**STATEMENT OF PREPARATION**

**Relevant Experiences**

Physiology and neurology have captivated me since neuropathy (damage or dysfunction of nerves) began impacting my life at 12 years old. In the years since, I have been decoding data from electromyography (EMG ; measures the activity of sensory and motor nerves) and reading journal articles to learn about neurotransmitters and how factors like medications and stress influence them. I have become acutely aware of the connection between the nervous system to all our other systems, such as the muscular system, and the reciprocal relationships between these systems, stress, and appetite. Taking my history into account, it is no surprise that at 17-years-old, I sat in the front row of Dr Crosby’s Foundations of Biology (BIOL-1001) lecture where I learned about her research and realized that I wanted to research neurophysiology with Dr Crosby for my eventual Honours project.

My passion for physiology and healthcare is reflected in my work as a MtA student athletic therapist, lifeguard, and first aid instructor. Through these experiences, I have seen first-hand the observable effects of the nervous system, and how it responds to stress, and well as developed problem solving and communication skills. Through my experience as a peer tutor and teaching assistant for the Biology, Chemistry & Biochemistry, and Math Departments, I have been able to practice laboratory skills and scientific communication. To balance these roles and their responsibilities, I utilize effective organization and time management skills, which will contribute to successfully managing the multifaceted demands of research.

In Environmental Physiology & Biochemistry of Animals (BIOL-4201), I learned about adaptations of various systems, including the nervous system, under extreme conditions, and dedicated time both inside and outside of class to analyzing and understanding scientific journal articles. In Enzymology & Metabolism (BIOC-2001) and Protein Biochemistry (BIOC-3521), I practiced a variety of laboratory techniques, such as preparing solutions and assays. In Environmental Microbiology (BIOL-3111), I developed, conducted, and analyzed data for a term project on antibiotic resistant bacteria in Sackville Waterfowl Park. This project allowed me to take the next step in lab work and become more self-directed and independent and taught me the importance of open research and audit trails. Animal Form and Function (BIOL-2401) taught me about the structure, function, and evolution of the animal nervous system, from sponges to humans, as well as dissection skills I will need for this project. Intro Design & Statistical Analysis (BIOL-2701) taught me how to interpret and apply statistics in biology, and how to use the software I need to analyze data for my Honour’s thesis.

I am currently taking Human Physiology (BIOL-3211) and Human Anatomy (BIOL-3221), both of which have units focusing on the brain and nervous system, providing a strong foundation on the human brain, which provides the rationale to this research. In Research in Neuroscience (BIOL-4591), an independent study supervised by Dr Crosby focusing on the effects of cold stress on neuronal communication, I have begun learning the laboratory techniques that I will use for my Honours research and I already completed Canadian Council on Animal Care modules as part ofAnimal Ethics Training at Mount Allison. This independent study will allow me to practice sharing my findings in new formats, such as in a poster during the 2025 Biology Honours Day.

**Connection to Long Term Goals**

Not only have my experiences and interests led me to this point, but they have allowed me to acquire the skills, background knowledge, and determination I need to be successful in this work. This independent research will be the start of my Honours Bachelor of Science in Biology (to be completed during the 2025 – 2026 academic year), supervised by Dr Crosby, during my fourth and final year. I ultimately plan to become a family medicine physician. My experience with this research and scientific communication will prepare me to be a healthcare provider who will help Canadians manage stress and appetite. I hope to be able to use research that I contribute to, for the benefit of my future patients.

**The effect of repeated stress on excitatory neurons in the female rat dorsomedial hypothalamus.**

**Background**

Over the past five years, people worldwide have experienced significant stress and uncertainty. Stress hormones motivate the intake of comfort foods, potentially as a coping mechanism (Dallman, 2003). Davies et al. (2023) found females were at higher risk for pandemic stress-induced binge eating, withfemales ages 10 to 19 being the most affected (Auger et al., 2023).

Sex differences in food intake are also observed in rodent models of emotional stress-induced binge eating. A study by Anversa et al. (2019) found that female rodents with unrestricted food access, and no previous history of food restriction, ate 72% more when subjected to chronic stress than their unstressed controls. This change was not seen in male rodents with the same unrestricted food access (Anversa et al., 2019). Although there is a clear link between stress and appetite in rodents and humans, the mechanisms are poorly understood. The dorsomedial hypothalamic nucleus (DMH) is an ideal brain region to study the link between stress and appetite for two reasons. **1)** cells in the DMH have receptors that allow them to respond to stress hormones (Myers et al., 2014) and **2)** the DMH is very important in appetite and body weight regulation (Bellinger and Bernardis, 2002). The main objective of our study is to determine the effect of repeated stress on DMH neurons of female rats.

