Hemispheres

A Newsletter of the Neural Engineering Center at GA Tech & Emory

Spring 2026

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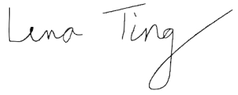
Georgia Tech Neural Engineering Center EMORY UNIVERSITY

Lena Ting, PhD.
Co-Director, Georgia Tech
& Emory Neural Engineering Center



Garrett Stanley, PhD.
Director, McCamish Parkinson's
Disease Innovation Program and
Co-Director, Georgia Tech
& Emory Neural Engineering Center

from the Directors

Spring is a time for growth. Highlighted in this issue of the Emory/GT NEC newsletter are just a few of the ways that we as a community are growing.

One way we grow is to give back to the community. Members of the Computational Neuralengineering Training Program (CNTP) take this to heart, by spending their free time on outreach to the larger community to convey the value of computational neuroscience research to a broader audience, to ground their research in the needs and goals of our community, and to inspire future generations to pursue research. This has been a long-standing passion for many within the Neuralengineering community and has been formalized through the student-led CNTP Recruitment and Outreach Committee. Read on to find out what they do in both our local schools, and in the larger Atlanta community.

A primary mission of the NEC is to help support and train the next generation of leaders in neuroengineering, across academic, industrial, and government sectors. It is especially rewarding and exciting to get to watch and participate in the professional growth of our trainees as they go from first arriving on the GT or Emory campuses to receiving their degrees and opening the next chapter of their lives. In this issue, we talked with Dr. Nmachi Anumba, a recent graduate of the GT/Emory BME program and Fellow of the inaugural class of the CNTP, to find out about her growth during her training here and where this has led her.

Finally, in its fifth year, the McCamish Parkinsons Disease Innovation Program has grown considerably, starting from scratch in 2021 and working to bring numerous scientists and engineers in the Atlanta community to bring their talents and expertise to help solve the problems of Parkinson's disease. In this issue, learn about how the program started, and about its current focus on team science across the GT and Emory campuses in "Disentangling Movement, Sensation, and Cognition in Parkinson's Disease Through Measurement, Manipulation, and Machine Learning".

We're excited about the growth of the people in our community, the growth of the community itself, and the growth of interest in the larger community in how neural engineering can improve our lives.

Garrett and Lena

Team Science to Tackle Parkinson's Disease

In 2021, the Georgia Tech/Emory Department of Biomedical Engineering received a generous gift from the McCamish Foundation to launch the McCamish Parkinson's Disease Innovation Program. The program was created to drive research, innovation, and community building across Georgia Tech and Emory University, to better understand, treat, and ultimately cure Parkinson's disease (PD). The first phase of the McCamish Program from 2021-2024 consisted of open calls for research proposals from multi-investigator, multi-disciplinary teams across GT and Emory, identifying and financially supporting a wide range of PD research in the community. The program ultimately provided $1.6M in funding to 19 different multi-disciplinary teams spanning 18 different units across Georgia Tech and Emory, catalyzing new collaborations and building up the local PD research community.

In 2024, the McCamish Program began a new phase, focusing the financial support on Team Science across laboratories at Emory and Georgia Tech. Through the open calls for proposals in the first phase of the program, it was recognized that the community excels in several key areas that could have a profound effect on understanding and treating Parkinson's disease: measurement and manipulation of the brain at the microcircuit level, behavioral sensing and measurement from humans to animal models, and data analysis/machine learning/AI. Two interconnected research teams were formed across Emory and Georgia Tech to tackle a joint project entitled "Disentangling Movement, Sensation, and Cognition in Parkinson's Disease Through Measurement, Manipulation, and Machine Learning". The Emory team is a partnership between the laboratories of Svjetlana Miocinovic, Lucas McKay, Michael Borich, and Lena Ting, and the Georgia Tech team is a partnership between the laboratories of Annabelle Singer, Jeff Markowitz, Bilal Haider, and Garrett Stanley, with the McCamish Program supporting the large team with an additional $1.2M. Across humans with PD and animal models of PD, the team is developing and utilizing expansive and coordinated approaches to measure and manipulate brain regions associated with the disease, developing a holistic characterization of the motor and non-motor aspects of PD, and developing adaptive, closed-loop therapies that significantly enhance current therapeutic approaches.

