When I was younger, I held the misconception that because we are conscious, our behavior necessarily follows our intent. Born in Brooklyn, I was raised with local indigenous groups in Northern Potosi, Bolivia by my mother as she conducted anthropology research. I returned to the U.S. at six**,** an indigenous Hispanic. In school, because of the physical and cultural differences between my peers and me, I was cast the black sheep and developed a social insecurity. Introduced to social analysis by my bohemian mother and pan-African father, I tried to understand everyone's reasons and intentions. I eventually realized that we are largely unaware of the behavioral patterns we exhibit. Pursuit of the origins of these patterns led me to the brain, which constantly receives and parses massive amounts of information to create a representation of the world we live in and to provide the basis for our behavior in it.

Take the example of Black and Hispanic children who, when asked to write their names on tests, tend to perform more poorly than when tested anonymously, because this means subconsciously bringing in their ethnic identity and its social tie to poor test performance[1]. Lack of empirical evidence for the capability of these groups, coupled with empirical evidence for the capability of White and Asian groups, lead some to create stereotypes in which individuals from Black and Hispanic groups are low-performing, and those from White and Asian groups high-performing (especially in STEM fields). Because of my ambiguous appearance, I have experienced different treatment depending on whether I was placed into the category of Hispanic or Asian. This has become one of my behavioral interests – how the brain parses information in the presence of stereotypes – and I have chosen it as the subject of my research statement.

I come from a low-income household so my parents cannot financially support me here at Stony Brook University. I am a recipient of the NSF-funded Scholarships for Science, Technology, Engineering and Mathematics (S-STEM) and Louis Stokes Alliance for Minority Participation (LSAMP). These scholarships have funded some of my research assistantships, allowing me to leave my on-campus jobs for undergraduate research as a source of income. I have chosen to maintain my job as a physics and mathematics tutor for the Educational Opportunity Program (EOP) because of the outreach it provides me to the Black and Hispanic community. I get to work with students one-on-one throughout academic semesters, helping them maintain their morale for success (especially in STEM). I have seen this community suffer from low-morale and I actively fight to combat this. I have served on a Collegiate Science and Technology Entry Program (CSTEP) panel encouraging underrepresented students to pursue undergraduate research; I plan to serve on a similar panel this coming November. Moreover, this coming spring, I will be a teacher and mentor in Stony Brook's new NIH-funded Bio-Math learning center, a center for strengthening the foundations of those with poor-foundations in mathematics, namely the underrepresented[2].

My outreach is inspired by my social awareness and interest in behavioral phenomena. A logical thinker, I rely on axiomatic approaches towards understanding concepts and problems. As a freshman, these attributes led me to choose a physics major in order to use axiomatic approaches towards understanding the dynamics of the brain, and the resultant behavioral phenomenon that manifests. Now, as a senior, I am interested in learning more about fields like applied mathematics and computer science so I can apply topics such as network theory and computational complexity towards understanding the brain. I have resolved to pursue a PhD in theoretical neuroscience.

Intellectual Merit: The summer after my freshman year at Stony Brook, I gained my first research experience through SUNY Oswego's Global Laboratory, working in Dr. Shenqyang Shy's Turbulent Combustion Laboratory at National Central University in Taiwan. I worked with two graduate students to verify theoretically defined parameters for the flow of fluids in pipes of varying cross-sections. The experimental nature of this research juxtaposed the computational nature of the research that succeeded it (modeling a particle detector) and manifested my preference for computational research.

The following semester, looking for research more closely related to my neuroscience interests, I came across the work of Christof Koch. His interest in studying the brain, specifically the "mind-body" problem from a reductionist point of view resonated with mine. I discovered "theoretical/ computational neuroscience," and proceeded to find my school's only faculty in it, Dr. Giancarlo La Camera. The following spring I took his computational neuroscience course, where I learned about mathematical models and techniques used in neuroscience research.

To continue gaining research experience, the following spring semester I began to work with Dr. Axel Drees on my current DOE-funded research project. I write libraries in C++ to study the feasibility of using a Detection of Internally Reflected Cherenkov Light (DIRC) particle detector on the high-multiplicity collisions produced at Brookhaven National Lab's Relativistic Heavy Ion Collider (RHIC). We found, sometime last year, that with minimal pattern recognition techniques applied, the detector had a 60% identification success rate with medium multiplicity collisions. Should this detector prove feasible for the collisions produced at RHIC, it will provide us with critical data towards learning new principles about the strong force interaction. I presented a poster of these results last spring at my school's URECA celebration of undergraduate research & creativity. Dr. Drees has nominated me for the honor of Stony Brook's Researcher of the Month and I will be featured this coming December.

Working for Dr. Drees for the past 2 years, I have been able to learn how to develop and manage sophisticated systems of libraries that can perform large-scale data analyses. Furthermore, the analytical skills I have gained here should translate well to my interests in studying the brain. If I have to model physical phenomena in the brain, such as electric signals through neural networks, I will have the experience of modelling the emission of radiation from particles traversing a medium. If I have to analyze noisy fMRI or EEG data, I will have the experience of applying analytical techniques to noisy radiation data.

