
Biochemistry – The McMaster Way

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Something amazing happened 40 years ago. And no, we're not talking about the last time the Leafs drank from Lord Stanley's Cup. What we're talking about didn't receive quite the same fanfare – no real celebrations, street parties or parades – but amazing, nonetheless.

It was in 1967 that McMaster's Department of Biochemistry was born. And while its birth was a fairly quiet event, what happened over the last 40 years has given much cause for celebration.

Over the last four decades, the department grew both in size and stature – indeed, it's recognized as one of the top centres for life sciences research in North America. Some 1600 students have graduated; more than \$100-million was awarded in research grants, hundreds of honours and accolades were awarded to faculty and students for their scientific contributions, and world-class, state-of-the-art laboratories now line the corridors.



A 1969 photo of the late Professor Thomas Neilson. Today, the Thomas Neilson Scholarship is awarded yearly to top McMaster Biochemistry graduate students on transfer to the Ph.D. programme.

So, how exactly did the department get its start? It was the year before, in 1966, that McMaster opened its flagship school of medicine. It was under the leadership of John Evans, the school's first dean, that a group of innovative educators developed an undergraduate medical program that stirred controversy and defied convention by emphasizing self-directed learning.

But McMaster was missing a key component common to all medical schools – a department of biochemistry. While the core work was taking place in the departments of chemistry and biology, a decision was made to form the department and bring the existing work together under the new banner.

After an exhaustive search, Dr. Ross Hall, a cell biologist who completed his doctorate in biochemistry from Cambridge University under Nobel Laureate Lord Todd, and his post-doctoral work under Nobel Laureate Gobind Khorana, was recruited from the Roswell Memorial Cancer Research Institute in Buffalo, New York, to become the department's founding chair.

Hall's first order of business was to build the department. He established a core group, with members coming primarily from chemistry, including Dennis McCalla, who was then the University's first dean of science, and then began his recruitment effort, securing the likes of Hara Ghosh, Louis Branda, Barbara Ferrier and Bill Chan. At the time, the department's primary focus was nucleic acids, but, like the department, the focus continued to grow.

When Karl Freeman (Ph.D Toronto, 1959) took over the reins as chair in 1973, budgets were tight, nothing unique to Biochemistry, rather a reality facing the entire university. But even with decreased budgets, Freeman managed to secure funding for two new recruits – Richard Eppard, a

cell biologist who would go on to publish more than 370 papers (at last count) and whose name would become synonymous with McMaster biochemistry, and Gerhard Gerber, a membrane expert who had also studied under Khorana, and would eventually go on to become the department's fifth chair and co-founder of Fermentas – a world leader in the discovery, manufacturing and marketing of quality molecular biologicals – one of the University's most successful spin-off companies.

According to Freeman, regardless of budgets, these were exciting times in research, with lots of graduate students, particularly international graduate students. But, in terms of the educational component, there was always a great discussion on just how much the department contributed to Health Sciences education.

Dennis McCalla, the department's third chair, recalls the new medical school adding both excitement and consternation to McMaster. While the approach to learning was different from other medical schools and was receiving international attention, there were those at the university who considered the approach to be "not very academic." That would soon change as the benefits of this style of learning became increasingly obvious, and the approach would eventually be adopted at medical schools around the world.

McCalla was focused on bringing in some new stars to build on the reputation the department was beginning to enjoy. He can take credit for recruiting research stars like Calvin Harley, who left the University in 1994 to become the Chief Scientific Officer at Geron in California, and Evert Nieboer, a toxicology and epidemiology expert who still calls McMaster home.

Collaborations were fairly rare back then, but McCalla saw the potential and power of partnering. Early on he did some work with Russell Bell (chemistry) and Tom Neilson (biochemistry), and a few years later he collaborated with chemist Brian McCarry, and their work had a profound effect on the lives of many Hamiltonians.

The occupational health group at Dofasco had witnessed a seven-fold elevation in lung cancer inci-

dents among crane operators and was looking for answers as to the cause – were chemicals responsible and, if so, what were these chemicals? They called on McMaster and collectively, McCalla and McCarry discovered the buckets of molten steel that were being carried by the operators were the root of the problem. The bucket molds were made of sand and glued together with an organic substance which, when in contact with the molten steel, produced and released carcinogenic chemicals. Their study and subsequent findings saved the lives of countless steelworkers.

The department continued to expand under the leadership of Tom Neilson and subsequently Hara Ghosh, who had also been trained under Khorana. Ghosh spent his early days trying to convince the University's administration of the critical and essential need for developing molecular biology and biotechnology. And convince he did. He went on to recruit four molecular biologists (Bruce Fitcher, now in Cold Spring Harbour, NY; Rick Rachubinski, now at the University of Alberta; John Capone and David Andrews) and two structural biologists (Daniel Yang and Vettai Ananthanarayanan). He was also instrumental in raising awareness of biotechnology, helping to create a President's Biotechnology Advisory Committee and, subsequently, the McMaster Molecular Biology Institute.

