

Ivy-covered professors seek greener pastures for students: The biology-pharmacology co-op programme is set up

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Bright college days, oh, carefree days that fly
To thee we sing with our glasses raised on high
Let's drink a toast as each of us recalls
Ivy-covered professors in ivy-covered halls.

—Tom Lehrer in “Bright College Days,” 1959

In the Fall of 1989, 16 students took a chance. They entered an untried, untested undergraduate science program at McMaster University, a joint one between the Faculties of Science and Health Sciences. It had some novel features—it was a hybrid program where the pharmacology courses were taught in the small-group format of problem-based learning (PBL) by health sciences faculty, whereas many of the other courses in the Faculty of Science were largely didactic. It also had a co-operative component, where students got academic credit for working beyond the sacred groves of academe. The objectives were to create a cadre of resourceful, flexible students for future academic and industrial research in Canada. Thirty-two years later, in the Spring of 2021, during an unprecedented year of turmoil, 15 students graduated from the program. Despite the passage of time, the original vision of its founders appeared intact.

I (PKR) had been closely involved with the program for over 15 years in its early days, and I contacted Dr. E. E. Daniel, its chief architect, to discuss the genesis of the venture. Now a professor emeritus (Department of Pharmacology, University of Alberta; Faculty of Medicine, McMaster University) with national and international status as an eminent pharmacologist, he was the chair of pharmacology at the University of Alberta before moving to McMaster to set up the Smooth Muscle Program, which quickly attained an enviable international reputation. Despite his extensive research commitments, he was extremely active in teaching, spearheading the initiative that established the first co-op program at McMaster University, the Honours Biology and Pharmacology (Bio-Pharm) Co-op Program. What follows is a series of email exchanges between us discussing the early years of the Bio-Pharm Program. The interview has been lightly edited for clarity and comprehension, but nothing substantive in the content has been altered.

PKR: Thanks for being willing to discuss the genesis of the program. I remember some of the early discussions with the Department of Biology where we were greeted with scepticism, if not downright hostility. Given that environment, how did you manage to get it done? More importantly, what was the impetus for you to think of starting such a venture in the first instance?

EED: I will begin by saying that I had worked first to set up such a program in the Medical School. However, there were long-term and hardened restraints. A long history of fear and jealousy from the university, which considered the Medical School to be overly privileged, led to rules that faculty could not develop undergraduate courses in other faculties such as the Faculty of Science.

From a variety of sources, I had come to feel that pharmacology students needed experiences in laboratories that were useful in the real world. This required that my pharmacology course had to have a co-op component. I found that co-op programs were strongly supported by the Faculty of Science. Do you remember the name of the lady who looked after these programs in the science faculty?

A colleague, Dr. Jo-Ann Fox, hinted to me that the Department of Biology was led by a chair, Dr. Stephen Threlkeld, who was open to a shared biology-pharmacology honours program. When I met with him, he was enthusiastic. Thus, the human components of setting up our co-op honours program were in place. This, of course, was only the beginning. Yet to be done were the following:

1. Finding faculty with time and interest to develop and provide instruction consistent with our goals and who cost no money;
2. Finding pharmacology or related laboratories to house and pay our students doing their co-op terms;
3. Persuading the Faculty of Medicine and the then Department of Bio-Medical Sciences to approve a new and somewhat irregular program, which might cost money;
4. Finding the physical resources (classrooms, books etc.); and
5. Discovering if there were any students willing to tackle this new adventure.

PKR: A tall order! Perhaps you could flesh these out—let's start with resources—the people and places. I know when you started these discussions, several of us were quite eager to join in—almost all of us had been tutors in the MD undergraduate program and were familiar with the small-group variant of problem-based learning, and a few of us were also teaching in the nursing and graduate programmes. The thought of focusing on pharmacology was quite appealing. Further, several of us who had major interests in that discipline were attached to the Smooth Muscle Research Program that you had set up, which also gave an added fillip. If I remember rightly, Evert Nieboer, Jack Rosenfeld, and Kim Rainsford were most enthusiastic about the co-op component.

