Unlocking science's secrets

Einstein College's Irish professors research cancer, genetic diseases

By Peter McDermott
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If you don't believe in evolution, then go to work in a cancer lab for a few months and you'll soon change your mind.

That's the view of Hayley McDaid, one of several Irish-born researchers on the faculty at the Albert Einstein College of Medicine of Yeshiva University in the Bronx.

"Cancer cells want to mutate and change to survive," said the Strabane, Co. Tyrone native. "One cancerous cell alone has 22,000 changes at the DNA level."

"It's a huge challenge," she said about her own specialty. "There are so many different types of lung cancer.

"The organ itself is complex; that's why the disease is so complex," added McDaid, who came from Northern Ireland to New York in 1998.

Far simpler is the message that she would like the general public to hear - smoking kills. For McDaid, it can't be said often enough.

"Ireland is the first country were women are smoking more than men. So this message is not getting through to the female population for some reason," she said. "It's a huge concern."

McDaid, who is married with one child, knows well the stigma that the lung cancer patient suffers. Her father died of the disease in 2001. It remains the No. 1 killer in America and worldwide, and even if one excluded those victims with a smoking history, it would rank 6th in the number of cancer fatalities in the U.S.

PHOTO BY PETER MCDERMOTT

From left: Dr. Michael Keogh (who is from Athlone, Co. Westmeath), Dr. Hayley McDaid (Strabane, Co. Tyrone), Dr. Paraic Kenny (Templemore, Co. Tipperary) and Dr. John Greally (Galway City) are all faculty members and researchers at the Albert Einstein College of Medicine of Yeshiva University.

"But the funding doesn't reflect that. I feel strongly about that," said McDaid, a recipient of grants from Joan's Legacy and the LUNGevity Foundation.

"Phenomenal progress has been made, particularly with regard to the non-smoking segment of the population," she said. But she believes that the "underdog population," patients with a smoking history, deserve better.

McDaid's dedication to science dates at least as far back as her mid teens. At age 16 in the British system, high-school students are required to narrow their focus academically. She picked three science subjects. She went on to Queen's University in Belfast, where in her second year, she took a course on the genetics of cancer given by Ivor Hickey.

"He just completely inspired me," she said of an academic who now teaches at St. Mary's College, a Queen's affiliate. "He was absolutely outstanding."

McDaid completed her doctorate at Queen's before joining Einstein. In contrast, some of her Irish colleagues on the college's faculty studied for their advanced degrees abroad.

Paraic Kenny, who comes from Templemore, Co. Tipperary and graduated from University College Cork in 1998, was awarded his doctorate for studies on mouse mammary cancer biology from the Institute of Cancer Research, University of London in 2002. He did post-doctoral research at Berkeley for six years before joining Einstein's staff last year.

Kenny, who got married in June, was initially intent on becoming a medical doctor but changed his mind before applying to university. "I asked myself whether I might make a bigger impact by actually becoming a scientist and getting involved in basic research," he said.

Making faculty

Michael Keogh, assistant professor at the Department of Cell Biology, also left Ireland in pursuit of advanced degrees and research opportunities. After he graduated from NUI, Galway, in 1988, the Athlone, Co. Westmeath, native studied for his M.Sc. at Brunel University in London, and for his doctorate at Imperial College, which he completed in 1995. He then did 11 years of post-doctoral research, first at the Thrombosis Research Institute in London and then at Harvard Medical School. He joined Einstein in 2006, where he works in the area of colorectal cancer and general research. His girlfriend, a microbiologist from England, got a job there a few months later.

"She has her own lab," Keogh said. "It's much bigger than mine. They gave her more real estate. I'm so envious."

He said that graduate students interested on pursuing an academic career must first do some do some serious thinking.

"If they're not certain they want to do it, they shouldn't," said Keogh, who does "amazing work" according to his colleague John Greally, a Galway native.

"We really do try to scare them straight," he added with a laugh. "It can be a horrible job. But when it's working well, it's the best job on Earth."

The downside is the amount of work and years needed to succeed. "And sometimes, it doesn't matter how hard you work if you're unlucky in your choice of projects," he said.

He compared science to a pyramid scheme. "Very few get to be faculty," he said.

A few years ago, Keogh and his girlfriend were confident that they were on the right track for jobs. It was stressful, nonetheless, traveling around the country doing interviews.

"They give you quite a lot of

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From the lab to the bedside

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Cures for the various cancers and some other major diseases remain elusive in the early 21st century.

But if there have been few big breakthroughs, some point to the cumulative effect of small victories.

"We've made a lot of strides in the last five to 10 years in terms of early detection," said Paraic Kenny, who specializes in breast cancer research.

New understandings of the cancerous cell have suggested better targets and smarter types of drugs, he said.

"Things are getting better, definitely," he added.

Kenny made an early calculation that he could accomplish more good by working as scientist in a laboratory than as a doctor in a hospital ward. His career choice ultimately led him to Albert Einstein College of Medicine, which has 2,000 faculty members and more than 300 research labs. He's also part of a broader research community that is committed to sharing the scientific knowledge it has gathered.

