about the Training Program in Basic Neuroscience, visit

<https://grad.neuroscience.ucdavis.edu/Basic-Neuro>. For more information about the Training Program in Learning, Memory and Plasticity (LaMP), visit <https://lamp-training.ucdavis.edu/>. For more information about the Training Program in Vision Sciences, visit <https://vision-training.ucdavis.edu/>.

Application deadline: December 1

Application fee waivers: Available to applicants affiliated with graduate prep programs (e.g., IMSD, MARC, RISE). For a full list, visit <https://grad.ucdavis.edu/admissions/admission-requirements/steps-applying>.

GRE: The GRE is not required.

Information regarding COVID-19: We strongly hope to offer in-person or hybrid interview visits this year, if the public health situation permits.

UNIVERSITY OF CALIFORNIA SAN DIEGO

Neuroscience Training Program | <https://neurograd.ucsd.edu/>

Program Description: The Neurosciences Graduate Program, at the University of California, San Diego, is an interdisciplinary, inter-institutional, student-centered, research training program leading to the only Neuroscience Ph.D. degree offered at UC San Diego. Our top-ranked program provides training to an extremely high-quality pool of graduate students who share the goal of becoming the next generation of neuroscience leaders at all societal levels. The program encompasses over 150 affiliated research faculty laboratories distributed across more than fifteen academic and clinical science departments at UC San Diego, the School of Medicine, [The Salk Institute](#), [The Scripps Research Institute](#), [V.A. Medical Center](#), [Scripps Institution of Oceanography \(SIO\)](#), and the Sanford Burnham Prebys Medical Discovery Institute. The program combines broad-based intellectual scholarship and training, with focused, cutting-edge research cultivating experimental design, quantitatively rigorous data analysis, problem solving, and communication skills, yielding a wide breadth of foundational understanding in the fundamental principles and practice of all neurosciences. Our program leads the way on campus for the recruitment and retention of diverse students. We guide the professional development of each student through intensive, personalized career advising, strong mentoring, and broad outreach and teaching opportunities. We provide unparalleled access to established world-leading research environments at all levels of discovery, exceptional young faculty, progressive curricula, and an outstanding record of placement for our graduates.

The collective efforts of our students, faculty and staff have carried our program to remarkable levels of achievement. If you share the goal of joining the next generation of innovative, productive, impactful neuroscience leaders, join us.

For more information, contact neurograd@ucsd.edu.

Application deadline: December 1, 2022

Application fee waivers: <https://grad.ucsd.edu/admissions/admission-faq/faq-application-fee.html#How-can-I-apply-for-a-waiver-of>

GRE: The GRE is not required.

Information regarding COVID-19: The Program follows UC San Diego campus policies <https://returntolearn.ucsd.edu/> On the Admissions application there is an optional COVID-19 question where applicants can add any COVID-19 related impacts that may have impacted them or their studies.

UNIVERSITY OF CALIFORNIA SAN FRANCISCO

Neuroscience Ph.D. Program | <https://neurograd.ucsf.edu/about-neuroscience-graduate-program>

Program Description: We utilize innovative cellular, computational, electrophysiological, genetic, imaging and molecular strategies to address outstanding problems in neuroscience. These

approaches are employed in an integrative manner to engage in research in all areas of neuroscience, including behavior, biophysics, cell biology, development, neural systems, and disorders of the nervous system. Our curriculum and the system of laboratory rotations expose students to different fields in neuroscience, enabling them to make an informed choice about their thesis research. The high quality of the research and the collaborative nature of the UCSF environment offer a unique opportunity in which to take advantage of the interdisciplinary nature of research at the frontier of modern neuroscience.

UCSF is committed to a diverse and inclusive graduate student population, which enhances the educational experience, the workplace, and the nature of scientific research. The program participates in a number of initiatives along these lines (SRTP, UCLEADS, Diversity Network Initiative, IMSD, Diversity and Allyship breakfasts, Brain Camp @UCSF) some that are program specific and some that are through the UCSF Office of Diversity and Outreach.

The UCSF Neuroscience Graduate Program is committed to improving diversity, equity, and inclusion in our admissions process. We recognize that privilege and personal circumstance affect access to information and support when applying to graduate school. We aim to help reduce the impact of these inequities on the admissions process by highlighting the existence of organizations, not affiliated with UCSF, that support applicants who otherwise do not have adequate access to mentors or support networks, such as Project SHORT. Organizations such as Project SHORT often have limited capacity and enrollment deadlines. Thus, applicants should plan ahead to give themselves the best chance at receiving the support they need. Please note that the use of such third-party mentoring services does not guarantee any particular admissions outcome.

For more information, email neurosciadmin@listsrv.ucsf.edu. Follow on Twitter [@UCSFNSGrad](https://twitter.com/UCSFNSGrad).

Application deadline: November 15

Application fee waivers: U.S. citizens and permanent residents may request a fee waiver in the Application Fee section of the application. Details on eligibility can be found [here](#). Applicants should initiate this process as soon as possible to ensure a fee waiver can be processed prior to the application deadline. We also provide fee waivers to trainees in approved post-bac training programs.

GRE: The Neuroscience Program no longer accepts GRE scores.

Information regarding COVID-19: We anticipate in person interviews in February 2023, but this is subject to COVID related restrictions which will be determined closer to that time.

