

Matthew Downer: *Self-Directed Learning Award 2018*

Background/Context: As far back as I can remember, I had a deep passion for sport and exercise and participated in everything I could. Exercise was always an integral part of my life, allowing me to maintain physical health as well as provide me with many social groups. Throughout my youth, I played on multiple sports teams and was uncertain as to how I would use my love of sport and exercise in an academic setting. I had little idea at the time of what I wanted to pursue professionally, however I always hoped that physical activity could play a role in some fashion.

It was during high school that I discovered my second passion in life: *neuroscience*. I vividly remember sitting in psychology class at Gonzaga High School when we began the fourth chapter titled *The Brain* – I was hooked. As I started to pursue post-secondary education, I made the decision to study neuroscience in the Faculty of Science to pursue this second passion at Memorial.

In my first years at MUN, I worked through entry-level classes and began to formally grasp the fundamental principles of neuroscience. I continued to read supplementary material in the field, exploring various sub disciplines to try to find a niche that suited my interests. At the start of second year, I volunteered in Dr. Christina Thorpe's with the aims of gaining a greater knowledge of research and the cellular basis of neural transmission. Through this early work, I built my knowledge of the basic science that would prove to be a vital background for me later in my career.

As I worked through this time at university, I continued to involve exercise in my life in many ways. I played in the local junior hockey league over the school year and joined ultimate frisbee teams over the summer. I began coaching for the *St. John's Special Olympics* in my first month at MUN, coaching floor hockey in the winter and golf in the summer. It was through this experience that I discovered how fulfilling combining my two main passions could be. By coaching sport and exercise to individuals living with disabilities and neurological conditions, I applied my knowledge from both areas to help these athletes strive towards their goals. This work has been the most purposeful and meaningful work I have done in my life.

After realizing how much I enjoyed and learned from these volunteer experiences, I decided to further pursue this concept in my academic and research career. I contacted Dr. Michelle Ploughman, a neurorehabilitation researcher in the Faculty of Medicine to express interest in her work using exercise to help individuals with brain recovery. I began volunteering in her lab in January of second year, and have had the pleasure of being a team member in the lab to this day. It was during these early months that I started working on my own project with the support of Dr. Ploughman answer my own research questions.

Project Description: My research project examined a unique phenomenon that occurs in people living with multiple sclerosis (MS), a demyelinating condition of the central nervous system. People with MS (PwMS) often have difficulties doing multiple things at the same time, such as

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attempting to do a motor task (walking or other exercise!) with a cognitive task. This is also called *Dual Tasking*, and has been found to impact the quality of life of those living with MS around the world. My project was among the first to look at how people with MS may have cognitive declines during this type of task, such as walking and talking. The protocol involved having participants complete a cognitive assessment while sitting and once again while walking to see if any changes in thinking had occurred. With the help of my fellow lab members, I worked to review the relevant literature and worked with participants to collect data over the course of several months. In the end, we found that people with MS showed a significant decrease in thinking ability while walking, whereas the healthy controls did not. This was the first finding of this nature for this type of task in the MS population, and our team then worked to spread our findings to the greater community once our results were complete.

Learning Outcomes and Resources: My personal learning outcomes from this project included the invaluable experience that accompanies implementing and conducting my own research project. This included learning about research design, creating proposals, collecting data, and disseminating my research findings. I learned on my own the intricacies of clinical research at a very young point in my career by seeing this project through from start to finish. Beyond personal learning outcomes, the overarching goal was to allow the scientific and MS community to learn more about this unique phenomenon and to learn more about the disease itself. As a result, a key goal for this project was to present and publish our findings to communicate our new knowledge to the world, making my own contribution to the field and the MS community.

Further, I must acknowledge the resources that were required to complete a project of this nature. I have discovered that the greatest strategy in any research project is teamwork, as this project would have never left the initial stages without a great deal of help. First and foremost, Dr. Ploughman has been a tremendous wealth of knowledge for me in the field and provided guidance at each step during the process. Second, the *MS Society of Canada* provided both financial support and a network of connections in the field that allowed me to further explore and develop my research. Further, I used several resources through the Department of Psychology and the many faculty members that have wonderful support for their students. Specifically, I had to use the program's courses and faculty to build my neuroscience and research knowledgebase to complete the project.

Project Successes: At its conclusion, myself and the team at the Recovery and Performance Lab concluded the study that was a great success. This project has been one of the most rewarding academic and professional work of my career, and I owe many thanks to all those involved since its inception. My research proposal was accepted as one of six in Atlantic Canada to be funded as

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I undertook an *endMS Summer Studentship*, using the funds to collecting data and recruit participants. Without their support, this project would not have been possible.

After collecting the data over the summer in 2015, I have presented my results at multiple meetings on the local, regional and international level. I shared my findings with the local research community at MUN Medicine's *Biomedicine Symposium* in 2015. Later that year, I presented at the *Atlantic endMS Research Retreat* and I was honoured with the Top Presentation Prize, competing against students at the undergraduate, masters and doctoral level. In November 2016, I had the incredible opportunity to present my project at the *Society for Neuroscience* conference to an international audience in San Diego, California. This opportunity was made possible by a *Faculty of Undergraduate Neuroscience (FUN) Travel Award*, as my work was selected as one of twenty undergraduates in North America to be funded. We also achieved a key goal when the project was accepted for publication in the summer of 2016 in the journal *Human Movement Science* accepted. Presently, the project has been read in every continent in the world and continues to grow to other research groups today.

Project Benefits: From a personal standpoint, this project has had considerable significance for my personal career. I learned how to use my collaborator skills in a novel professional and research setting, and through this work made many close relationships with all my lab members. Further, I benefitted by having the opportunity to meet individuals in the field both at home and across the world. Through this, I developed a much deeper understanding of the field of clinical neuroscience. This proved to be exceedingly valuable to me for my career as it helped me achieve a longtime career goal: *acceptance into medical school*. As I have recently completed my first semester at MUN Medicine, I have gained a great appreciation of how this project has taught me the value of effective research integrated into clinical practice. As I move forward in my medical career, I am confident that the skills I developed through this venture will be essential as I move forward in both research and practice.

In a broader sense, this project benefitted both the research field and the MS community. First, our work allowed PwMS have a better understanding of their unique thinking deficits while multitasking, particularly walking, which occurs in everyday life. As a result, we hope these individuals can be more cognizant of this problem to help avoid falls or cognition issues while walking. In the future, this project will help both patients and clinicians by providing greater knowledge that MS cognition issues may not be detectable using a standard sitting pen and paper test. Through this, clinicians and researchers in the field can work create more holistic measures for comprehensive and accurate measurement of cognitive ability. Lastly, our findings provide the field with new understanding of MS as a neurological disease by identifying these unique deficits.