The lady you mentioned earlier was Dr. Doris Jensen who was then the assistant dean of

science. A wonderful person with whom I kept in touch for a long time. Sadly, she passed away a few years ago.

EED: Our program was fortunate in that we had faculty who were dedicated both to problem-based learning and to pharmacology. My experience in the medical faculty was that learning about the use and abuse of drugs was assumed to be inherent in the problems medical students worked through. But my experience had convinced me that this was not so. This placed an initial requirement that any bio-pharm program have problems in its pharmacology component in which solutions required knowledge of pharmacology and the application of it. This, in turn, required that we build our program with unpaid faculty who had knowledge about pharmacology and the desire to use PBL as the learning tool. I was fortunate to find them. Two early recruits were yourself, a natural-born educator, and Denis Crankshaw, also an excellent educator. There were others noted above in your comments, but these two were crucial. They volunteered to help build this bio-pharm program.

PKR: Those comments are quite flattering! When the program was set up, several health sciences faculty taught the first cohort. If my memory serves me right, apart from Denis Crankshaw, others were involved: Stuart MacLeod, Gurmit Singh, Mary Richardson, Peter Winocour, Evert Nieboer, Jack Rosenfeld, George Sweeney, Henry Szechtman, Ram Mishra, Eva Werstiuk, David Kwan, Jan Huizinga, and maybe more. Another difficult issue would have been physical resources since space was so jealously guarded. In terms of tutorial rooms, that was less of a problem, but you wanted a proper lab where students would do hands-on inquiry-based experiments rather than mechanical cookbook ones. Negotiating space must have been tricky, and in the early years, the lab was housed in the space allotted to the nursing program initially. How did you pull that one off?

EED: I was fortunate that I had a former student and now colleague, Dr. Jo-Ann Fox, who was established in the Faculty of Nursing. Her courses required laboratory space which was not used full time. She very kindly allowed us to share it.

PKR: Another contentious issue was the method of instruction. At that time, the biology faculty felt we were extraordinarily naïve in wanting to use the PBL model. I remember one particularly stormy session where a very senior person dismissed us by saying that we had never taught undergraduates in our lives and had absolutely no idea how dependent they were on being told what to do. I was appalled that such a comment was made about university students, but that seemed to be the general opinion of the biology department.

Did you have any arguments with the Department of Biology about selecting students? You wanted not just grades but also some assessment of the intangibles (personal qualities) and an interview process like that set up for the medical students. We had a longer process in the first couple of years, but that got truncated later since there were some arguments over resources. Do you remember how this process was sorted out in those early years? I am sure that the Department of Biology must have felt that we were either naïve or obtuse!

EED: The biology department finally agreed to allow us to set up a process which evaluated students both on grades and on their interest in PBL learning and pharmacology. Insofar as I can recall, this strange procedure worked well enough to get us started until we developed more formal procedures acceptable to all.

PKR: You mentioned earlier about the proposed program being “irregular”—one aspect that must have proved difficult was the alternation of work and academic terms. The fourth year was split into two terms separated by a year, so that the students were committed to a 5-year program. Further, the students were given credit for the work terms. I have often felt that even intrepid explorers such as Magellan may have balked at navigating the treacherous waters of academia guarded by the dreaded calendar dragons.¹ How did you steer your way through the Academic Calendar?

EED: We were greatly aided by the fact that the Faculty of Science had set up a co-op office and knew how to navigate the shoals of getting our mutated program into the calendar.