By the time Gerhard Gerber became chair in 1991, the department was in full swing, as was its focus on molecular biology. Wanting to expand the department's mandate while employing the philosophy of hiring individuals who were not only excellent scientists, but also strong, independent thinkers, Gerber recruited Harvard-trained Gerry Wright, now Canada Research Chair in Molecular Studies of Antibiotics and current chair of the department, and structural biologist Albert Berghuis, now at McGill.

When Gerber became the University's vice-president of research in 1996, John Capone, who had studied under Ghosh, took over as chair. And while the department was coming out of some tough times – the province's social contract and other cutbacks – there were some emerging oppor-

tunities for growth, part of which came with the strategic re-allocation exercise that the University was undertaking.

Under Capone's leadership, molecular biology was identified as a strategic priority for the University and new positions were granted to the department. The positions came in the form of Canada Research Chair in Chemical Biology Eric Brown, microbiologist Justin Nodwell and cell biologists Ray Truant and Dino Trigatti.

Around the same time, new linkages with the Faculty of Science were being made, particularly in Chemistry, two new joint-positions were created, and enzymologist Paul Berti and Canada Research Chair in Directed Evolution of Nucleic Acids Yingfu Li were hired. That same partnership model was extended to Physics and Astronomy, resulting in the joint hires of Canada Research Chair in Molecular Biophysics Cecil Fradin and Canada Research Chair in Biophysics Paul Higgs.

At the time, federal and provincial governments were investing heavily in university research – trying to maximize their investments in opportunities that would bring universities together with industry and government to create the infrastructure so desperately needed for Canada to compete on the world's research stage. The department scored high in these competitions, leading to the creation of new facilities including the High Throughput Screening Lab, which continues to provide screening expertise and service to researchers across Canada and around the world.

The momentum continued when Gerry Wright, the department's current chair, took over, resulting in further research collaborations and new joint undergraduate and graduate programs. His leadership led to strategic hiring, securing Canada Research Chair in Human Stem Cell Biology Mick Bhatia to head up the Cancer and Stem Cell Research Institute, housed in the new Michael G. DeGroote Centre for Learning and Discovery, and strategic partnerships, like those underway with engineering, physics and medicine. He also paved the way for the \$20-million Centre for Microbial Chemical Biology – a Canadian first, and a true

testament to the strategic investments McMaster has made in the chemical biology and infectious disease research and the \$12 million Biophotonics Imaging Facility – an international centre dedicated to live cell analysis.

There has been tremendous growth over the last four decades – from its humble beginnings with fewer than a dozen faculty to the now 43 faculty members; 27 of whom have their primary appointment within the department. It's grown so much it had to change its name – it is now Biochemistry and Biomedical Science – to reflect its breadth and depth. The research focus now encompasses six themes – structural biology and protein/nucleic acid structure and function; membrane biology and lipid biochemistry; metabolism and toxicology; cell biology and regulation; cancer biology; and micro-biological biochemistry and antimicrobial research.

Its research institutes and centres – The High Throughput Screening Lab; the Antimicrobial Research Centre; the Centre for Gene Therapeutics; the Centre for Functional Genomics; the McMaster Biophotonics Facility; and the Stem Cell Research Institute – are internationally recognized and provide a fertile training ground for future generations of researchers.

So where does it go from here? Well, in keeping with the hockey analogy, Wright says they need to play like a team and take a page from Gretzky's playbook to stay on top of the research game. "Gretzky's success was based on his ability to skate to where the puck was going to be; not to where it had already been, and that's what needs to happen with research – we need to anticipate what's next," he says.

And what's next, according to Wright, is systems biology – the collaboration between the life and physical sciences. Genome sequencing has revolutionized biology – a revolution that will be felt for decades. This "new biology," as Wright calls it, means no more silos or single-streamed thinking. It means considering many things at the same time, in multi-disciplinary teams, with an emphasis on large-scale data management and analysis.

It also means that the department, under Wright's

leadership (he's in year one of a second five-year term), will build on areas that are not only relevant, but those that bridge the disciplines and emphasize collaboration. His track record to do just this speaks for itself.

And while the department's research agenda grows, so do the opportunities for the students. "Active Learning" is the department's motto and where better to find the action and develop critical thinking and creative problem solving skills than in state-of-the-art laboratories alongside first-class researchers.

The department will celebrate its 40th anniversary on October 13, 2007, with a great line-up of speakers, a poster session and tours of its new facilities.

Check out www.hsc/mcmaster.ca/biochem for more details.