

Undergraduate Student Fights Against Epidemic of Heart Disease in Canada

Fourth-year biochemistry student Matthew Stecy completed his Honours project and gave his final presentation April 7, 2018. His research project, entitled *Regulation of Scleraxis by microRNA* investigated whether the production of the protein scleraxis, which promotes the development of cardiac fibrosis, can be inhibited in live mouse cells.

“Learning hands-on how the whole [research] process works has been really valuable for my own personal development. Pursuing a career in medicine, I think it’s really important to understand the fundamentals. There’s so much new research coming out and I think it’s really important for physicians to keep up to date,” Stecy said.

Cardiac fibrosis is a heart condition whereby fibroblast cells in the heart overproduce extracellular matrix (ECM) proteins. ECM proteins normally help give structure to tissues of the heart, but when overproduced, as in cardiac fibrosis, the tissues of the heart thicken beyond normal and make it difficult to pump blood. This overaccumulation of ECM, over time, not only leaves the tissues rigid but it also leaves the heart exhausted from being overworked.

Stecy started working in the laboratory of Dr. Michael Czubryt, molecular pathophysiology professor at the U of M Department of Physiology and Pathophysiology. Dr. Czubryt’s lab, at the St. Boniface Hospital Albrechtsen Research Centre, studies how genes influence heart diseases. With the aid of sophisticated technologies, they study the genes that may be involved in normal and abnormal heart conditions. Dr. Czubryt and his team were the first to identify the scleraxis protein as an activator of the production of the ECM protein collagen whose overproduction contributes to cardiac fibrosis.

“I love that [Dr. Czubryt] is doing research that has practical applications that relate to the human body,” said Stecy on why he chose his research topic. “I relate much better to humans and diseases, and that’s what interested me.”

Taking advantage of the current knowledge of how microRNAs regulate messenger RNAs, Stecy’s research tested the interaction between miRNA-7087 and scleraxis. He also wanted to see whether the production of scleraxis messenger RNAs and scleraxis protein can be inhibited in live mouse cells. While previous studies have investigated the role of microRNA and messenger RNAs in cardiac fibrosis, the role of miRNA-7087 in regulating scleraxis had yet to be, until now. *In silico* mathematical models were used to decide which microRNA to choose, from a pre-existing database of microRNAs of possible regulators of scleraxis.

“We used three different programs, and they all identified miRNA-7087 as the front runner, and so it was a pretty obvious choice to investigate how it works,” Stecy explained.

For undergraduate students, the prospect of starting and successfully completing a research project is often daunting. But students must realize that they will be working in the context of a much larger project, and under the guidance of mentors who provide tremendous support all the way through.

“Reach out to people [whose research] you’re interested in,” is Stecy’s advice to students who might be interested in research. “Principal investigators and researchers on campus are typically really open to having students work for them. They love people who are interested in what they do.” He said students should not only go into labs for the experience, but also to find research that they are genuinely interested in.

Undergraduate students receive invaluable mentorship through working under senior researchers and principal investigators, but graduate students often also play a role in this mentorship experience. Matthew pointed out that PhD candidate Raghu Sundaresan, although not his principal investigator, was “instrumental” in the success of his project.

“I was really lucky to have awesome graduate students to teach me things,” stated Matthew as he recounted the benefits he gained from the research experience at Dr. Czubryt’s lab, starting last summer. “I would watch and learn, slowly becoming independent and helping with the graduate students’ experiments.”

The biggest challenge, for Stecy, was working with the NIH-3T3 mouse cell line because they were easily infected with foreign materials and had to be kept sterile at all times, using meticulous aseptic techniques.

“One little slip-up can lead to a week or two’s work down the drain,” he added. He acknowledged that his undergraduate microbiology courses gave him the foundation for that good technique. “The techniques I learned in those [microbiology, biochemistry, and organic chemistry] labs were really helpful.”

“Regardless of what I end up doing next year, I hope to continue in research.” Speaking generally about the advantages he gained through his research experience, and his future plans, Stecy said, “Having this experience — learning how to read and analyze papers, learning how statistics work, and whether you can trust the methods — are all important for where I want to go with my career.”

— David Zirangey

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