UNIVERSITY OF COLORADO ANSCHUTZ MEDICAL CAMPUS

Neuroscience Graduate Program | <https://www.cuanschutz.edu/graduate-programs/neuroscience>

Program Description: Welcome to the Neuroscience Graduate Program (NSP) at the University of Colorado, Anschutz Medical Campus. Through rigorous training and mentoring the program aims at graduating neuroscientists who are critical thinkers and poised for success in any endeavor of their

choosing. Below are some of the features of the program:

- A world-class research environment from an extremely collaborative group of faculty. A large fraction of our faculty members have joint grants. Often these collaborations are initiated by students.
- A convivial and close-knit group of students who are actively involved in all aspects of program governance.
- More than half of NSP students are successful in obtaining individual fellowships from NIH or NSF.
- Rigorous coursework spanning cellular, systems, developmental, and quantitative neuroscience. Students also take a grant writing course, biostatistics, and a number of electives in neuroscience.
- A robust seminar series.
- A student-run journal club held in the presence of senior authors of the papers being discussed.
- A fun annual Program Retreat in the Colorado Rocky Mountains.
- A creative and vibrant outreach program. NSP students collaborate with local schools, colleges, and the Denver Museum of Nature and Science. Our students write blogs for the Museum. In general, we have fun with Neuroscience.
- Student-led summer research training program for under-represented students from local colleges.

For more information, email jared.vazquez@cuanschutz.edu.

Application deadline: December 1, 2022

Application fee waivers: After the Graduate Recruitment and Networking Fair, you will receive an email message from CU Anschutz where you can acknowledge the waiver. Or you can contact Program Administrator Jared Vazquez, jared.vazquez@cuanschutz.edu.

GRE: The GRE is not required.

UNIVERSITY OF IOWA

Neuroscience Graduate Program | <https://neuroscience.grad.uiowa.edu/>

Program Description: The University of Iowa has a long tradition as a leading center for study of the nervous system and behavior, and for the training of graduate students in this area. The curriculum is designed to provide a multidisciplinary foundation in the conceptual and methodological approaches to study of the nervous system, emphasizing original, independent student research. The Neuroscience Program at the University of Iowa offers broad research opportunities with particular strength in areas including flexible curriculum, teaching experience, full financial support, and state-of-the-art facilities.

For more information, email grad-neuroscience@uiowa.edu.

Application deadline: December 1 for best consideration; January 1 for final deadline

Application fee waivers: Visit <https://grad.admissions.uiowa.edu/finances/graduate-fee-waiver>. GRE: The GRE is not required.

Information regarding COVID-19: Visit <https://coronavirus.uiowa.edu/>.

UNIVERSITY OF MARYLAND SCHOOL OF MEDICINE

Program in Neuroscience | <http://lifesciences.umaryland.edu/Neuroscience/>

Program Description: The Graduate Program in Neuroscience trains outstanding graduate students to earn a Ph.D. degree in Neuroscience. We are an interdisciplinary program spanning several Departments in the Schools of Medicine, Dentistry, and Nursing. Our alumni fill top-tier academic, government, and industry positions worldwide.

Our curriculum emphasizes critical thinking and experimental design through an innovative applied learning model. This coursework is completed within the first 16 months, after which students perform full-time dissertation research in a laboratory chosen from 2-3 laboratory rotations completed in the first year.

Our students are fully supported by the Graduate Program in Life Sciences for their first 15 months and subsequently fully supported by their dissertation research lab. Additional support for students is provided by a T32 NIH Neuroscience Training Grant and the Meyerhoff Scholars Program that supports underrepresented students. Our students (66 in total) boast an impressive 50% success rate for securing additional individual NIH funding through F31 National Research Service Awards. Our >100 principal investigators teach and mentor students in their NIH-funded laboratories. Our research interests include, but are not limited to, addiction, synaptic and neural circuit form and function, neurodevelopment, neuroendocrinology, pain, schizophrenia, depression, neurodegeneration, stroke recovery, TBI, and cognition.

Our Location is in the heart of historic downtown Baltimore, offering all the amenities of city life while maintaining easy access to the Appalachians and the irresistible appeal of the Chesapeake Bay.

For more information, email Jenn McFarland, jmcfarland@som.umaryland.edu.

Application deadline: December 1

Application fee waivers: Please contact jmcfarland@som.umaryland.edu for fee waiver information.

GRE: The GRE is not required.

UNIVERSITY OF MICHIGAN

Neuroscience Graduate Program | <http://neuroscience.med.umich.edu/>

Program Description: The University of Michigan Neuroscience Graduate Program (NGP) is a collegial, diverse, and interactive group of students and faculty that work across the breadth of the neuroscience field. The NGP focuses on excellence in education and training of our 88 Ph.D.

students. Our program encompasses the complete spectrum of neuroscience training and research, incorporating the full range of multidisciplinary techniques in an integrative and supportive environment. The NGP program captures the excitement and interdisciplinary collaboration intrinsic to the field of neuroscience by drawing on the expertise of over 160 faculty members from more than 29 departments. The NGP at the University of Michigan was constituted in 1971, making this the longest-standing neuroscience graduate program in the United States. The Neuroscience graduate students form a cohesive group that promotes interactions among the faculty, making the NGP the nexus of the neuroscience community on campus. Graduates receive a Ph.D. in Neuroscience that provides tremendous flexibility in choosing one's career path. There are more than 250 alumni of our Program, and these graduates work in many different areas including academic research/medicine, biotechnology, biomedical and pharmaceutical research and development, and science communication and policy. Our goal is to facilitate training of the future leaders in the field of neuroscience and to develop students that compete successfully in the scientific marketplace. For more information, email neuroscience.program@umich.edu.

For more information, email neuroscience.program@umich.edu.

Application deadline: December 1

Application fee waivers: For information about fee waivers through the Rackham Graduate School at the University of Michigan visit <https://rackham.umich.edu/admissions/applying/application-fee-and-waivers/>. Please contact neuroscience.program@umich.edu about additional opportunities for fee waivers.

GRE: The GRE is not required.

Information regarding COVID-19: The University of Michigan currently requires COVID-19 vaccination of all University of Michigan students, faculty, and staff unless you have an approved exemption. There is not currently a policy for extensions to the application deadline due to COVID-19. We encourage any applicant who is running into a delay due to COVID to be in contact with us at neuroscience.program@umich.edu.

