

Cornell Presidential Research Scholar, Michael Matly '03, Tracks Ion Channels in the Brain

Trying to figure out how the brain works—how humans generate consciousness, learn things, and are able to produce coordinated behaviors—is the basic research in the laboratory of Professor Ronald Harris-Warrick, Neurobiology and Behavior. These actions depend on neurons that have special properties, such as the ability to burst rhythmically, or rebound after inhibition, and these special properties depend on the ion channels that each neuron expresses. Ion channels open and close in response to signals, such as changes in voltage and neurotransmitters. They are what make neurons excitable. They are the molecular basis for neural function, and there are hundreds of different types of ion channels, each with specific properties that allow the neurons to fire in different patterns.

Harris-Warrick and his research group are studying a set of ion channels that is selective for potassium and others that are selective for calcium ions. A number of diseases are caused by mutations in ion channel genes that can cause various motor and other defects. “While our work is not aimed at studying disease specifically,” says Harris-Warrick, “it provides an important background of information about the brain which is needed before we can really understand these diseases.”

Cornell Presidential Research Scholar, Michael Matly '03, began his research in Harris-Warrick's laboratory last fall, working with Lauren French, a graduate student, on a project to map the distribution of a set of ion channels in neurons that have been identified in a small neural network. Matly locates these channels in the 3-D structure of a neuron, in order to determine where they are active in the cell. This involves making antibodies for peptide sequences of the channels, and then using the antibodies to label the ion channel proteins with a fluorescent tag. Then, the researchers can use a confocal fluorescence microscope to see where the ion channels are located on the cells.

The key aim of the project is to discover how the firing properties of neurons are regulated by the ion channels that they express. Contrary to common belief, neurons are not all alike; they vary considerably in their properties and thus in their activity in the brain. This variance results from the palette of ion channels that each neuron expresses in its membranes, due to selective activation of the genes for these channels.

Matly has always been interested in medical-related research. He has worked on numerous health care-related research projects, so he came

to Cornell with extensive experience. When he was a freshman in high school, Matly worked on a science fair project in his basement using *Daphnia*, a type of water flea with a transparent body, which makes it easier to monitor various functions such as heartbeat. Matly used *Daphnia* to study the relationship of diabetes and hypertension. He won his state science fair with this project and then competed at the international level. After this experience, he went on to conduct research on diabetes at the Department of Endocrinology and Metabolism at Indiana University Medical School. He then went to Purdue University, where he worked with neuronal regeneration in the Division of Neurobiology. Finally, he worked at Harvard Medical School in the Center of Neurological Disorders.

During high school, Matly was the only Intel Science Talent Search semi-finalist in the state of Indiana. He presented his research all over the country, traveling to Albuquerque, New Mexico; Tucson, Arizona; Research Triangle Park in North Carolina; and Anaheim, California, for the American Academy of Sciences national meeting, where he was made an honorary student member. Matly also spent a summer working at Eli Lilly Pharmaceuticals conducting research on transfectant prostate cancer cell lines in the Cancer Division.

Harris-Warrick says, “Michael had a lot of previous training, so he was able to come right into the lab and start up. We taught him our way of doing the experiments, and he has made significant progress already in his first year!” Matly's experience has been extremely positive. “Research is an amazing opportunity for a student to get involved in science, which is truly all around us,” says Matly. “It has provided me with an opportunity to see firsthand how progress in science and health care is created. Additionally, Professor Harris-Warrick has been more than a research mentor to me. He has been a friend. His support, caring advice, and extreme patience is a continuing catalyst for my interest and passion for the sciences.”

As for the future, Matly says, “I will definitely be involved in science and will continue to develop my career plan as I continue through my college years. I am very interested, at this point, in medicine and I am premed. However, research will play an intricate role in my career.” He may pursue an M.D./Ph.D., and he also wants to be involved in bioethics. “I am getting a new and intense interest in politics and am seriously

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Michael Matly

considering the Cornell-in-Washington program. Whatever my interests, I love people and will want to be involved with people on a day-to-day basis,” Matly says. Between research and classes, Matly found the time to form the Bio-ethical Society of Cornell, an organization whose aim is to “spread awareness on various opinions and issues in bioethics in a scholarly manner. It helps students to form their own opinions based on their moral values.”

The Cornell Presidential Research Scholars program has played a significant role in providing Matly with the resources and support to pursue his research interests. “The Presidential Research Scholar Program is one of the best things that happened to me as an undergraduate interested in science. The program's support, whether financial or other, has played a critical role in my decision to actively participate in research during my undergraduate experiences at Cornell,” says Matly. Matly spent this past summer continuing his research at Harvard Medical School, where he worked in the Center of Neurological Diseases. His research was supported entirely by the Cornell Presidential Research Scholars program. “It was a wonderful and exciting opportunity. What made it a reality was the Cornell Presidential Research Scholarship that provided me with the financial compensation I needed to live in Boston,” he explains.

“Cornell, and the opportunities it provides for students, is phenomenal. I know students in many other universities who would only dream of the opportunities I have been given,” Matly exclaims.

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