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 both psychology and neuroscience. I then wanted to get a better grasp of how the brain computes information, which is why I pursued my graduate education in neuroscience at McGill to study 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. MIT would be the perfect university for me to pursue such a project due to its strong background in both computational and theoretical neuroscience.

I’ve had the chance to take many neuroscience courses at McGill such as “Human cognition and the brain”, “Behavioral neuroscience 2”, and “Topics in systems neuroscience”. These classes taught me about a variety of cortical systems and allowed me to get an overview what neuroscience is like across different fields. I’ve also developed a solid statistical background from classes such as “Statistics” and “Multivariate linear regression and ANOVA”. These classes taught me statistics from a mathematical perspective, which now grants me a deep understanding of how statistical tests work and help me greatly in analyzing data. Finally, I’ve challenged myself in my last semester of undergraduate studies by taking a graduate-level “Applied machine learning” course from which I’ve learned a variety of machine learning skills and techniques.

My undergraduate studies granted me solid research experience through research projects in three different laboratories. This is where I’ve learned to conduct rigorous research and to be critical about it. These experiences also got me to develop practical skills like R and Python.

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.

My statistics background has allowed me to develop teaching experience. I have been teaching students undergraduate statistics courses for a few years. I have also taught two workshops for graduate students on how to use R for statistical analysis. These teaching experiences have improved my ability to explain complex ideas and techniques.

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 to better understand how hippocampal structures are wired to encode space. I would also be interested to use STDP learning rules in response to natural images to replicate and understand how the visual system is wired. I believe such simulations would help us understand how neurons become efficiently wired to process the real world.

MIT would be a great fit for me due to its outstanding laboratories studying plasticity and computational vision. I am especially interested in working under the supervision of Ila Fiete, due to her expertise in modeling plasticity in hippocampal grid cells. I am also interested in working with James DiCarlo to better understand how the visual ventral stream processes complex stimuli. 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.