UNIVERSITY OF PENNSYLVANIA

Penn Neuroscience Graduate Group | <https://www.med.upenn.edu/ngg/>

Program Description: The NGG is a collaborative and interdisciplinary Ph.D. program that provides training for careers in neuroscience research, teaching, and more. Our training program is designed to provide a strong foundation of neuroscientific knowledge while at the same time taking into account each student's strengths, needs, and career goals.

We place a high value on activities that promote professional development, cohesiveness within our program, and outreach to the outside community. Many of these activities are organized by our students through the [Graduate-Led Initiatives and Activities \(GLIA\)](#) Committee.

We also emphasize both diversity and inclusion. We embrace differences in background, age, color,

disability, ethnicity, family or marital status, gender identity or expression, language, national origin, ability, political affiliation, race, religion, sexual orientation, socio-economic status, veteran status, and other characteristics that help define who we are. We continue to work to promote a sense of inclusion for everyone in the program via mentoring, workshops, and other mechanisms that focus on open communication.

The NGG is closely affiliated with the Mahoney Institute for Neurosciences ([MINS](#)) and the Penn Medicine Translational Neuroscience Center ([PTNC](#)).

For more information, contact Mariel Featherstone, mariel.featherstone@penntranslationalmedicine.upenn.edu.

Application deadline: December 1, 2022

Application fee waivers: Please contact bgs@penntranslationalmedicine.upenn.edu to request a fee waiver.

GRE: The GRE is not required.

Information regarding COVID-19: <https://coronavirus.upenn.edu/>

UNIVERSITY OF PITTSBURGH

Center for Neuroscience | <https://www.cnup.pitt.edu/about>

Program Description: The CNUP Graduate Training Program is designed to accomplish several objectives:

- To develop competence in conducting laboratory research including planning, executing, reporting, and defending an original piece of research relevant to the study of neuroscience.
- To develop general competence in neuroscience and specific expertise in one or more areas of neuroscience such as behavioral/systems/cognitive, cell and molecular, development/plasticity/repair, and neurobiology of disease.
- To develop a general professional competence in oral and written expression, necessary for a career in science and/or teaching.
- To develop fundamental skills in scientific reasoning required to redefine research questions and devise innovative multidisciplinary strategies as a means for adapting to the continually evolving landscape of neuroscience and neuroscience research.

In formulating the graduate training program, the faculty has been guided by several principles. First, the program aids each student in the development of an individualized training program based on the student's background and interests. Second, research experience forms the core of each student's training. Thus, students are expected to begin research immediately upon entering the program. Third, students are typically able to complete the program in approximately five years.

Fourth, the progress that a student makes in the program is considered primarily in terms of the student's performance as an investigator: designing, conducting, and evaluating research, both their own and that of others.

For more information, email Rob Turner, rturner@pitt.edu.

Application deadline: December 1

Application fee waivers: In an effort to reduce financial barriers to attending graduate school, the Kenneth P. Dietrich Graduate School of Arts and Sciences offers application fee waivers. Please note that fee waivers are approved on a case-by-case basis and not all fee waiver requests will be granted.

GRE: The GRE is not required.

Information regarding COVID-19: Our visits and interviews will be virtual rather than in-person. Other than that, the admissions process is the same as previous years. Currently, many of the graduate classes are currently being offered virtually and most research activities are occurring in-person with social distancing and mask-wearing. The CNUP graduate program is doing everything possible to be flexible and supportive during this time.

UNIVERSITY OF TEXAS HEALTH SCIENCE CENTER AT SAN ANTONIO

Neuroscience Graduate Program | <https://www.uthscsa.edu/academics/biomedical-sciences/programs/integrated/neuroscience>

Program Description: The Neuroscience Program at UTHSCSA provides didactic and laboratory training in a range of subject areas and levels of analysis from molecular, cellular, and neurochemical to systems, behavioral, and clinical, all focused on the regulation and function of the nervous system. Drawing on the expertise of approximately 50 faculty from 5 basic science departments and 8 affiliated departments or divisions within the medical and dental schools, we emphasize a flexible program of study and research tailored to the individual needs and interests of all students in Neuroscience. In addition to track-specific fundamental and elective courses, we offer a rich diversity of research rotation opportunities, upper-level elective courses, and a broad selection of faculty dedicated to mentoring graduate students in dissertation research. In addition, Neuroscience students will enjoy a number of enrichment opportunities, including journal clubs, seminars, an annual retreat, participation in brain awareness week activities, and several social functions. Students are encouraged to present their research in a variety of settings, to attend professional meetings locally, nationally, and even internationally, and to publish their work in peer-reviewed professional journals. A highly interactive community of faculty, post-doctoral fellows, laboratory staff and fellow students all contribute to a challenging, stimulating and supportive environment within which our students can develop into successful neuroscientists. The UTHSCSA and the Neuroscience Program are committed to excellence through diversity in education and employment, and all qualified students are encouraged to apply. We are dedicated to providing an environment where success in our program will be determined solely by the ability to succeed as a neuroscientist!

For more information, email David Morilak, morilak@uthscsa.edu.

Application deadline: Priority deadline for applications is Jan 1 – later applications will be accepted but availability of potential interview dates may be limited.

Application fee waivers: NO APPLICATION FEE.

GRE: The GRE is not required.

Information regarding COVID-19: We follow all recommended safety and mitigation protocols.

Vaccination is available on campus for students, universal masking and social distancing practices are in place.