My work with Dr. Drees proved beneficial to my interests as early as the summer after my sophomore year. I worked in Dr. Matthew Johnson's Neuromodulation Research and Technology Lab through the NIH-funded Life Sciences Undergraduate Research Program at the University of Minnesota. What I learned in Dr. La Camera's course and my newly acquired programming experience served as good preparation for my project. I developed a library in Python that interfaced with simulation environment, NEURON, in order to simulate deep brain stimulation (DBS) of a neuron linked to Parkinson's disease. Libraries written in Python allow for "on-line" analysis of the simulation data (analyzing the data during production as opposed to postproduction). This allows for less time in between analyses and thus allows for quicker obtainment of advancements in using DBS to treat Parkinson's disease. I presented the results at a Poster Symposium that summer at the University of Minnesota, and at the 22nd Annual CSTEP Statewide Student Conference.

This past summer, I was a Howard Hughes Medical Institute Minority Undergraduate Research Fellow in Dr. Ralph Adolphs' Emotion and Social Cognition Laboratory at the California Institute of Technology (Caltech). I worked with two post-doctoral scholars, Dr. Bob Spunt and Dr. Damian Stanley, to devise an experiment that studied how people infer traits about other people. We looked specifically at the roles of the cognitive ability known as *Theory of Mind* (creating or maintaining a mental representation of another person[3]), and the cognitive process known as *attribution* (the process of integrating situational and behavioral information to infer the traits of another person[4]). To my knowledge, no free, web-based, general-purpose platforms exist to administer experiments with user-input contingent progression. I took the initiative of creating a web application, coined the "New Experimental Tool for Psychology" (NEXT Psych) for this purpose. I designed it to facilitate sophisticated online behavioral testing, especially in fields such as psychology and neuroscience. It supports this experiment and other current and future experiments of Dr. Adolphs' lab. It is open-source, publicly available[5], and under active development—meant to benefit the larger scientific community. Unfortunately, I finished preliminary development of NEXT Psych with only a few weeks left to the program. The poster I presented at Caltech's Summer Seminar Day, then, focused more so on the implementation of our experiment in the software, and less so on the behavioral phenomenon we were studying. Nevertheless, this experience has been among my most rewarding experiences. Caltech required that I write a research proposal, two progress reports, and a final report that emulated an article that could be submitted to a scientific journal. The numerous drafts I went through with Dr. Spunt, Dr. Stanley, and Dr. Adolphs made me familiar with the type of writing that is required in academia.

Now, in my last year at Stony Brook, while I continue my work with Dr. Drees, I am an NSF-funded LSAMP scholar in Dr. Giancarlo La Camera's computational neuroscience group. I perform time-series analyses of neural signals. This analysis method allows us to find temporal patterns for neural data, which can provide insight into repetitive functionality in the brain. This is among my most exciting research opportunities yet, as this is my first encounter working first hand with analytically rigorous approaches to understanding neural data. I am excited to continue this research until I graduate; it will serve as the basis of my senior thesis.

Broader Impact: My various research assistantships have helped me realize that a graduate program that incorporates computer science and applied mathematics is critical to understanding the brain. I believe that my social awareness, behavioral interests, logical thinking, and reliance on axiomatic approaches will facilitate my integration of the social, natural, life, and information sciences in neuroscience research. This integration is necessary in order to fully understand the brain, its capacity to process and organize information, and how this relates to its physical structure and to the complex social behavior that manifests (i.e. is there a correlation between the brain's learning algorithms, its electric signals, and how it parses behavioral information). Moreover, this integration holds the potential to elucidate how we may better emulate and simulate intelligence, allowing us to draw inspiration from the brain towards fields such as artificial intelligence and machine learning.

The NSF GRFP will allow me to focus on my interests by freeing me from funding restrictions. It will allow me to dedicate more of my time towards additional courses in fields such as computer science and psychology. I can then use these courses, with my interdisciplinary neuroscience PhD training and greater research freedom to conduct novel, integrative neuroscience research. Moreover, I will be afforded the time to continue offering mentorship, support, and myself as a role model (and empirical evidence for the capability of those underrepresented in STEM fields). Funding me is investment in diversity in STEM and in the integration of diverse approaches towards understanding the brain.

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[1]Shih, et al. Stereotype Susceptibility: Identity Salience and Shifts in Quantitative Performance. (Psychological Science, 1999). [2]http://sb.cc.stonybrook.edu/news/general/140829inclusiveedu.php?=marquee3
[3]Malle, et al. in Handbook of Motivation and Cognition Across Cultures (Elsevier, 2008). [4]Gilbert, et al. The correspondence bias. (Psychological Bulletin , 1995). [5]https://github.com/wcarvalho/NEXT-Psych