


## CANADA'S GOT (SCIENCE) TALENT

Researchers launch prize-winning strategy to attract students to medical research



He had just finished his freshman year at the University of Toronto, and Chi-Han Chang felt like packing his bags and returning to his native Taiwan. Living on his own for the first time, on another continent no less, Chang was homesick. He also wondered if he should have stayed in Taiwan, where he would have been able to earn his bachelor and medical degrees more quickly.

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“I was unsure whether medicine was a better path for my undergraduate education, or [whether] basic science [was],” says Chang, a fourth-year physics and chemistry student. “I was convinced to stay, because at that time I hadn’t done any research, and someone told me that I should do at least one research project before deciding to leave.”

The decision to stay in Canada would prove to be a critical one for Chang. He found one of his passions: research. The 22-year-old has spent the last two summers working with professors from U of T thanks to two undergraduate awards he received from the Natural Sciences and Engineering Research Council of Canada. “I’m really excited not just about the results, but the whole process of research,” he says.

Stimulating enthusiasm for science and discovery in students such as Chang is a priority for scientists at Sunnybrook Research Institute (SRI), who are mentoring the next generation of problem-solvers. Dr. Kullervo Hynynen, director of the physical sciences platform at SRI, says he thinks it’s important to give high-school and undergraduate students hands-on research experience. “When I was an undergraduate, I had no idea of the opportunities in research,” he says. To give younger students the opportunity to work in a lab, Hynynen and fellow SRI imaging scientist Dr. Rajiv Chopra offer summer placements to high-school students enrolled in the enriched math and science program at Toronto’s Marc Garneau Collegiate Institute, through its TOPS program, which stands for Talented Offerings for Programs in Science.

The physical sciences faculty at SRI last year launched another outreach initiative: the Sunnybrook Prize. This annual, national award recognizes excellence in undergraduate research. The idea for the award came out of staff meetings about a year ago. “The imaging scientists here have lots of students, including summer students, who are undergrads. They do important work, but sometimes it doesn’t link to a paper. We wanted to make a prize that would recognize their contribution,” says Hynynen, who holds the Canada Research Chair in Imaging Systems and Image-Guided Therapy and is a professor at U of T.

The prize is open to physical sciences and engineering students who are in their final year at a Canadian university, and who have completed a research project. The \$10,000 prize is funded by income generated by royalties from technology developed by SRI scientists. Dr. Graham Wright, director of the Schulich Heart Research Program at SRI and one of the competition’s judges, thinks the award is a worthwhile investment.

“We think it very important to encourage the top undergraduate students to consider research as a career option,” says Wright, who holds the Canada Research Chair in Imaging for Cardiovascular Therapeutics and is also a professor at U of T. “The value of the prize reflects our commitment to building this talent pool. The funding comes from revenues generated through companies spun out from Sunnybrook research. Those spinoffs wouldn’t have been possible without the type of students recognized by the prize. Such students were central to the founding of past spinoffs and will be critical to the development of an innovation economy in Ontario and Canada.”

In January, Chang and nine other students from universities across Canada were invited to SRI to present their work as part of the first competition. Sunnybrook Research Institute covered the travel and accommodation costs of the finalists who live outside Toronto. There was a diversity of projects that ranged from those tackling problems in basic science to those with an applied research focus. Although the students’ backgrounds were different, what they had in common was potential for success, as Hynynen said during his opening remarks at the competition: “Each of you has huge talent. You can be anything you want and make lots of money, but we need you. We hope you will work in science and make the contributions we all need.”

Each finalist had 15 minutes to present and answer questions from the judges. “I was a bit nervous, to be honest,” says Chang, who was the first presenter of the day. He described his research into the problem of entanglement in photosynthesis, a phenomenon in physics that supports the existence of long-range quantum behaviour in biology.