UNIVERSITY OF UTAH

Neuroscience Ph.D. Program | <http://neuroscience.med.utah.edu/>

Program Description: The primary goal of the Neuroscience Program at the University of Utah is to develop well-rounded scientists who will become the next generation of leaders in our society. Our program offers rigorous training through a combination of coursework, research training, mentoring, and professional development. More than 80 program faculty from 26 participating basic and clinical departments provide broad expertise from molecular and cellular neuroscience to systems and cognitive neuroscience. Students receive hands-on training and mentorship within a world-class research environment, collegial and collaborative mentorship and a vibrant research community. Our mentors provide guidance across a range of research and career options. 98% of our graduates have obtained careers in science related positions in academia or industry. Incoming students begin formal training through a series of wet lab bootcamps in molecular neurobiology and electrophysiology, and through a series of three 8-week rotations within specific Neuroscience Program labs. Students also receive formal training through core and elective course work in order to ensure each student has a practical foundation in neurodevelopment, cell and molecular neurobiology, systems neuroscience, anatomy and statistics. Through electives students are able to hone their knowledge across disciplines such as computational neuroscience, genomics, advanced molecular biology, electrophysiology, and pharmacology. In addition to coursework, student's knowledge is further established through 1st year capstone exam, 2nd year qualifying exam and final year thesis defense. Students also have the unique opportunity to develop professionally through a variety of student leadership roles, such as organizing the Annual Snowbird Neuroscience Symposium and Neuroscience Program Speaker Series. Our Neuroscience Program is committed to promoting diversity and inclusion within our program and our broader community. Our faculty and students lead and participate in programs including the University of Utah - Rising Stars in Neuroscience Symposium, Women in Neuroscience, ABRCMs and SACNAS meetings and Brain Awareness Week.

For more information, email jim.heids@neuro.utah.edu.

Application deadline: December 1

Application fee waivers: Application fee waivers available to all.

GRE: The GRE is not required.

UNIVERSITY OF WASHINGTON

Graduate Program in Neuroscience | <https://depts.washington.edu/neurogrd/>

Program Description: The goal of the Graduate Program in Neuroscience is to produce the best neuroscientists possible. The breadth of our faculty allows us to provide interdisciplinary training drawing from a variety of topics, techniques, and perspectives, including neuroanatomy, biochemistry, molecular biology, physiology, biophysics, pharmacology, in vivo brain imaging (e.g., fMRI, M-EEG), computational modeling and behavior. A graduate of our program will be well versed in the neurosciences, prepared to conduct independent research, and equipped to pursue a variety of career paths. 170+ faculty members of the University of Washington provide outstanding graduate training in all areas of modern neuroscience. Our students perform cutting-edge research, at a leading research university, in one of the most famously livable American cities.

For more information, email neurogrd@uw.edu.

Application deadline: November 28, 2022 by 5 p.m. PT

Application fee waivers: Fee waivers available for McNair Scholars and for financial needs. Make sure to submit application one week early to ensure fee waiver has enough time to clear.

GRE: The GRE is not required.

Information regarding COVID-19: Interviews will be online with potential accepted student days to follow.

VANDERBILT UNIVERSITY

Neuroscience Graduate Program | <https://medschool.vanderbilt.edu/brain-institute/>

Program Description: Vanderbilt's Neuroscience Graduate Program prepares each student to make significant contributions in neuroscience and fosters development from trainee to independent research scientist and educator. This is achieved by combining sound training in the fundamentals of neural science with more specialized training that focuses on the integration of this knowledge base into a study of nervous system function and disease. Students have the option of a curriculum and research program that emphasizes either cellular & molecular or cognitive & systems neuroscience. The training, which combines rigorous course work with opportunities for state-of-the-art research, is designed to prepare graduates for a future in which neuroscientists must be able to make the transition from molecules and cells to neural systems and behavior.

For more information, contact roz.johnson@vanderbilt.edu.

Application deadline: December 1, 2022

Application fee waivers: Visit <https://gradschool.vanderbilt.edu/admissions/application/index.php>.

GRE: GRE scores not required.

Information regarding COVID-19: For the University's COVID-19 policy, visit <https://www.vanderbilt.edu/coronavirus/>.

WAKE FOREST UNIVERSITY SCHOOL OF MEDICINE

Neuroscience Program | <https://school.wakehealth.edu/education-and-training/graduate-programs/graduate-programs-in-neuroscience>

Program Description: Neuroscience Ph.D. training has been a component of graduate student training at Wake Forest University for approximately 30 years. The field of neuroscience is at the cutting edge of scientific developments and the Wake Forest Neuroscience Program believes its long-term returns from student training will have positive consequences for our community and nation. Neurological disorders associated with trauma, an aging population, drug addiction, and neurodevelopmental and psychiatric disorders represent urgent local and national needs.

The goal of our Neuroscience training program is to provide students with

- a) A fundamental understanding of all levels of nervous system organization, from genetics, molecular, and cellular to systems and behavioral,
- b) A skill set that includes extensive training in experimental design and interpretation, statistical and quantitative methodology,
- c) Hands-on experience in state-of-the-art laboratories that carry out meaningful and significant research in all areas of modern neuroscience, and
- d) A “Bench to bedside” appreciation of how basic neuroscience research supports and translates into treatments for neurobehavioral pathologies.

Our program’s success is facilitated by a robust advisory structure for student guidance and mentorship, and an outstanding collaborative environment maintained by our diverse faculty. While preparation for a research career in the Neurosciences is the central focus of our program, we also ensure students gain experience in teaching and outreach, and exposure to an increasing number of opportunities in industry in which scientists with the training we provide go on to be extraordinarily successful. These additional experiences not only expand students’ competencies and enhance their opportunities for highly impactful careers; they encourage them to maintain broad interests and open them to collaborative pursuits, including pursuing translational/clinical directions such as Clinical, Population and Translational Science, Health Disparities in Neuroscience Disorders, collaborations with industry (Ph.D./M.B.A. program), commercialization and tech transfer elective courses, or industry internships.

