**Personal Statement:** I saw firsthand how early adversity affects children's health and development in both subtle and stark ways. I grew up in a low-income Mexican-American neighborhood in Texas. When I entered high school, I was expected to obtain a full-time job to help support my family and care for my nephew and younger brother. Despite devoting many hours per week to caring for my family and working two jobs, I was determined to pursue the most advanced courses offered at my city's only high school. In addition to the financial challenges, I was actively discouraged by teachers from entertaining the thought of higher education, let alone a career in STEM. For example, when I met with my guidance counselor to discuss the pros and cons of taking Advanced Placement Statistics, I confronted what I now understand to be the discrimination that many low-income, female, and minority children face. Indeed, my counselor rolled her eyes and told me I was wasting my time, promptly dismissing me from her office. While frustrating, these experiences did not weaken my resolve. I ultimately adapted well; however, I know from personal experience and from the scientific literature that early adversity is a risk factor for many negative outcomes, including psychopathology and poor physical health. At Stanford University, my goal was to enter a scientific discipline that would better society for individuals who are at higher risk for poor mental and physical health due to early adversity. I want to use my opportunities to promote resiliency in others.

During my sophomore year, I took my first developmental psychology class and was astounded to learn about the rapid development that occurs in early childhood. It was fascinating to watch each child quickly adapt to the challenge of the famous marshmallow experiment, in which children are promised two marshmallows instead of just one if they can delay eating the single marshmallow that sits before them. I was surprised to learn the extent that "self-control" during this experiment predicted later life outcomes. The children in this study, however, generally came from well-off, educated, and well-adjusted families. Given the limited communication that young children have, I grew excited at the possibility of using biological measures to examine individual differences at this young age in high-risk populations. This class coincided with my first research assistantship offer, and I jumped at the opportunity to pursue research to gain a better understanding of the relations among early adversity, biological mechanisms, and behavioral outcomes. Dr. Ian Gotlib's laboratory provided the ideal training environment for me to begin to understand these questions and afforded me the opportunity to examine brain development, autonomic function, and emotional reactivity and regulation across development. I strongly believe that gaining a more comprehensive understanding of how early adversity and resilience to these risk factors affect brain development and later development of psychopathology and physical health will elucidate critical points for intervention and ultimately benefit society as a whole.

**Research Experience and Intellectual Merit:** My first foray into research began with examining biological correlates of psychopathology in adults. In collaboration with Dr. Katharina Kircanski, we sought to elucidate the relation between Major Depressive Disorder (MDD) and Generalized Anxiety Disorder (GAD) comorbidity and autonomic nervous function in adults during acute stress. We found, surprisingly, that these three clinical groups did not differ in autonomic stress response; however, transdiagnostic emotion regulation characteristics did predict aberrant autonomic stress response. Worry predicted greater acute stress response while rumination predicted a blunted response when confronted with the stressor.[1] Through this project, I gained important skills that would come to serve me well as a scientist, including knowledge in literature review, study design, data collection, analysis, and interpretation along with more technical skills specific to psychophysiology signal processing. After observing this

clear evidence relating emotion regulation and biological function, I sought to dig deeper and learn other methods of examining biological correlates of psychopathology. During my first post-baccalaureate year, I collaborated with Dr. Matthew Sacchet to examine the effects of depression on gray matter volumes in on the adult brain. We found that volume of the putamen, a component of the basal ganglia implicated in voluntary motion and reward processing, was more strongly negatively associated with age in the MDD than in the control participants, suggesting accelerating aging in this structure in MDD.[2] I presented these findings in my first scientific talk at the 2015 Stanford Neuroscience Forum and at the 2016 Society of Biological Psychiatry meeting; in fact, my poster was selected as one of the finalist prize posters.

These two studies in adult psychobiology indicated to me that I was on the right track, but I wanted to examine relations among stress reactivity, adversity, and brain development in younger samples to gain a better understanding of the mechanisms that may produce these differential biological measures. I extended my skills in analyzing gray matter volumes in adults to working with Dr. Kathryn Humphreys to assess the effects of early adversity on hippocampal development in young adolescents. The hippocampus, a brain structure involved in autonomic stress response, has been found to be functionally and structurally aberrant in adult populations with psychopathology and/or early adversity. Consistent with this literature, we found that the severity of adversity in the first years of life was associated with smaller bilateral hippocampal volume in this young and still developing sample; this further convinced me how important it is to understand early life adversity and brain development. These exciting results have been presented at the 2016 Society of Biological Psychiatry meeting, and are currently being prepared for publication.[3] To further explore this finding, I am collaborating with Dr. Tiffany Ho and Dr. Sarah Ordaz to extract cortical anatomical data from this sample at multiple time points, with the long-term goal of elucidating the longitudinal relation between adversity and neural development.