A Little Bit of Background. Parkinson's disease (PD) is a prevalent neurodegenerative disorder, affecting approximately 1 million individuals in the United States annually, with 90,000 new diagnoses reported each year. Although the precise mechanisms of the disease remain elusive, the hallmark characteristic is the profound loss of neurons in the brain that produce dopamine, which is a neurotransmitter involved in a range of functions including movement, reward, and motivation. Diagnosis of PD is conventionally based on identifying common motor symptoms such as tremor, bradykinesia (slowed movement), and muscular rigidity. When these overt motor symptoms emerge, it has been estimated that approximately 70% of the dopaminergic neurons have already been lost. However, PD patients also exhibit more subtle changes in movement that are not captured with traditional measures, and importantly also experience non-motor impairments, including alterations in olfactory, auditory, tactile, nociceptive, thermal, and proprioceptive perception, as well as other memory-related cognitive deficits. Notably, these symptoms precede the manifestation of gross motor symptoms by two or more years, offering a potential window for early diagnostic methods. Making diagnosis further difficult, the way that PD affects different individuals is highly variable, likely due to the complexity of the underlying brain circuits whose function is increasingly disrupted during disease progression. The "basal ganglia" (BG) refers to a group of subcortical nuclei responsible primarily for motor control, as well as other roles such as motor learning, executive functions and behaviors, and emotions. It is the death of dopamine producing neurons in a region of the BG called the substantia nigra that is thought to be at the root of PD. Importantly, other dopamine producing regions outside of the BG are also degraded in PD, but much less well understood. All of these regions have strong and extensive connections with the cerebral cortex, thalamus, and hippocampus, brain regions responsible for sensing, moving, and elements of learning, memory, and cognition. The teams across Georgia Tech and Emory are well positioned to better understand non-motor and non-traditional motor effects of PD to better understand the disease and develop earlier diagnoses, and to pinpoint the circuits in the brain that are responsible for these effects as a means to enhance our understanding of the mechanisms that underlie this disease.

Humans with PD: The McCamish PD Systems Team. This research direction, led by Prof. Lena Ting at Emory, focuses on the holistic, systems-level aspects of movement and balance, using cutting-edge approaches to measurement and sensing, coupled with data-driven, machine-learning analytic approaches to study movement and balance in normal physiology and in individuals with PD. The neural mechanisms underlying Parkinsonian symptoms are poorly understood, impeding progress for treatments. Due to the degenerative nature of the disease, compensatory changes in neural circuitry may be highly individualized, leading to a great deal of heterogeneity in the underlying mechanisms of debilitating symptoms that affect motor, perceptual, and cognitive domains. However, there is a lack of appropriately precise behavioral measurements, neural recordings, and neural stimulation outcomes to advance progress toward mechanistic, prodromal, and individualized approaches for mitigating the debilitating effects of Parkinson's disease. This team aims to change that.

The team consists of scientists and engineers located at Emory who are leaders in synergistic areas of systems-level and clinical neuroscience, bringing a unique combination of skills and experience to bear on this problem. **Lena Ting** brings extensive experience in human movement and balance, combining rigorous quantitative, data-driven methods with precise measurement and sensing to capture the interplay between the musculoskeletal system and nervous system in normal physiology and in individuals with PD. **Lucas McKay** brings experience in data-driven approaches to understanding balance and falling in individuals with PD. He co-directs the Emory Brain Health Center Motion Analysis Laboratory and maintains one of the largest repositories of full-body behavioral testing data of movement disorders patients in the world. **Svjetlana Miocinovic** is a neurologist and engineer, with a specialization in Parkinson's disease, dystonia, tremor and other movement disorders. She brings extensive experience in electrophysiology of human motor circuits, and development of new device-based therapies. Her clinical focus is on delivering expert patient care and using DBS to treat movement disorders. **Michael Borich** is a rehabilitation neuroscientist with extensive experience in the brain's capacity for change in response to rehabilitation after injury or in the context of disease. His work incorporates multimodal neuroimaging and neurostimulation approaches to investigate brain structure and function and has worked extensively with Ting in the area of balance.