For more information, email milligan@wakehealth.edu.

Application deadline: December 6

Application fee waivers: We offer fee waivers for ENDURE participants. See also our website, <https://school.wakehealth.edu/Education-and-Training/Graduate-Programs/How-to-Apply>.

GRE: The GRE is not required.

YALE UNIVERSITY

Interdepartmental Neuroscience Program | <http://medicine.yale.edu/inp/>

Program Description: The interdisciplinary research activities of Yale neuroscience faculty are central to Yale's Graduate Neuroscience Program. This unique, broad-based training program is best described as a "department without walls," whose primary purpose is providing students with maximum diversity and depth in the most important areas of neuroscience research. The training program draws on the knowledge and expertise of 130+ faculty members, representing at least 20 departments, ranging from Neuroscience, Psychiatry and Pharmacology to Computer Science. Faculty work together as a cohesive and collaborative unit whose aim is to foster in graduate students an appreciation of and familiarity with the breadth of neuroscience and to create an environment in which students are encouraged to study problems from several perspectives. The Neuroscience Track students graduate with both specialized knowledge and a broad understanding of the discipline. Students engage with a recently revised core curriculum, designed to ensure a comprehensive understanding of modern neuroscience. Students complete at least two laboratory rotations in different areas of neuroscience. A course in Statistics and Data Analysis is required as well as two additional electives. Admission to candidacy requires passing a qualifying examination and a dissertation prospectus (NIH NRSA grant format). These requirements, in addition to journal clubs, Student Research Talks, a seminar series and an annual one-day research retreat expose students to the multi-disciplinary nature of the field in a highly interactive environment.

Successful candidates come from undergraduate institutions such as Cornell, University of Wisconsin, Johns Hopkins, NYU, University of Oregon, Kenyon College, Rutgers, UCSD, Howard, UMBC and many more. They have range and depth of research experience and strong academic preparation. Clear communication and demonstrated leadership ability are valued skills. Average time to degree is 5.4 years and our graduates go on to careers in academia, industry (consulting, biotech and pharma), and other related fields.

For more information, email carol.russo@yale.edu.

Application deadline: December 1

Application fee waivers: For detailed information, visit

<https://gsas.yale.edu/admissions/phdmasters-application-process/application-fees-fee-waivers>.

Information regarding COVID-19: Our recruitment activities this year will be a hybrid model.

Interviews in January will be conducted virtually. We will have an in-person recruitment weekend for candidates offered admission in February when admittees will meet with their faculty of interest and get to know our graduate students in small groups.

GRE: The GRE is not required.

SFN ACTIVITIES FOR ENDURE STUDENTS

<p>SATURDAY</p> <p>Nov 12</p>	<p>7:00 – 11:30 am 12th Annual NIH Blueprint ENDURE Meeting Location: Marriott Marquis San Diego, San Diego Ballroom (Sections A, B, & C)</p> <p>7:00 – 7:30 am Registration 7:30 – 8:00 am Introductions & Welcome 8:00 – 9:30 am Featured Speakers & Panelists 9:30 – 11:30 am Graduate Program Recruitment and Networking Fair</p> <p>12:00 – 2:00 pm Graduate School Fair Location: SDCC Sails Pavilion Description: Prospective graduate students can meet face-to-face with student advisors, program faculty, and graduate school representatives from dozens of national and international institutions at the Graduate School Fair.</p> <p>12:00 – 2:00 pm “Can You Write Me a Strong Letter of Recommendation?": Soliciting, Writing, and Evaluating Recommendations (Professional Development Workshop) Panelists: H.G. McFarlane, Kenyon College; R. Gonzales, University of Texas Austin; D. Robinson, University of North Carolina Chapel Hill (Moderator) Location: SDCC 31ABC Description: Letters of recommendation are critical parts of applications to graduate school, postdocs, faculty positions, and career grants. What makes a letter of recommendation effective? This workshop will consider the elements of a strong letter for each career stage and is aimed both at scientists soliciting letters from mentors, scientists writing letters for others, and scientists evaluating letters for admission, fellowship, and hiring decisions.</p> <p>3:00 – 5:00 pm Beyond the Rainbow: Empowering LGBTQ+ Trainees and Colleagues Toward Successful and Authentic Careers (Professional Development Workshop) Panelists: T.A. Roepke, State University of New Jersey; M. Guthman, Princeton; A. Mosly, Brown University; S. Ramakrishnan, University of Puget Sound; K.S. Singleton, Georgetown University; J. Honeycutt, Bowdoin College (Moderator) Location: SDCC 31ABC Description: The LGBTQ+ community is more visible than ever, with increased presence across our field and within the Society for Neuroscience. The personal and professional experiences of LGBTQ+ trainees pose a unique mentoring challenge within the laboratory and classroom. Here, we aim to bring attention to the challenges LGBTQ+ neuroscientists face and discuss best practices for mentoring an intersectional community of neuroscientists from varied socioeconomic, racial/ethnic, religious, etc. backgrounds.</p>
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<p>SATURDAY</p> <p>Nov 12</p>	<p>5:15 – 6:30 pm Presidential Special Lecture: How Do You Feel? The Molecules That Sense Touch</p> <p>Speakers: A. Patapoutian, Howard Hughes Medical Institute/Scripps Res. Institute; G. Turrigiano, Brandeis University (Moderator)</p> <p>Location: SDCC Ballroom 20</p> <p>Description: Our sense of touch holds the capacity to connect us with the world and warn us of harm and hurt. These senses depend on mechanotransduction, the conversion of pressure into chemical signals. Dr. Patapoutian will discuss work from his laboratory that identified and characterized PIEZO1 and PIEZO2, pressure-activated cation channels. Genetic studies established that PIEZO2 is the principal mechanical transducer for touch, proprioception, baroreception, and bladder stretch, and that PIEZO1 mediates many mechanosensory roles throughout the body.</p> <p>6:30 – 8:30 pm Diversity Fellows Poster Session</p> <p>Location: SDCC Halls B-H</p> <p>Description: Join a special poster session and networking event featuring participants of the Neuroscience Scholars Program (NSP), ENDURE, D-SPAN, and SPINES. The NSP is a two-year training program open to underrepresented graduate students and postdoctoral researchers.</p> <p>6:30 – 8:30 pm FUN Poster Session</p> <p>Location: SDCC Halls B-H</p> <p>Description: The FUN poster session will feature presenters from the Faculty for Undergraduate Neuroscience (FUN). FUN is an international organization supporting neuroscience research and education at the undergraduate level.</p> <p>7:30 – 9:30 pm Career Development Topics: A Networking Event</p> <p>Location: SDCC Halls B-H</p> <p>Description: Experienced neuroscientists will answer attendee questions on a wide range of topics at this informal, roundtable event. Topics include work-life balance, securing grants, setting up a lab, choosing a postdoctoral position, and careers outside of academia, among others. Nearly 30 tables will be offered at the event. During the event, attendees will have the opportunity to rotate among the tables that are of interest to them. Neuroscientists at all career stages are encouraged to attend.</p>
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SUNDAY