PKR: You mentioned that one possible issue that concerned you was finding students for this venture. Surprisingly, that proved to be less of a problem than imagined. I remember well the first information night we held in the Department of Biology. The relatively large room was about three-quarters full. I said a few words about PBL and the tutorial process, then told them that it would be better to have a demonstration. I asked for some volunteers, and about six students came forward. I had written a brief sketch about designing a bravery pill for Canadian soldiers based on a brief news item that had appeared that week. Oddly, I still have a copy of that scenario. None of the students had seen that item so it came as something totally new. Yet the process worked like a charm—the brainstorming phase, the framing of tasks, and so on. In later years, it became much simpler since we always had students who had been through at least the first year and could act as spokespersons. In that first year, several applied who were quite disgruntled with their courses and were willing to try something new.

EED: I cannot help here. No recollection.

PKR: Finding co-op placements must have been a difficult task. I recall that in the early years, students had options of applying for placements in several companies (Astra-Zeneca, Merck-Frosst, Glaxo, Ciba-Geigy, Janssen, Ortho-McNeil) as well with Health Canada. Students who were placed with Astra Zeneca had to commit to doing all their terms with them in their labs in Lund, Sweden, whereas the others could move around and experience different placements. How was all this set-up? I remember that Kim Rainsford was involved in a lot of these discussions.

EED: No recollection of this.

PKR: At the outset, one of the goals was to produce flexible, dynamic students who would function effectively in multiple settings—in a sense, pluripotent enough to thrive in different niches. Over the years, this has been achieved. Several years ago, I showed a slide at the World Congress in Pharmacology in Cape Town where I commented on the career paths of graduates from the program which turned out biomedical researchers, health economists, lawyers, patent agents, epidemiologists, medical writers, consultants, nutritionists, occupational therapists, and physicians. What may please you, in particular, is that several of the graduates have become first-rate biomedical researchers—principal investigators in several different universities both in Canada and elsewhere. Given the small intake (restricted to 25 from the first year of the program), the wide range of careers contrasts sharply with other undergraduate ventures in the Faculty of Health Sciences, which turn out to be mere med school feeders. I think I have some inkling as to some of the underlying reasons, but I would like

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to hear your thoughts.

EED: I am tempted to claim that we challenged students in a new way, a way that opened their eyes to a different way of looking at a future in academia. This may be an example of self-over-evaluation. It would be better if we could find a few students who are willing to look back and comment.

PKR: I suspect that was a significant element. I will see if I can get some comments from former graduates. There is, I believe a subtler factor that played a role. We did not go overboard on GPAs or transcripts. We made sure that the students were acceptable to an honours program but did not have high cut-offs that selected only those with A+'s in their courses. So, students with "patchy transcripts"—mixtures of C's and A's—found their way in. The presence of a person from the co-op office in the recruitment process provided a proper balance. When I interviewed students along with Natalie Nossal, who was the co-op officer, I considered their academics whereas she looked at their suitability for the work environment. Sometimes the straight-A student—who would have been a shoo-in for other elite programs—got short shrift. Fortunately, we did not go in for Multiple Mini-Interviews and gave ourselves sufficient time to probe students. The interactions with industry gave us a different gaze. Astra Zeneca, for example, sometimes chose students who were not the strongest academically, but they thrived in Sweden. I remember well one student who was rather muted and diffident in tutorials who went to Stockholm. On a site visit, when I spent several hours watching her in the lab, she stunned me with her competence, poise, and confidence. A far cry from her performance in a stifling classroom. Our reliance on transcripts is myopic to say the least. Thanks for the comments, will get back to you when I get some information from former grads.

PKR (later comments): Ed, I spoke to Natalie Nossal about the early days of Bio-Pharm Co-op and to two alumni (David Macarios and Andrew Rosner) who were in the original cohort.

Natalie told me that during the late 1980s the federal government established a grant program through Human Resources Development Canada (HRDC) to foster development of academic and training programs that would benefit the economy. The government had amended the patent act to give drug companies protection from compulsory licensing for 7–10 years. This opened the possibilities of interactions with the pharmaceutical industry, and a program in pharmacology seemed attractive. That funding allowed the university to set up a co-op education program, and Dr. Jensen, being the assistant dean, spearheaded the initiative. The Biology-Pharmacology Co-op Program was the first that was set up, and others in biochemistry, environmental science, and medical physics followed.