Animal models of PD: The McCamish PD Circuits Team. The other main research direction, led by Prof. Garrett Stanley at Georgia Tech, focuses on the circuit level, using non-human models of PD, to investigate fundamental mechanisms that underlie PD that are difficult or impossible to measure in humans. This team focuses on the detailed aspects of circuits in sensing, moving, and cognition, bringing an extensive array of tools to the problem for measurement, manipulation, and behavior. Despite decades of research in PD, the fundamental brain circuit mechanisms underlying the disease are poorly understood, and yet are the key to developing treatment strategies and ultimately discovering a cure. The modern explosion of tools for measurement and manipulation of brain circuits in mice positions the team well for making major strides in understanding these complex networks and developing therapeutic strategies.

The team consists of scientists/engineers who are leaders in synergistic areas of circuit-level neuroscience, bringing a unique combination of skills and experience to bear on this problem. **Bilal Haider** and **Garrett Stanley** have extensive experience in circuit-level electrophysiology of the thalamocortical circuit in mice, combined with precisely trained sensorimotor behaviors and a wide range of optogenetic tools for probing and manipulating the underlying circuits, and are extending their multi-site recording techniques to targeted regions of the basal ganglia in addition to thalamocortical targeting. **Jeff Markowitz** brings expertise in developing machine learning tools for sophisticated tracking of movement in mice, along with cutting-edge techniques for measuring dopamine in-vivo. **Annabelle Singer** brings deep experience in cognition and the brain circuits that underlie memory and spatial navigation, as well as neurotechnology development and translation.

Two Teams, One Goal. Despite active research communities studying PD in humans and animal models of PD, there is often less overlap and synergy than one would expect or hope. By coordinating research across the Emory and Georgia Tech teams and designing research from the onset with the goal of leveraging the strength of both lines of work, the McCamish Team hopes to make major strides in this direction. But this takes time, and researchers who are dedicated to this cause. The team further plans to make a core principle of the project to share the tools and data widely across the scientific community, with the hope to inspire other teams and drive the research in PD closer to the goal of better treatments, and one day even a cure.

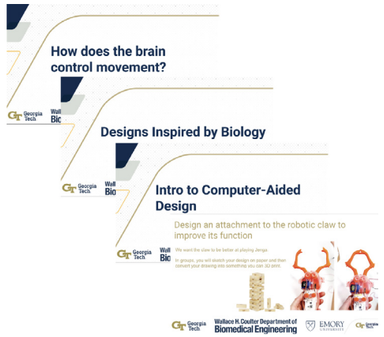
Article Written by Garrett Stanley
Neural Engineering Center, Georgia Tech and Emory University

CNTP Outreach: Clawing Paths To Success

Science outreach is a key component of CNTP training. By interacting with the community, trainees convey the value of computational neuroscience research to a broader audience, ground their research in the needs and goals of our community, and aim to inspire future generations to pursue research. The CNTP Recruitment and Outreach Committee- led by CNTP fellows and scholars Kennedy Kerr, Ethan Corey, X Velez, Gunhee Lee, Caleb McKinney, Anna Pritchard, and Jemma Jiang- organizes CNTP community engagement events throughout the school year. This year, the committee organized a Neural Engineering Center booth at the Atlanta Science Festival and developed a 3-part lecture series + field trip for 7th grade science students at Dekalb Arts Academy.

Forging a Partnership

In 2024, the committee was partnered with Ms. Ellison's 7th grade science class at Dekalb Arts Academy (DAA) through STEM Forward, a Science ATL initiative. Through this program, the committee designed a 3-part, interactive lecture series that introduces students to the intersection of neuroscience and engineering. Using "The Claw" from Backyard Brains (a commercially available electromyography (EMG) controlled robotic claw) as the core demonstration tool, CNTP trainees taught introductory concepts on (1) How the brain controls movement, (2) Bio-inspired design, and (3) Computer aided design (CAD) during classroom visits to DAA.

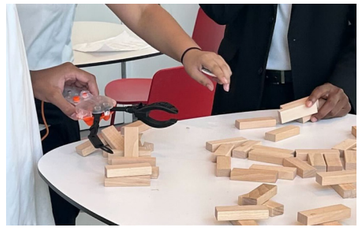


STEM Forward Team

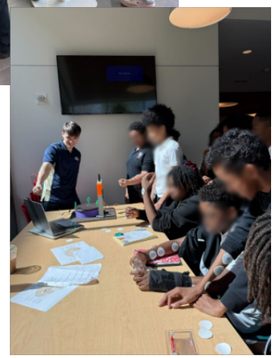
Now in the second year of this STEM Forward partnership, the committee expanded upon their curriculum by developing an engineering design project along with the lectures, culminating in a field trip to Emory. Students were challenged to design a new arm attachment for The Claw for playing Jenga. Students incorporated concepts they learned throughout the school year to ideate on their design choices, create a design using CAD, and test their designs at the field trip. The top four student designs were 3D printed and swappable, so students could compete against each other with different combinations of their new attachments. Through this exercise, students could physically see the results of their work, and how their designs have the potential to be used in assistive technology like the robotic claw.