**Experimental Design**

Once approval from the Mount Allison Animal Care Committee is obtained, female Sprague-Dawley rats will be separated into two groups, **i)** unstressed controls, and **ii)** repeated stress. Groups will have unrestricted food access, and the repeated stress group will undergo five consecutive days of 30-minutes of physical restraint, a well-established stressor (Patchev and Patchev, 2006). In both groups, we will measure food intake, and take blood samples to measure corticosterone (the stress hormone in rodents) levels. Following the fifth day, both groups will be anesthetized and euthanized, then their brains will be removed. The brains will be sliced, and their neurons will be kept alive in oxygenated artificial cerebrospinal fluid. Using patch clamp electrophysiology, we will study **i)** the amplitude and frequency of action potentials (to observe the effects of stress on neuron excitability), and **ii)** excitatory and inhibitory currents (to understand how stress affects communication between neurons in the DMH). A total of ~8-10 neurons/group and ~2 neurons/brain will be used for each experiment.

**Expected Outcome**

The relationship between stress and appetite is complex, with chronic stress both increasing and decreasing food intake in rodents and humans. Because DMH neurons can stimulate appetite, it is possible that repeated stress will increase their excitability and enhance neuronal communication that could lead to increased food intake.

**Impact/Significance**

Electrophysiology studies commonly use rats to gain insight into human brain function, but the majority of studies use male rats, despite clear sex differences in appetite regulation in humans. Our research aims to answer the question how does repeated stress in young female rats affect the synaptic transmission of neurons in the DMH that regulate appetite? By addressing this question, we can lay the foundation for further research on females and sex differences.

**References**

Anversa, R. G., Campbell, E. J., Ch’ng, S. S., Gogos, A., Lawrence, A. J., & Brown, R. M. (2019). A model of emotional stress‐induced binge eating in female mice with no history of food restriction. *Genes, Brain and Behavior*, *19*(3), e12613. <https://doi.org/10.1111/gbb.12613>

Auger, N., Steiger, H., Luu, T. M., Chadi, N., Low, N., Bilodeau‐Bertrand, M., Healy‐Profitós, J., Ayoub, A., Brousseau, É., & Israël, M. (2023). Shifting age of child eating disorder hospitalizations during the Covid‐19 pandemic. *Journal of Child Psychology and Psychiatry*, *64*(8), 1176–1184. <https://doi.org/10.1111/jcpp.13800>

Bellinger, L. L., & Bernardis, L. L. (2002). The dorsomedial hypothalamic nucleus and its role in ingestive behavior and body weight regulation. *Physiology & Behavior*, *76*(3), 431–442. <https://doi.org/10.1016/S0031-9384(02)00756-4>

Dallman, M. F., Pecoraro, N., Akana, S. F., La Fleur, S. E., Gomez, F., Houshyar, H., Bell, M. E., Bhatnagar, S., Laugero, K. D., & Manalo, S. (2003). Chronic stress and obesity: A new view of “comfort food”. *Proceedings of the National Academy of Sciences*, *100*(20), 11696–11701. <https://doi.org/10.1073/pnas.1934666100>

Davies, H. L., Hübel, C., Herle, M., Kakar, S., Mundy, J., Peel, A. J., Ter Kuile, A. R., Zvrskovec, J., Monssen, D., Lim, K. X., Davies, M. R., Palmos, A. B., Lin, Y., Kalsi, G., Rogers, H. C., Bristow, S., Glen, K., Malouf, C. M., Kelly, E. J., … Breen, G. (2023). Risk and protective factors for new‐onset binge eating, low weight, and self‐harm symptoms in >35,000 individuals in the UK during the COVID ‐19 pandemic. *International Journal of Eating Disorders*, *56*(1), 91–107. <https://doi.org/10.1002/eat.23834>

Myers, B., Mark Dolgas, C., Kasckow, J., Cullinan, W. E., & Herman, J. P. (2014). Central stress-integrative circuits: Forebrain glutamatergic and GABAergic projections to the dorsomedial hypothalamus, medial preoptic area, and bed nucleus of the stria terminalis. *Brain Structure and Function*, *219*(4), 1287–1303. <https://doi.org/10.1007/s00429-013-0566-y>

Patchev, V. K., & Patchev, A. V. (2006). Experimental models of stress. *Dialogues in Clinical Neuroscience*, *8*(4), 417–432. <https://doi.org/10.31887/DCNS.2006.8.4/vpatchev>