Nov 13

[Plan Your Itinerary for Neuroscience 2022](#)

Morning and Afternoon Scientific Program Events

• Featured lectures • Symposia • Special lectures • Minisymposia

8:00 – 12:00 pm Undergraduate Neuroscience Programs

Location: SDCC Halls B-H

Description: 15 poster presentations featuring undergraduate neuroscience programs.

9:00 – 11:00 am Why and How to Account for Sex and Gender in Brain and Behavioral Research (Professional Development Workshop)

Panelists: M.M. McCarthy, University of Maryland; A. Beery, UC Berkeley, E.G. Jacobs, UC Santa Barbara; L. Eliot, Rosalind Franklin University of Medicine & Science (Moderator)

Location: SDCC 31ABC

Description: Long overlooked in research, sex and gender are now recognized as key variables that impact all levels of neurobehavioral analysis. But many neuroscientists do not understand the difference between sex and gender, the complexity of each variable, or how to best analyze their influence on data. Given recent NIH mandates to equally include males and females in both animal and human studies, this session will deepen neuroscientists' understanding of why and how to most rigorously do this.

12:00 – 2:00 pm Graduate School Fair

Location: SDCC Sails Pavilion

Description: Prospective graduate students can meet face-to-face with student advisors, program faculty, and graduate school representatives from dozens of national and international institutions at the Graduate School Fair.

12:00 – 2:00 pm Integrating Life and Work in Neuroscience: Strategies for Success (Professional Development Workshop)

Panelists: D.A. Bangasser, Temple University; S. Russo, Mount Sinai School of Medicine; J.R. Turner, University of Kentucky; Y. Kozorovitskiy, Northwestern University; K.Y. Salas-Ramirez; G.E. Hodes, Virginia Tech (Moderator)

Location: SDCC 31ABC

Description: Participants from diverse backgrounds/family structures provide perspectives on strategies they use to navigate their lives/careers before and during the pandemic. Intended for trainees to mid-career researchers, we will discuss how we cope with issues experienced by many scientists. Topics include having/raising children, the “two body problem”, caring for aging parents from afar, travel, choosing between soft or hard money positions, and how to prioritize professional and personal success.

SUNDAY

Nov 13

**5:15 – 6:30 pm Presidential Special Lecture: The Basis of Sleep:
What We Are Learning From Small Animal Models**

Speakers: A. Sehgal, Howard Hughes Medical Institute/University of Pennsylvania;
G. Turrigiano, Brandeis University (Moderator)

Location: SDCC Ballroom 20

Description: Studies of sleep have now expanded to diverse species, including invertebrates with very simple nervous systems. Mechanistic analyses in such models have identified molecules that regulate sleep as well as cellular functions served by sleep. Basic principles underlying sleep appear to be conserved across organisms, underscoring the relevance of an evolutionary approach. The lecture will focus largely on advances made in *Drosophila* and the extent to which these inform our understanding of sleep.

MONDAY

Nov 14

[Plan Your Itinerary for Neuroscience 2022](#)

Morning and Afternoon Scientific Program Events

• Featured lectures • Symposia • Special lectures • Minisymposia

9:00 – 11:00 am Culturally Validated Pedagogy and Inclusion in Neuroscience (Professional Development Workshop)

Panelists: A.R. Zavala, California State University; N. Gordon, Marquette University; K. D'Anna Hernandez, Marquette University (Moderator)

Location: SDCC 31ABC

Description: The proposed session will focus on culturally validating pedagogy in Neuroscience courses to increase inclusion and retention and graduation rates in students from underrepresented and marginalized backgrounds. Together we will workshop with instructors how to validate their assignments and syllabi in Neuroscience courses as well as mentorship programs to include culturally relevant content and practices.

12:00 – 2:00 pm Graduate School Fair

Location: SDCC Sails Pavilion

Description: Prospective graduate students can meet face-to-face with student advisors, program faculty, and graduate school representatives from dozens of national and international institutions at the Graduate School Fair.

12:00 – 2:00 pm Brain Data Science: A World of New Neuroscience Career Opportunities (Professional Development Workshop)

Panelists: A.S. Rokem, University of Washington; S.E. de Vries, Allen Institute for Brain Science; E. Thiels, National Science Foundation; D. Yatsenko, Baylor College of Medicine; M. Abrams, INCF; W. Grisham, UCLA (Moderator)

Location: SDCC 31ABC

Description: Open collaborative brain research is generating huge piles of data that must be managed and analyzed. The explosion of brain big data, machine learning and AI has created a demand for “data competent” neuroscientists working in multiple sectors who will shape the future of neuroscience. But how do we get into brain data science? This workshop features individuals with a variety of positions in brain data science to present how they do what they do, how they got there, and where they are going.

Monday
Nov 14

**3:00 – 5:00 pm Neuroscience Departments and Programs
Workshop: From Design to Analysis: Improving Research Skills
for an Evolving Field (Professional Development Workshop)**

Panelists: M.E. Harrington, Smith College; A.L. Juavinett, Cold Spring Harbor Laboratory; E. Batty, MA; R. Calin-Jageman, Dominican University (Moderator)
Location: SDCC 31ABC

Description: Every neuroscientist has a list of “methodological resolutions” — things we’ve been meaning to learn or teach about more but haven’t had time to delve in to. This workshop will help you get started with four common “gaps” in your training or your graduate training program: Experimental design, math, coding, and statistical thinking. For each, we’ll explain why these gaps matter, highlight what’s especially useful to know, and provide resources to help you and your trainees get up to speed.

**5:15 – 6:30 pm Presidential Special Lecture: The Neurobiology
of Escaping From Predators**

Speakers: T. Branco, UCL Sainsbury Wellcome Center; G. Turrigiano, Brandeis University (Moderator)
Location: SDCC Ballroom 20

Description: Running away from threat is an ethological behavior that is universal across the animal kingdom. At one end, escape can be a simple reflexive action implemented across a few synaptic connections. At the other, evading predators might rely on coordinating sensory, motor and memory systems to rapidly navigate to a known safe place. This lecture will discuss the components of escape at the behavior level and highlight how cellular and neural circuit mechanisms work together to implement the underlying computations.

7:00 – 8:00pm Diversity in Neuroscience Reception

Location: Marriott Marquis, Marina EF
Description: A special reception in honor of the SfN diversity programs, and the NINDS-funded R25 Neuroscience Scholars Program.

Tuesday

Nov 15

[Plan Your Itinerary for Neuroscience 2022](#)

Morning and Afternoon Scientific Program Events

• Featured lectures • Symposia • Special lectures • Minisymposia

10:00 – 12:00 pm Celebration of Women in Neuroscience Event

Panelists: M. Jones-London, NIH NINDS; Y. Goda, Riken; A.A. Disney, Duke University; J. Becker, University of Michigan (Moderator)

Location: SDCC 11

Description: The annual Celebration of Women in Neuroscience Event honors female leaders in neuroscience. During this year's event, Jill Becker, Ph.D., will moderate a panel discussion focused on the impacts of COVID-19 and how neuroscientists navigated this challenge and found success. The panel will feature Anita Disney, Ph.D.; Yukiko Goda, Ph.D.; and Michelle Jones-London, Ph.D.

12:00 – 2:00 pm Graduate School Fair

Location: SDCC Sails Pavilion

Description: Prospective graduate students can meet face-to-face with student advisors, program faculty, and graduate school representatives from dozens of national and international institutions at the Graduate School Fair.

5:15 – 6:30 pm Presidential Special Lecture: The Macaque Face Patch System: A Turtle's Underbelly for the Brain

Speakers: D. Tsao, UC Berkeley; G. Turrigiano, Brandeis University (Moderator)

Location: SDCC Ballroom 20

Description: Research on the macaque face patch system has given us a remarkable window into the processes underlying visual object perception. This lecture will discuss the anatomy, coding principles, and behavioral role of this system. It will also tell how face patches, together with modern deep networks, reveal a unifying principle for inferotemporal organization in terms of 'object space'. Finally, the lecture will discuss work exploiting feedback in this system to test if the brain encodes a generative model of reality.

6:30 – 9:00 pm The Neural Exposome and Why it's Important to You!

Speaker: D. Jett, NIH NINDS (Organizer)

Location: Marriott Marquis – Marina Ballroom G

Description: Many neurological disorders have complex etiologies that include noninheritable factors, collectively called the neural exposome. The National Institute of Neurological Disorders and Stroke has developed a new office with goals to advance our understanding of the multiple causes of neurological illness. This satellite event will feature a panel of experts to discuss neural exposomic research, its impact on health inequities, and why this is important to you.

WEDNESDAY

Nov 16

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Morning and Afternoon Scientific Program Events

• Featured lectures • Symposia • Special lectures • Minisymposia

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MAKING THE MOST OUT OF SCIENTIFIC CONFERENCES

A Guide for Undergraduates to the Society for Neuroscience Annual Meeting

José-Edwards DS, et al. J Undergrad Neurosci Educ. 2017 Jun 15;15(2): E10-E12. PMID: 28690443; PMCID: PMC5480849.

ABSTRACT: The annual meeting of the Society for Neuroscience (SfN) attracts over 30,000 attendees, including many of the world's most accomplished researchers. Although it can be intimidating to attend a conference of this scale, there are many rewards for undergraduates. Based on surveys of young neuroscientists, we provide planning strategies to ensure attendees maximize their exposure and retention of the breadth and depth offered by this large conference format without becoming overwhelmed.



Figure 1. How to survive a large, international conference. Key advice for undergraduates before, during and after the SfN meeting. This two-month plan for the 5-day meeting aims to maximize a student's ability to meet and learn from colleagues.

For the full article, visit <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5480849/>. Please also see the WUSTL Guide to SfN for Undergraduates: <https://endure.wustl.edu/resources/for-undergrads/attending-sfn/>

MENTORING RESOURCES

“A mentor is not someone who walks ahead of you to show you how they did it. A mentor walks alongside you to show you what you can do.”