From the Classroom to the Stage

On the day of the field trip, 100 seventh grade students presented the designs they made, tested printed designs through Jenga competitions, and went on a tour of Emory's campus. The field trip peaked with a final competition, in which three student teams competed against each other in a series of Jenga games using the EMG-controlled claw. Competing in a tournament style, teams were given 90 seconds to move a Jenga piece to the top of the tower. This conclusion to the trip left the cohort of 7th graders invigorated, as "Team 67" was proclaimed the victor. This final competition provided the opportunity for the students to see their hard work applied to an exciting and challenging task after a year of learning various biological and engineering concepts.



Field trip demo stations: Jenga with Backyard Brain Claws and Dino Jump Game



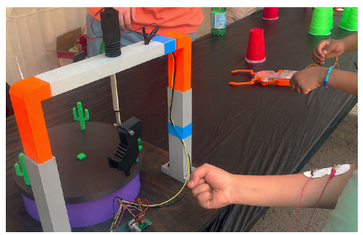
Planting Seeds

By developing curricula and visiting Dekalb Arts Academy four times throughout the 25-26 school year, with a final field trip at Emory, the Recruitment and Outreach Committee introduced neuroengineering concepts, taught practical engineering skills, and excited a cohort of middle schoolers about higher education and careers in STEM. These successes, facilitated by numerous trainee and faculty volunteers throughout the CNTP, set the stage for a tradition of repeatable and continuously improving outreach initiatives with direct community impact.

Beyond a Single Classroom

Trainees organized a booth on how the brain controls movement for the 2026 Atlanta Science Festival (ASF), which hosted over 100 events and thousands of participants for the purpose of celebrating science and expanding STEM learning opportunities. At the Georgia Tech & Emory CNTP booth, trainees used demos of hobby electromyography (EMG) devices from Backyard Brains to show participants how the electrical activity from their muscles could be detected and used to control a physical claw mechanism. Participants were tasked with using this claw to stack plastic cups, mimicking a rudimentary prosthesis. These demos were accompanied by a visualization tool that allowed participants to see the raw EMG output from their forearms while opening and closing their hands. With this initiative came the opportunity to showcase neural engineering concepts to hundreds of children and families.

CNTP Booth at ASF 2026



Dino Jump Game at ASF 2026

Along with the claw demos, the CNTP Recruitment and Outreach Committee debuted an EMG-controlled game modeled after the Google "No Internet" page, in which a dinosaur jumps over cactuses. Inspired by a similar project from Backyard Brains, the committee designed, 3D printed, and assembled the game from scratch as an additional learning tool to get younger students excited about the many applications of neural engineering. In this game, the top plate spins at a constant rate, and players are tasked with timing their muscle activation to raise or lower the dinosaur in order to jump over the cactuses. In addition to ASF, CNTP's Dino Jump Game was also demoed in DeKalb Arts Academy's STEAM night and Decatur High School's Math Symposium.

Written by CNTP Recruitment and Outreach Trainees:
Kennedy Kerr, Ethan Corey, and Xavier Velez

from **PhD Grad** to **Research Scientist**

Nmachi Anumba was one of four trainees who was inducted into GA Tech and Emory University's Computational Engineering Training Program (CNTP) when it began in Spring 2019. We sat down with Nmachi, now a Research Scientist at Eli Lilly, to discuss her journey and here's what she had to say:

GT/Emory NEC: Now that you're a CNTP alumna and have obtained your PhD, tell us what you've been doing since graduating from Emory?
Anumba: After graduating from Emory, I wanted to take some time off to recharge after the intense grind of grad school. I've always enjoyed learning languages and traveling, so I decided to move to South Korea for a year. I figured this was a good transition point in my career to do something like that, so I enrolled in a language institute in Seoul and spent my time learning Korean and traveling. After coming back to the States, I joined Eli Lilly and Company where I currently work in early-stage drug delivery research.

