How the brain can achieve extraordinary computations on a routine basis has sparked my curiosity for the longest time. This curiosity motivated me to pursue a career in research to understand how the human brain works. I first chose to do an undergraduate psychology in McGill for the university's strong empirical research background in psychology and neuroscience. To better understand how the brain computes information, I pursued my graduate education in neuroscience at McGill and researched the primary visual cortex. Next, I would like to further my understanding of brain computations even further by doing simulations of how plasticity rules shape cortical networks. Johns Hoskins would be the perfect university for me to pursue such a project due to its strength in computational visual neuroscience.

I am currently doing graduate research with Curtis Baker at McGill university on a project entitled "ON inhibition underlies stronger V1 responses to darkness". My project combines electrophysiology with machine learning to better understand how different inputs drive V1 responses. We predict recorded responses of V1 neurons to natural images with a biologically-inspired convolutional neural network which, like the early visual system, separately processes light (ON) and dark (OFF) information in two parallel pathways. This fitting procedure allows us to infer the amount of excitation and inhibition each neuron receives from both pathways. Using this approach, we show V1 neurons to receive much more ON inhibition than the three other types of inputs, especially at earlier time lags. These results explain why most V1 neurons are more driven by dark than by light stimuli (Yeh et al., 2009), and why V1 responses to dark are faster than to light stimuli (Komban et al., 2014). I have presented my research at the Society for Neuroscience (SFN) conference this year and intend to publish this work in an esteemed journal (such as Neuron, Journal of Neuroscience, or PL0S computational biology) in the near future. My graduate research not only taught me a lot about visual neuroscience, but also how to learn a new research field. I've learned how to be efficient and search the literature to ask the right research questions. This research also improved my computational skills and taught me how to apply machine learning approaches to answer neuroscience questions.

In my last year of undergraduate studies, my hard work allowed me to publish a first-author paper entitled "Modulating episodic memory alters risk preference during decision-making" in the *Journal of Cognitive Neuroscience*. This work taught me the autonomy required as a researcher to implement a research project from start to end. I also learned how to analyze and present data in a way suited to the scientific community.

For my PhD, I want to better understand how neurons' receptive fields are built from spike-time-dependent plasticity (STDP) learning rules. We have a good grasp of how connections between different types of neurons can be strengthened or weakened. However, our understanding of how such learning rules shape and improve cortical networks is still relatively poorly understood. I would like to use spike-time-dependent plasticity (STDP) learning rules in response to natural images to replicate the center-surround receptive fields of retinal ganglion cells and the orientation selectivity of V1 cortical neurons. I would also be interested in studying and modeling STDP in hippocampal structures. I believe such simulations would help us greatly in understanding how neurons become efficiently wired to process information.

Johns Hoskins would be a great fit for me due to its strength in theoretical neuroscience. I am especially interested in working under the supervision of either Ernst Niebur or Ed Connor, due to their ability to research visual neuroscience using computational models. I look forward to overcoming the challenges necessary to complete a PhD and what I will learn to prepare myself well to pursue a career in research.