Getting the Most Out of Your Mentoring Relationship | <https://neuroonline.sfn.org/Articles/Professional-Development/2015/Getting-the-Most-Out-of-Your-Mentoring-Relationship>

How to Find the Right Mentors and Ask for Career Advice | <https://neuroonline.sfn.org/Articles/Professional-Development/2015/How-to-Find-the-Right-Mentors-and-Ask-for-Career-Advice>

How to Get the Mentoring You Want: A Guide for Graduate Students at a Diverse University | <http://www.rackham.umich.edu/downloads/publications/mentoring.pdf>

Making the Right Moves and Training Scientists to Make the Right Moves | <https://www.hhmi.org/science-education/programs/resources/making-right-moves>

Your Science Avengers: How to Assemble Your Mentoring Team | <https://neuroonline.sfn.org/Articles/Professional-Development/2017/Your-Science-Avengers-How-to-Assemble-Your-Mentoring-Team>

Individual Development Plan (IDP), a web-based career-planning tool created to help trainees in the sciences define and pursue their career goals | <http://myidp.sciencecareers.org/>

Mentoring Compacts | <https://ictr.wisc.edu/mentoring/mentoring-compactscontracts-examples/>

National Research Mentoring Network | <https://nrmnet.net/>

PROFESSIONAL ORGANIZATIONS

Diverse venues for professional development activities, scientific presentations, and networking opportunities with research trainees, faculty, and academic biomedical research institutions.

American Indian Science and Engineering Society (AISES)

<https://www.aises.org/>

Annual Biomedical Research Conference for Minority Students (ABRCMS)

<http://www.abrcms.org/>

Association of Minority Health Professions Schools, Inc. (AMHPS)

<https://amhps.org/>

Black in Neuro

<https://www.blackinneuro.com/>

Científico Latino

<https://www.cientificolatino.com/>

Hispanic Association of Colleges and Universities (HACU)

<https://www.hacu.net/>

Neuroscience Scholars Program, Society for Neuroscience (NSP)

<https://www.sfn.org/initiatives/diversity-initiatives/neuroscience-scholars-program>

Society for the Advancement of Chicanos and Native Americans in Science (SACNAS)

<https://www.sacnas.org/>

ENDURE PRIDE

This is the last page of the booklet but turns the first page of YOUR FUTURE! ENDURE alumni are changing the face of neuroscience and making an impact on research knowledge. Stay connected to the ENDURE network!

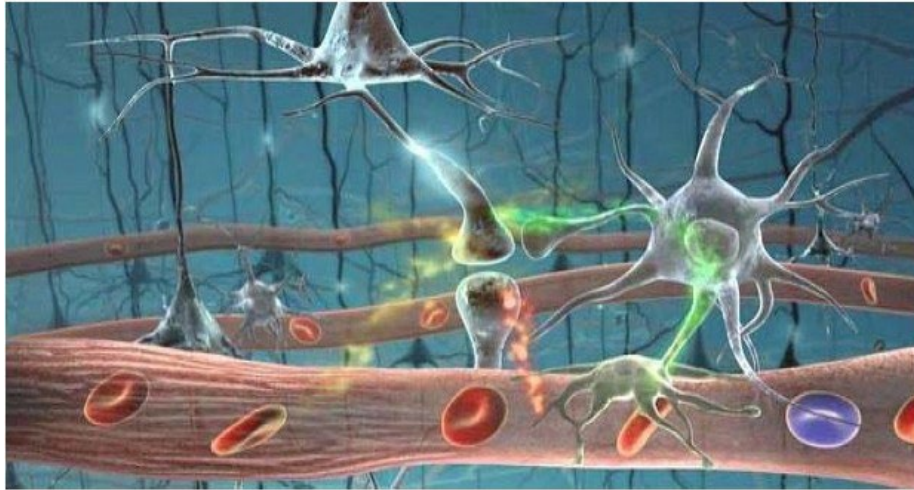
ENDURE Trainees and Alum: visit and join the ENDURE LinkedIn page, https://bit.ly/ENDURE_LinkedIn

ENDURE Outcomes (as of Sep 2021): 182 of 353 alumni (~52%) are currently enrolled in graduate programs!

- 98 in biomedical Ph.D. programs
- 37 in clinical doctoral programs (M.D. or D.O., M.D./Ph.D., Pharm.D., Psy.D., D.P.T.)
- 47 in MS degree/postbacc programs
- 28 completed PhD programs
 - 16 doing postdoctoral research
- 9 in residency programs or practicing medicine
- 28 in other research position (lab technicians, clinical research associates)
- 58 in other fields (teaching, pharma/biotech industry, pharmacy, physical therapy, nursing, science writing, policy, etc.)

Ph.D. Graduate Programs of ENDURE Alum

Albert Einstein College of Medicine	Massachusetts Institute of Technology	University of Arizona	University of North Carolina at Chapel Hill
Baylor University	Michigan State University	University of California Berkeley	University of Pennsylvania
Boston University	New Mexico State University	University of California Los Angeles	University of Pittsburgh
Brown University	New York University	University of California San Francisco	University of Puerto Rico
Columbia University	Ohio State University	University of Cincinnati	University of Southern California
Cornell University	Oregon Health & Science University	University of Colorado Anschutz Medical Campus	University of Texas at San Antonio
City University of New York	Ponce School of Medicine	University of Colorado Boulder	University of Texas Health Science Center at San Antonio
Emory University	Princeton University	University of Georgia	University of Texas Southwestern Medical Center
Georgetown University	Rosalind Franklin University	University of Houston	University of Utah
Harvard University	Stanford University	University of Illinois in Chicago	University of Wisconsin-Madison
Icahn School of Medicine at Mount Sinai	University of Washington	University of Iowa	Washington State University
Institute of Science and Technology Austria	University of Alabama	University of Massachusetts Amherst	Washington University in St. Louis
Johns Hopkins University	University of Alabama at Birmingham	University of Michigan	



THANK YOU FOR YOUR PARTICIPATION!!

Stay safe and take care!