GT/Emory NEC: Why did you decide to pursue a career with Eli Lilly?
Anumba: During my PhD, I completed an internship at Lilly Research Laboratories, which was my first exposure to working in the pharmaceutical industry and, generally, outside of academia. That experience helped confirm that I wanted to pursue an industry career after graduating, so I'm very grateful to my advisor, Dr. Shella Keilholz, for supporting me in gaining that experience. My internship at Lilly went really well, I enjoyed the work environment, the people I worked with, and the science was interesting, so when I was offered a full-time position, I was excited to come back!

GT/Emory NEC: Tell us about your work at Eli Lilly.
Anumba: I joined Lilly as part of a rotational professional development program, so for the first two years of my employment, I have the opportunity to complete three 8-month rotations in different departments throughout the company. My first rotation has focused on innovation and early-stage drug delivery research, where I've been able to apply my background in imaging to support ongoing research efforts and external collaborations.

GT/Emory NEC: How has your training within CNTP prepared you for your current position?
Anumba: One of the most valuable parts of CNTP to me was always the network and exposure to diverse career paths. I really enjoyed listening to the faculty and guest speakers because you could see how unique everyone's journeys are, that there isn't a single, linear path to success and that careers can evolve in many different ways. That perspective has encouraged me to stay open, flexible, and curious as I navigate my own journey.

> One of the most valuable parts of CNTP to me was always the network and exposure to diverse career paths." — Nmachi Anumba

GT/Emory NEC: What impact or contributions have you made (or would like to make) while working at Eli Lilly?
Anumba: Given that I'm still early in my career at Lilly, I'm still learning and growing, but it's been rewarding to see how the skills I developed during my PhD translate into an industry setting. For example, my team didn't have anyone with an imaging background before I joined, so some of the work I've done already has saved a significant amount of time for certain projects. It's been a nice reminder that despite how niche your work can feel in grad school, those skills can be highly valuable in other fields.

GT/Emory NEC: Is there anything that you would do differently as you reflect on your journey from CNTP to Eli Lilly?
Anumba: I wouldn't necessarily change anything, but I'm very thankful that I sought out industry exposure during graduate school. Some of that came through CNTP, and some through external organizations and programs focused on teaching and preparing graduate students for industry careers. I would highly recommend starting that process early if you're thinking about an industry job in any capacity. Also taking time off post-PhD is something that I feel incredibly blessed to have been able to do. If that's a possibility for you, even briefly, I would highly encourage it. The PhD is demanding, and taking time to reset can be incredibly valuable.

GT/Emory NEC: Tell us something that you didn't expect or that surprised you the most along your journey to Eli Lilly.
Anumba: One thing that really surprised me was how big the adjustment was from leaving school to working full-time. Not necessarily in terms of the schedule or the work itself, more so as it pertains to structure. I wasn't prepared for how strange it would be to work within a context that lacked a defined goal and standardized milestones. For the first time, I don't necessarily know what the next steps are, I have to define the goals for myself. Everyone is different and this may not be a big deal for some (and may even be exciting for others), but I personally found it quite difficult to adapt to this new mindset. Honestly, I'm still adjusting to this flexibility in shaping your own path, but it's been a good opportunity for growth.

GT/Emory NEC: Any advice that you'd like to share with the CNTP community?
Anumba: I would say, even though it can be hard sometimes, have confidence in the skills that you're developing and expertise that you're building as a researcher. Even if the specific subject matter you're studying is not something you want to continue in post-graduation, the critical thinking, problem solving, and communication skills that you evolve in grad school are highly valuable no matter where you go next. It was easy for me to forget the significance of PhD training when surrounded by others who were all doing the same thing, but getting a PhD is extremely impressive. Don't forget the gravity of that. Also, don't be afraid to "stray from the path" and pursue things you're interested in! Even if (maybe especially when), they may fall outside traditional career paths – those experiences can end up being some of the most meaningful.

Interview conducted by Fadrika Prather, Neural Engineering Center, Georgia Tech and Emory University

Georgia Tech Neural Engineering Center — Emory University

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Georgia Institute of Technology
U.A. Whitaker Building
313 Ferst Drive
Atlanta, GA 30332
nec.gatech.edu

Emory University
Health Sciences Research Building
1760 Haygood Drive
Atlanta, GA 30322
emory.edu

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