Research News

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Heart researcher to get national award

BY FRANK NOLAN
Research Promotion Officer

Heart researcher Michael Czubryt has been named as the recipient of the 2006 Young Investigator Award from the Canadian Cardiovascular Society. Each year, one award is given to an outstanding cardiovascular researcher who has been working at a Canadian university or hospital for less than three years.

He will receive his award during the Canadian Cardiovascular Congress being held in Vancouver from October 21 to 25.

Czubryt, physiology, works in the Institute of Cardiovascular Sciences located at the St. Boniface General Hospital Research Centre. His lab works with transcription factors – proteins that activate or repress genes. A major part of his research is focused on a particular family of transcription factors called MEF2.

"Muscle biologists have been interested in MEF2 for a long time, because it's expressed at high levels in all muscle tissue," Czubryt said. "My lab is focused on heart muscle, and we're very interested in the role that MEF2 plays in hypertrophy, or enlargement of the heart. We're looking at the good kind of hypertrophy, when the heart grows as a result of exercise, as well as hypertrophy due to pathologic factors, like high blood pressure and heart attack."

Czubryt's team is working to identify the genes that are regulated by MEF2, as well how it is regulated itself, and what other transcription factors it interacts with in heart muscle cells. They already know that MEF2 controls the proteins that cause heart muscle cells to contract, and that it regulates some of the important processes involved in energy production and energy usage in the cell.

"Our central theory is that MEF2 may provide a mechanism for the growing heart to up-regulate both the proteins that do the work in the cell and the proteins that provide the energy to do that work," Czubryt said. "We're trying to figure out if the function of MEF2 changes from development to diseases like hypertrophy and heart failure."

Czubryt's lab employs the latest transgenic mouse model technology, as well as an advanced microarray system that allows researchers to simultaneously examine thousands of genes to determine if they have been turned on or off by specific treatments.

"I was very fortunate to receive funding from the Canada Foundation for Innovation to purchase some key equipment, including the microarray system," he said. "Microarrays can be a goldmine for generating ideas, because they allow us to look at large sets of data, and depending on how we look at them, striking things can jump out."

Photo by Frank Nolan

Michael Czubryt, physiology, will be presented with the Canadian Cardiovascular Society 2006 Young Investigator Award during the Canadian Cardiovascular Congress next month in Vancouver.

Czubryt said the ultimate goal of his research is to create a better understanding of how energy metabolism is controlled in heart muscle cells, both in health and disease.

"We really need to understand how this works, and why diseases occur the way they do," he said. "Why do some people who develop hypertrophy go on to develop failing hearts, while others live out their days relatively normally? We don't know that, and it's something I'm very interested in learning."

Upcoming

Technology Transfer Office
presents
Pickerel & Patents

"Medical Device Inventions: Patenting Issues and Strategies"
with Dan Polonenko

September 27
12:00 noon - 1:30 pm
Theatre C
2nd Floor Brodie Centre
Bannatyne Campus

Includes a complimentary pickerel lunch. Seating is limited. R.S.V.P. required: phone: 204.474.6200 or email: tto@umanitoba.ca

Business of Science Symposium

October 25 & 26
The Fairmont Winnipeg

"From Idea to Execution: Understanding Critical Success Factors and Realizing Opportunities"

The Business of Science Symposium provides a forum to learn new strategies, hear the latest industry developments and create important relationships.

For more information visit their website: www.businessofscience.org

Physicists charged-up about DNA

BY FRANK NOLAN
Research Promotion Officer

A team of theoretical physicists at the University of Manitoba has developed a new model for how an electrical charge travels through DNA. Their research was published earlier this month in *Physical Review Letters*, the journal of the American Physical Society.

The team's leader is physicist Tapash Chakraborty, Canada Research Chair in nanoscale physics. He said scientists have been wrestling with the problem of charge migration in DNA since the double helix was discovered more than half a century ago.

"DNA is a fascinating, very intelligent molecule," he said. "It can self assemble, and with the recent developments in nanotechnology, there is a great deal of interest in its potential use as a molecular wire."

Researchers around the world have conducted a wide range of studies on the conductive properties of DNA. Some have found it to be highly metallic, while others found the molecule behaved like a semi-conductor.

"The results depend on whether the DNA is wet or dry, or whether it's a single strand or a rope, so it can be very complicated," Chakraborty said.

Previous research has shown that of the four bases that make up DNA – adenine, thymine, guanine and cytosine – guanine has the lowest ionization potential, meaning that it's easier to knock an electron off guanine. When this is done, a positively-charged guanine "hole" will move along the DNA strand until it reaches a "trap" made up of two or three non-charged guanines in a row. The other DNA bases act as barriers to this movement, but the hole can pass through them thanks to a quantum mechanical process called "tunneling."

Photo by Frank Nolan

Tapash Chakraborty, Canada Research Chair in nanoscale physics.

Earlier models suggested that when the hole encounters several barriers, it stops tunneling through them and begins to hop along the DNA strand. Unfortunately, this theory didn't explain some of the experimental results. Chakraborty's team suggested that since DNA is a double helix, the charge would more likely move over to the other strand and keep going.

"We said the charge could either move along the same strand or it can cross over to the other one, which we think is a more natural model," Chakraborty said. "We call it a 'multi-channel tunneling' model, in which the charge can tunnel all the way through to the trap, taking the path it finds easiest, and that could mean crossing over to the other strand."

Knowing whether DNA will conduct a charge is of more than just academic interest. Understanding exactly how a charge travels through DNA is very important to rapidly growing fields like nanotechnology, and it also has significant implications for medical research, particularly in understanding the process of DNA damage.

"It is well known that aging, many types of human cancer, and several degenerative neurological diseases are caused by mutations that happen when this DNA base, guanine, is oxidized," Chakraborty said. "It's very important to understand how this oxidative damage happens, and what physicists and chemists are doing, in the process of understanding how charges propagate, is describing the electronic properties of these mutational hotspots."

Bringing Research To Life

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