I. Contributions to research and development
a. Articles published or accepted in refereed journals

St-Amand, D., & Baker, C. L. (2023). Model-based approach shows ON pathway afferents elicit a transient decrease of V1 responses. *Journal of Neuroscience*, *43*(11), 1920-1932 (MSc work).

Sun, H. C., **St-Amand, D.**, Baker Jr, C. L., & Kingdom, F. A. (2021). Visual perception of texture regularity: Conjoint measurements and a wavelet response-distribution model. *PLoS Computational Biology*, *17*(10), e1008802 (Collaboration).

St-Amand, D., Sheldon, S., & Otto, A. R. (2018). Modulating episodic memory alters risk preference during decision-making. *Journal of Cognitive Neuroscience*, *30*(10), 1433-1441 (Undergraduate work).

d. Non-refereed contributions (e.g., specialized publications, technical reports, conference presentations, posters);

St-Amand, D., & Baker, C. L. (2019, October). On-afferent inhibition underlies stronger V1 responses to dark [Poster presentation]. Society for Neuroscience, Chicago, Illinois, USA.

St-Amand, D., & Baker, C. L. (2019, May.) System identification of single primary visual cortex neurons using machine learning [Oral presentation]. Biological & Biomedical Engineering Student Society, Montreal, QC, Canada.

II. Most significant contributions to research and development

a. Model-based approach shows ON pathway afferents elicit a transient decrease of V1 responses: In this work I showed that excitation and suppression of primary visual cortex (V1) neurons from the ON and OFF pathway have different temporal dynamics, with weaker suppression to dark than light stimuli at early latencies. This work is significant because it suggests a mechanistic explanation to the stronger V1 responses to dark than light stimuli.

The three years I've spent working in this project allowed me to develop both my machine learning skills and expertise in visual neuroscience. I got hands-on experience in machine learning by building my own, custom machine learning algorithm in Tensorflow. I also trained, fine-tuned and optimized this model to best fit the experimental data. After training the model, I analyzed the results and performed the statistical tests found in the paper. I then reviewed the literature to build a narrative that relates our findings to the rest of the literature. Finally, I wrote the entire first draft of the paper, and worked on further revisions with my supervisor.

The main target of this paper are visual neuroscientists, which is why we chose to publish this paper in the Journal of Neuroscience. Because I was about to start my PhD, we wanted to avoid spending too much time in the review process and did not aim for higher-impact journals.

b. Visual perception of texture regularity: Conjoint measurements and a wavelet response-distribution model: This psychophysics project studies the effect of jitter, texture size and texture spacing on the regularity perception of stimulus pairs using Maximum-Likelihood Conjoint Measurement (MLCM). While MLCM was previously used to study two variables when comparing stimulus pairs, our study was the first to simultaneously estimate the effect of three different variables.

As the group's statistical expert, I designed a new statistical framework to extend MLCM to test for two and three-way interactions in an experiment with three variables. I performed the MLCM statistical analyses, and wrote their relevant methods and results sections. This work was a collaboration with the Kingdom lab at McGill University, who performed the experiments and other analyses. Due to the computational nature of the paper, we chose to publish it in PL0S Computational Biology.

c. Modulating episodic memory alters risk preference during decision-making: This research was my undergraduate thesis project, which I performed under the direct supervision of Dr. Otto. In this project, I found that episodic memory can influence decision-making processes and reduce biases against risk. As the first-author of this project, I wrote the ethics proposal, programmed the computer task, ran the experiment, analyzed the data, wrote the first draft of the paper and did further revisions. Learning how to execute a research project on my own as an undergraduate student was challenging but greatly helped me develop my autonomy and sparked my interest for research. This project was a collaboration with Signy Sheldon at McGill University, who mentored me on how to do the experimental manipulation. My supervisor at the time (Dr. Ross Otto) got an invitation from the Journal of Cognitive Neuroscience, and selected my project to submit to that journal.

III. Applicant's statement

a. Relevant experience: I initially developed a solid computational expertise during my Bachelor's by taking many advanced courses in statistics, programming and machine learning. I was further able to develop my expertise in programming and machine learning during my Master's, by building and training my own custom, biologically-inspired convolutional neural network in Tensorflow. By doing research on the primary visual cortex for three years, I also developed a solid grasp of visual neuroscience research. Thanks to my expertise in both machine learning and visual neuroscience, I am an excellent candidate to research how retinal physiology can be explained from efficient coding principles.

b. Relevant activities: I've had many opportunities to develop my communication skills throughout my research career. In 2019, I've presented my MSc work twice: as a poster at SFN and as an oral presentation at McGill's Biological & Biomedical Engineering conference. This year, I've had the opportunity of giving a 30 minutes presentation about a computational vision paper (Maheswaranathan et al., 2023) at an auditorium in front of the entire Neurobiology department at Duke University. I am proud to see my research presentation skills improve with each and every presentation.

I've been able to develop my teaching skills early on in my research journey. From 2016 to 2018, I was a private tutor for undergraduate students in statistics at McGill University. Through tutoring, I've learned to put myself in the shoes of my listeners and simplify mathematical concepts to make them feel more natural to a general audience. In 2019, I further developed my teaching skills by giving an R workshop for neuroscience graduate students at McGill University.