That ethos is reflected in public policy. "When you get funding for a specific project from the National Institutes of Health, they require that you share," said researcher John Greally, referring to a federal agency that dispenses billions of dollars annually.

Research takes time, though.

"It has to go through a rigorous process before it reaches the bedside," added Greally, a qualified medical doctor who joined Einstein in 2001. "But at least we can start the process in a way that we weren't able to previously."

It isn't such an abstract question for an institution that trains doctors for the real world.

Said Kenny: "We always have a strong eye in the lab towards translational opportunities — essentially how can things we're doing right now be translated quickly for the benefit of women with this disease."

The County Tipperary-born scientist gave an example. Breast cancer cells, he explained, have proteins on their surface that act as antennae, listening for signals in their surrounding environment. These antennae sense proteins called "growth factors" that transmit a signal into the cell, instructing it to divide.

"We think one of the big problems in the most common types of breast cancer is excessive activity of one of these growth factors," he said. That growth factor, he believes, is a protein called amphiregulin.

"We've got translational work in this in two areas," Kenny said.

The first concerns the "scissors" that cuts amphiregulin to activate it. He has identified the enzyme that plays that role and is testing drugs that would counter it.

Secondly, amphiregulin, which is soluble, is not found in large amounts in women who don't have cancer.

"We think that if we can measure it effectively, we can develop an effective blood test for this type of tumor," Kenny said.

PHOTO BY PETER MCDERMOTT

Dr. John Greally pictured in the lab with colleague Dr. Bernice Morrow, director of Einstein's division of translational genetics.

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money when you start," Keogh said about faculty positions. "And they give you an opportunity to set up a lab and fund it for three years.

"They do a lot of due diligence before they offer you the job," he added. "They want to know you are ready for the next step, because before this you were operating under somebody else's protection."

Finding the gene

Keogh said that students usually press ahead with their plans in spite of his words of warning. "They've more imagination than me about fallback careers," he said.

Some former postdoctoral students go into patent law, while others find research work with drug companies. A few study to be medical doctors.

John Greally, who directs the Einstein Center of Epigenomics, took the path in the opposite direction: he was a practicing physician before becoming a researcher. After graduating in medicine from NUI Galway in 1988 (he later got his doctorate there in 1999) he did a residency at Children's Hospital of Pittsburgh for Pediatrics and then went to Yale University in 1993 for subspecialty training in clinical genetics.

Greally said it became frustrating treating children with genetic conditions. Medicine, though, was on the threshold of something big . "There was this great promise that the human genome project was going to revolutionize what we were going to do," he said.

"Ten years ago, you knew that there had to be something genetic going on but the chances of finding the gene were almost zero," Greally said. "Now, they can go hunting for the mutations that could be causing problems with autism or any other genetic disorder.

"We're standing in this completely new era. The technologies are there - we just need to do the experiments," said Greally, who is an associate professor in two Einstein departments, Genetics and Medicine.

His science specialty is epigenetics, the study of how genes get switched on and off. He explained that a cell may need a gene to switch on for it to function properly — in order to produce protein for example — and the failure to do so can be as bad as a mutation.

"We are now realizing that this freezing of the gene in the off-position and equally inappropriately in the on-position, when that's not the way it should be, that these things underly human diseases," he said.

Greally reflected for a moment on the pace of change he has seen in science. "It used to be that we'd say we don't know what's going to happen in five years; now we say we don't know what's going to happen in three years," he said. "The information is coming in at a much faster rate that it ever used to.

"We're getting insights almost at a rate that we can't handle," he said, adding that scientists now need computer programming skills to do their jobs.

Staff members, though, don't sit alone in front of the computers all day. "People are very interactive. Everyone talks to each other and discusses ideas. Doors are always open," he said. "It makes it a very pleasant atmosphere in which to work."

McDaid described Einstein as an intellectual hub. "People are very warm and there's such wisdom here. " she said. "They want to see people succeed. In some places the competitive streak can impede progress. At Einstein, the competitive streak is there, but it's there to foster collaboration."

She had spent all in her undergraduate and postgraduate career at Queen's and the move a decade ago to a different type of institution and a different country represented a dramatic change for her.

"I don't think you settle down until the first six months or a year," McDaid said. "I was culturally extremely naïve. I'd never even met a Jewish person until I came to Einstein."

She was never far from people from her homeland, however.

"There's been a great history of Irish people working at Einstein and it's continuing today," Greally said. He cited in particular George Orr, a Northern Ireland native who was a faculty member for 25 years until his death in 2005. "He left a huge mark on this place," he said.

"There are trainees from all parts of Ireland," said Greally, including two who are working with him.

He regards that presence as part of the great Bronx Irish story that includes Gaelic Park and Katonah Avenue.

Greally and his wife, Geraldine McGinty, who is also a medical doctor with advanced degrees, are regular visitors to their native Galway.

McDaid, like the other Irish professors at Einstein, keeps in close contact with home. "There's just the three of us here," she said about her 6-year-old daughter and her husband, a former construction worker who went back to college to study to be a nuclear medicine technologist.

"I'm really lucky to have a very supportive husband, and that's necessary if you're a woman and have this career," she said.