Cheryl Cui, an engineering student at U of T, showed no signs of fatigue even though she had caught a red-eye flight from Haiti in order to give her talk. Cui, who is interested in point-of-care medicine in developing countries, discussed her role in creating a device that captures and detects cancer cells. She says that taking part in the competition and hearing more about the research of SRI scientists,



LEFT TO RIGHT: DR. KULLERVO HYNYNEN, JONATHAN LIPSITZ, CHERYL CUI, CHI-HAN CHANG AND ERIC MOULT

particularly its translation to the clinic, reinforced her desire to pursue a career in research. “It got me more excited about medical physics. I knew I wanted to do research, but it gave me great exposure in terms of medical physics and imaging in particular,” Cui says.

Eric Moul, an electrical engineering student at Queen’s University, is also interested in the clinical impact of research in medical imaging. He was a finalist for his research into prostate brachytherapy, a treatment for prostate cancer in which radiation is delivered via radioactive seeds that are implanted in the prostate. For the last two years, Moul has been a member of the Laboratory for Percutaneous Surgery at Queen’s University. He has been working on an enhanced X-ray image computing technique that will allow clinicians to see the seeds and the prostate better during brachytherapy.

“It really grew on me,” says Moul about the project. “I never took biology in high school. I was more of a math and physics person. I really got into the interdisciplinary interaction between clinicians and engineers and biologists.”

The technology is now in clinical trials at Johns Hopkins Hospital in Baltimore, Maryland. “It has the potential to really make a difference. It sounds like things are going really well down there. It’s pretty exciting to make contributions to something that can be useful,” he says.

Although unrelated to medicine, Karl Ayton’s research project also impressed the judges. Ayton is a physics and chemistry student from Grant MacEwan University who travelled from Alberta to discuss his work. He and his supervisor,

Dr. Samuel Mugo, have developed plant-based waxes that can be substituted for petroleum products used in gasoline, asphalt and various consumer products. Mugo has filed for a provisional patent for the waxes.

“We don’t have a mass-produced product that’s ready to go on the shelves, but we have a prototype that we can further develop,” says Ayton, over the telephone from Edmonton. “It’s a step in the right direction in terms of environmental protection and sustainable, renewable resources.”

Following the presentations, Wright, Hynynen and the half-dozen other physical sciences faculty in attendance were charged with the unenviable task of selecting a winner. After a lengthy discussion and a vote to break a three-way tie, the judges reached their decision. “It was difficult choosing a winner. You are all stellar. You will have great futures. There is no doubt about it,” Hynynen told the group.

With the students on the edge of their seats awaiting the verdict, Hynynen announced Chang as the winner.

Wright says he was impressed with the quality of Chang’s work, as well as his communication skills. “They were all outstanding, but what stood out for me was his capacity to explain the concept. It’s very complicated physics, quantum entanglement. He conveyed the challenges and interesting aspects of the idea in a very effective way.”

Chang says it took a few days to recover from the shock and excitement of winning the award. “I was really surprised,” he says. “My research is related to transbiology, not medicine. I thought another person would win. I think it shows that SRI is open to several different disciplines.”

He isn’t the only student who thinks this. After touring the facilities, including the newly built Centre for Research in Image-Guided Therapeutics, Cui saw first-hand the interdisciplinary research that happens at an academic teaching hospital. “It’s a very unique environment where you have engineers working with clinicians,” she says.

Both Ayton and Moul are thinking about becoming clinician-scientists. Ayton says his visit to SRI helped him realize he has many career options. “I think a lot of students think that whatever degree they get, they’re locked into that for life. You can do a number of degrees but you can still end up doing what you like if you realize your tastes change.

Dr. Wright is certainly proof of that.”

Ayton was referring to a talk in which Wright shared his experiences with the finalists, along with some words of advice.

An engineer by training, Wright spoke of how much he enjoys medical research and why he finds it meaningful. “You are at a critical stage in your education where you have choices to make about your future. Hopefully that choice is driven by what’s going to be satisfying at the end of the day. Health research is not just about coming up with a neat idea, but the opportunity to see that idea used for the benefit of patients.”

As for Chang, he hasn’t ruled out medical school, but he says his PhD will come first and that winning the Sunnybrook Prize has helped him see he is on the right track. “This is definitely an encouragement to pursue interdisciplinary research—integrating different sciences for useful applications in either biomedical science or other disciplines.”

For all of the finalists of this year’s prize, the future is wide open. — Alisa Kim