More recently, our lab launched a project to examine stress and neural structure and functioning in infancy, building on work indicating that very early life is likely to be a sensitive period for the effects of stress on neurobiological outcomes. A growing body of literature supports the predictive power of early childhood behavior on many outcomes, from academic achievement to psychopathology. It is only recently, however, that imaging technology has reached the level of sophistication necessary for high-resolution study of the developing infant brain. The first time I scanned a 5-month-old, I was struck by how different her brain was compared to the adolescent and adult brains to which I was accustomed. Three months later, we scanned this infant again and in such a short amount of time, this baby's brain had changed dramatically. I needed to connect the drastic neural change I saw on the scanner console with measurable aspects of the environment and important behavioral outcomes. Infant scanning was novel to the lab, however, so with guidance from Drs. Humphreys and Gary Glover, director of the Radiological Sciences Lab, I took the initiative to research infant MRI acquisition and reach out to experts to craft an MRI protocol that was both cutting-edge in acquisition technique and suitable for the rapidly developing infant brain. This includes gray matter volumes, diffusion tensor image (DTI) white matter tracts, and arterial spin labeling-acquired (ASL) cerebral blood flow. The first few years of life coincide with the greatest rate of white matter development; furthermore, in studies of premature infants, strong associations have been found between neonatal cerebral blood flow and cognitive skills in childhood. A multimodal neuroimaging approach combined with well-characterized behavioral measures can therefore provide insight into the nature of the relations among early adversity, infant stress reactivity, and infant brain

function/structure. I am excited by the prospect of elucidating these relations and assessing predictors of cognitive and socio-emotional development as we follow the infants longitudinally.

Through this process, I became interested in resting-state fMRI (rsfMRI), which can be relatively easily acquired and is capable of reliably identifying functional brain networks across developmental and clinical populations. I was eager to learn how to incorporate rsfMRI into our examination of early neural development. To this end, I began working with Dr. Adina Fischer and Dr. Tiffany Ho analyzing rsfMRI data for a longitudinal project examining teenage girls at familial risk for depression. We have found evidence for differential functional network activation in frontolimbic connections implicated in emotion regulation in those who were resilient to developing depression. Preliminary results from this project will be presented at the 2016 America College of Neuropsychopharmacology Meeting,[4] and are currently being prepared for publication.

**Future Goals and Broader Impact:** My long-term objective is to become a professor at a research university and direct my own research lab using developmental neuroscience to advance our understanding of both resiliency to early adversity and the neurobiological consequences of adversity. The NSF Graduate Research Fellowship will enable me to obtain a developmental neuroscience graduate education, where I will gain the theoretical knowledge and the analytical tools to inform my specific research questions. I plan to dedicate my career to furthering scientific understanding of infant neural development, characterizing features of resiliency in early childhood, and engaging in interdisciplinary work with experts in psychology, medicine, education, and engineering to create tools leveraging features of resilience in early childhood to improve individual and societal outcomes.

My research experiences have not only taught me the latest analytical tools that I will continue to use in graduate school and beyond, but also the importance of teaching and mentoring. I feel strongly that both teaching new generations of researchers and providing accessible resources to them are critical to the advancement of any scientifically based field. In keeping with this philosophy, I am currently mentoring five undergraduates, and I keep an open-access repository of all my functions, programs, and protocols on our lab servers. I have eagerly trained more than 15 undergraduate and post-baccalaureate research assistants in the basics of neuroanatomy, depression, and research methodology, and I designed a five-day course that covers anatomical MRI processing. I will teach this course for the first time this winter and will make all of the slides, functions, and materials publically available online. As my toolkit of scientifically sound methods expands and I develop more elegant analysis pipelines, I will continue to make all materials freely available online in a format that is accessible to a wide range of researchers (e.g., my GitHub page). I will continue to disseminate my work to the scientific community through attending and presenting at scientific conferences, publishing in top journals, and presenting my work within my academic community. Graduate school, and ultimately professorship, will provide the infrastructure for me to continue mentoring young scientists, particularly those from underrepresented groups such as women, minorities, individuals from low-income families, or who are first-generation college students.

***Select Publications*: 1**. Kircanski, K., Waugh, C.E., **Camacho, M.C.**, Gotlib, I.H. (2016). Aberrant parasympathetic stress responsivity in pure and co-occurring major depressive disorder and generalized anxiety disorder. *Journal of Psychopathology & Behavioral Assessment*. **2**. Sacchet, M.D., **Camacho, M.C.**, Livermore, E.E., Thomas, E., Gotlib I.H. (in press). Accelerated aging of the putamen in major depressive disorder. *Journal of Psychiatry and Neuroscience.* **3**. Humphreys, K.L., Sacchet, M.D., **Camacho, M.C.**, King, L.S., Colich, N.L., Ordaz, S.J., Ho, T.C., Gotlib, I.H. (in prep). Evidence for a sensitive period in the effects of early life stress on human hippocampal volume. **4**. Fischer, A.S., **Camacho, M.C.**, Ho, T.C., Whitfield-Gabrieli S., Gotlib, I.H. (in prep). Functional connectivity markers of resilience in adolescents at high familial risk for depression.