Developing new treatments for substance use disorder relies on a comprehensive understanding of the brain circuits contributing to addiction. My research is fundamentally focused on dissecting the neural circuit-specific effects of opioid signaling to provide a more detailed understanding of the neural mechanisms underlying opioid use disorders. The Matthew Osborne Postdoctoral Fellowship will allow me to apply my skills to tackle crucial, unresolved questions in the broader addiction field. I will be able to move beyond generalized views of circuit function to gain a granular understanding of how opioids impact reward pathways that are susceptible to dysfunction in opioid use disorder.

My academic background established a foundation in studying the impacts of early life exposure to drugs of addiction. In my post-baccalaureate and graduate work, I studied early life exposure to fentanyl and nicotine. I helped to develop a model of perinatal fentanyl exposure in mice which revealed long-term changes to the structure and function of sensory circuits and lasting impacts on behavior (J Alipio, **C Haga**, et al., 2021). I also established a developmental timeline of nicotinic modulation in fast-spiking parvalbumin-expressing neurons which are crucial for patterning early cortical circuits (**Haga** et al., 2025). Together, these studies provided key insights into how drug exposure alters neural circuit development and function, informing broader understanding of the neural adaptations relevant to substance use disorder. I have now shifted my focus to understanding the fundamental mechanisms in the brain that contribute to opioid use disorder in adults.

As a postdoctoral fellow in the laboratory of Dr. Barbara Juarez, I will bridge my expertise in electrophysiology with the application of innovative, circuit-dissecting techniques, specifically focusing on the neurobiological mechanisms of opioid use disorder. I will gain expertise in advanced methods that represent the new frontier in substance use research, including the application of CRISPR/Cas9-based gene editing tools, *in vivo* neural recordings, and optogenetics in advanced animal models of drug taking, withdrawal, and seeking. My goal is to become an independent investigator who can combine these advanced techniques in creative ways to answer important questions about substance use disorder across the human lifespan. My work focuses on understanding how diverse populations of dopamine neurons within the ventral tegmental area, a midbrain region central to reward processing, are differentially regulated by opioids to modulate drug taking and seeking behaviors. By systematically defining the function of opioid-sensitive dopamine circuits, this research will directly address fundamental, unresolved questions regarding dopamine function in addiction and substance use disorder.