David and Andrew entered the program in 1989, later did MBAs, and they spent their professional lives in the non-academic world. David was at Amgen for many years and is now the head health economics and outcomes research and payer engagement at EMD Serono Inc. in New York. Andrew is the director of ARKs Business Consulting in Toronto. Both of them said that they were in the biology department at that stage, and they found the courses and the options dull and limited. Word was spreading about this new venture, and they got excited at the prospects of more active learning. They had heard of problem-based learning, and the possibility that they could get out of large classes was appealing. The co-op element was also enticing. In David's case, Dr. Jensen helped him out as he had to stay for an extra year to be

able to apply to the program. They said that several of them felt they were oddballs and misfits and were prepared to take a chance. That clearly benefited us as we got risk takers who were more flexible and willing to help us as we made several changes to the courses as we went along. Alyssa Burrows, who graduated this Spring (i.e., 2021), contacted several of her cohort for me. Their comments again emphasise the attractive elements: small groups, problem-based learning, transferable skills such as communication and problem-solving, as well as opportunities for work experience and interest in the subject itself.

As you mentioned at one point, the program survived because it remained limited. The pharmacology courses were taught by the Faculty of Health Sciences, and the biology department was not overburdened. In fact, the chairs (Rainbow, Finan) and also the deans of science (Sutherland in particular) that I interacted with were very supportive and some, like the late Gordon MacDonald in biology, were extremely helpful. The pharmacologically inclined from the Faculty of Health Sciences whom I mentioned earlier stepped in with alacrity. Many like Mishra, Werstiuk, and Huizinga continued teaching for decades and were joined by others such as Derek Lobb, Alison Holloway, and Luke Janssen, as well as graduates of the program such as Renee Labiris and Rosalyn Johnson. In addition, the co-op office provided a lot of support and so did many of the employers who trained students. Clearly, sticking to our guns paid off. Small *is* beautiful (to use the elegant Schumacher phrase) and will always be. Mass production rarely breeds quality! Personally, I cannot thank you enough for setting it all up!

CODA

The first decade of the venture was challenging. Fortunately, the students were flexible and helpful as we steered our way through. A year after the program was set up, the stewardship of the province changed hands. An NDP government produced considerable uncertainty in the job market which affected job opportunities for students in terms of co-op placements in the province. These were sought elsewhere, and one year we had students in Australia, India, Hong Kong, and the USA, as well as Canada. Students often proved enterprising in finding their own placements. Work terms also posed interesting calendar challenges. The program was structured to allow students to shuttle between the university and the workplace. The fourth year was split, with the two terms being separated by an entire year. Students began their course work in the Fall term and had three intervening, alternating work/thesis terms that occupied a full year away, after which they returned to campus to complete their fourth academic year in the Winter term of their fifth year at McMaster. For many students, the return to campus life was a needless drag since they relished the freedom to work in diverse environments. Those who worked in labs in major companies often had access to better facilities as well.

Many employers chose to keep their students longer so that students had the opportunities to complete their fourth-year thesis off campus. This posed other problems, where students worked on projects that required them to sign confidentiality agreements. Since presentation of their work as part of their thesis defences was an academic requirement, open to all. Their supervisors were uneasy and wished to have these presentations limited to a select group since the information generated formed part of a future patent application. A

diplomatic sleight of hand was needed to overcome the concerns of the university which balked at these restrictions. In one instance, the supervisor candidly told me that he had sized up the student as being extremely capable and competent and put them on a project that gave them an opportunity to have their name on several patents. Having a restricted presentation session seemed a trivial issue compared to the benefits for the student, so I allowed that session to be held in camera. These interactions taught us a lot, far more than we bargained for! It also gave us a much greater appreciation of the university that allowed us to navigate these waters, which were uncharted, at least for us. