Understanding how the nervous system encodes external sensory stimuli and translates this information into behavior is the main intellectual drive of my research. My previous research experiences on the neural mechanisms of sensory transducing, encoding, and resulting behaviors have been extremely rewarding, and have inspired me to dedicate my career to elucidating mechanisms of sensory perception. Moreover, during my seven years of research experience, it has become increasingly important to me to address short-comings within the scientific community. I aim to combine my research with active efforts to improve communication scientists have with the public and to address the lack of underrepresented minorities in the sciences. With the support of the National Science Foundation Graduate Research Fellowship Program (NSF GRFP), I will continue contributing to research in the field of sensory perception and my steadfast commitment to outreach causes.

Intellectual merit: With an early interest sensory perception, I began investigating taste in Dr. John Glendinning's lab during my sophomore year at Barnard College. We found that, compared to wild-type mice, mice lacking the T1r3 sweet taste receptor produced a normal physiological insulin response after licking sugar solutions, despite being unable to detect sweet taste. This surprising result provided evidence for the existence of a novel taste pathway that is responsive to caloric value in food, and unconsciously triggers an appropriate physiologic response of lowering blood sugar. My contribution to this project led to my first publication[1]. The idea that there are yet undiscovered pathways of sensory perception continues to motivate me in my research.

Eager to learn more about other sensory systems, I applied to and was accepted to the Summer Undergraduate Research Program (SURP) at Princeton University in the summer of my sophomore year[2]. I worked in Dr. Mala Murthy's lab on an assay that used lasers to track and identify individual *Drosophila melanogaster* flies that had developed an odor preference after an associative learning experience with innately neutral smells. These flies were then used to study "memory traces," the physical and chemical manifestations of memory, by investigating changes within olfactory learning circuit neurons through electrophysiology and mRNA expression changes. The remarkable creativity of this assay's design astounded me and instilled in me a fascination for assays engineered to reveal the perceptual experiences of model organisms.

Motivated by the techniques I had seen in the Murthy lab, I chose to learn electrophysiology upon my return to Dr. Glendinning's lab. To better understand how sensory perception can be modulated by experience, I focused my senior thesis on the effects of fetal ethanol exposure on peripheral nerve responses in rats during adolescence. Recording from *in vivo* nerves was my most challenging experiment yet and taught me the patience and work ethic required to develop the technical skills needed to succeed in research. The obstacles I faced in this project and throughout my research showed me the vast complexity of neuroscience problems—which has reinforced my passion to solve them. My work creating a new dissection prep for sensory nerves and on the lab's electrophysiology protocol hinted that, after fetal ethanol exposure, peripheral sensory nerves exhibit reduced responsiveness to ethanol in adolescence[3].

Realizing that sensory processing alone does not determine behavioral outcomes, I was determined to learn more about the internal and decision-making processes that occur in the brain. After graduating, I joined a lab at Columbia University Medical Center to study the impact of neuromodulators on behavior, where I was advised by Dr. Eleanor Simpson and Dr. Eric Kandel. We investigated ability of a serotonin 2c receptor selective ligand to cross talk with the dopamine system as a potential treatment for motivational disorders. This drug was shown by the lab to increase goal-directed behavior in mice without increasing locomotor output. Although the drug was shown to have no impact on reward-related phasic dopamine release, I used *in vivo*

microdialysis to investigate drug-induced changes in tonic dopamine levels. I was responsible for this project on every level. I learned how to surgically implant cannulae in the brains of mice, developed a new method for histological evaluation of probe placement, taught myself to code to improve the analysis for my behavioral data and, alongside an analytical chemist, developed a more accurate method for processing and measuring dopamine samples. My results ultimately indicated that our experimental treatment correlated with increased tonic dopamine levels in the dorsal striatum, increasing goal-directed effort through increased motor efficacy or effort allocation. As we prepared the results for a paper[4], seeing my results directly improve existing models of the neural mechanisms encoding motivation and effort was incredibly exciting.

Inspired by recent advances like CRISPR-Cas9 which have allowed researchers to tackle the scientific challenges of exploring perceptual spaces of uncanonical model organisms, I have recently joined Dr. Leslie Vosshall's lab for its leading research in sensory neurobiology in *Aedes aegypti* mosquitoes. Building upon my preliminary data[5], I will investigate the multisensory-mediated avoidance of the insect repellent DEET, the most effective and widely used insect repellent. The effectiveness of DEET has been a longstanding mystery in mosquito neurobiology; understanding this mechanism promises to shed light on new principles underlying how chemosensation is encoded and subsequently translated into behavior. My experience in behavioral and sensory neurophysiology and tool development, combined with the Vosshall lab's expertise in powerful genetic and molecular methods in *Aedes aegypti*, positions me to uncover elusive neurobiological mechanisms of DEET repellency.

Broader impacts: To non-scientists, science can often seem inaccessible, overwhelmingly technical, or even, at worst, untrustworthy. I am committed to counter this impression for different audiences, including biology students or the general public, to share with them my enthusiasm for science and to help them connect with their own sense of curiosity. My passion for science communication and accessibility are at the core of my passion for outreach.

As an undergraduate, I spent three years as a supplemental instruction leader, a resource for students that may have had less preparation for college. For a class of 150 in introductory biology, and later for advanced genetics, I developed discussion-based review sessions three times a week to go over lecture material. I also served as a *de facto* advisor to many students, emphasizing important study strategies, and helping to guide their academic choices in college. For many years after I graduated, my former students would recognize me around New York City, telling me about the impact that the program had in enabling them to pursue careers in the biological sciences. This experience made me realize that I love helping other people thrive and succeed. Teaching has led me to take on other leadership opportunities that help me foster supportive environments and human connections within the sciences. In recently joining a lab that encourages mentorship and outreach, I am excited to once again guide future scientists through the scientific process. I look forward to mentoring students through summer programs at Rockefeller University offered to students at public high schools and undergraduate institutions and I hope to mentor undergraduates during the year. I am also looking forward to giving a lecture on chemosensation at Rockefeller's Summer Neuroscience Program, a graduate student-led program for students from underserved New York City public schools.

Teaching biology often requires the right metaphor or analogy to make material "click" with a student, and writing poses a similar challenge of recognizing and understanding your audience. During my first year as an undergraduate, I co-founded a blog to represent students at Barnard College, the all-women's college of Columbia University. In the ecosystem of Columbia's student-run publications, Barnard women's voices were often drowned out or specifically mocked

and harassed. We gave Barnard students a platform to discuss issues specific to our campus and being a female student. Serving for four years in editorial positions, I helped obtain funding for our publication, wrote articles, and guided less-experienced students in the writing process. In my third year of college, I served as Editor-in-Chief, where I doubled the size of our staff and increased our readership by 500%. My experience with media and publication has dovetailed with my science outreach. For the past two years, I have been a contributor to the non-profit Graduate Women in Science, dedicated to empowering women in STEM fields. I am a committee member for their fellowship award and writer for their online publication.

With my leadership experience in journalism, I realized that I could help increase diversity in STEM through supporting and amplifying the voices of others. Having graduated from a diverse public school in New Jersey, I have never felt comfortable in communities without minority voices. To address this issue, my colleague Robert Fernandez, who grew up undocumented in New Jersey, and I started an online publication called *Científico Latino*, which aims to provide undocumented or underrepresented college students with open-access resources that will help them succeed in STEM. Drawing from my previous media experiences, I designed and update the website, workshop and edit blog posts with our contributing writers, write for our blog on professional development in STEM, and contribute what I have learned about public relations strategies to expand our impact and readership. To be accessible to and supportive of current students considering graduate school, we started an informal public Facebook group, where minority early-career scientists solicit advice from myself and other current graduate students. Encouraging and advising prospective graduate students through *Científico Latino* and helping them find the right path for achieving their career ambitions has been incredibly rewarding.

"Belongingness" is a commonly cited factor for graduate student retention and success, particularly for minority students. Since joining graduate school, I have become acutely aware of how important my scientific network has been for professional and personal support. I acquired funding from the Rockefeller University's Dean's office and the Kavli Neural Systems Institute to start a journal club called Neurostorm, which brings together a community of graduate students and postdocs at several New York City institutions of diverse specialties to practice informal but rigorous scientific presentations and discussion. Throughout my career, informal relationships with scientists as peers and mentors have been crucial to my professional development, thinking about science in the bigger picture, and my sense of "belonging" in science. With that in mind, we encourage undergraduate students and research assistants to attend, so that they can meet mentors and role models and build graduate school-level skills around presenting and conversing about science. To practice engaging in conversation beyond the scientific community, we also invite non-science experts to speak, including political strategists, virtual reality artists, philosophers, entrepreneurs, and high school educators.

Future goals: With the aid of the NSF GRFP, I plan to advance our understanding of the mechanism of action of the insect repellant DEET and elucidate underlying principles of how chemosensation is encoded and translated to behavior. Throughout my research career, and one day as a principal investigator, I am determined to continue developing new methods to gain insight into sensory perception, while pursuing my passions of building scientific communities, supporting the careers of early-scientists, and making science accessible to the general public.

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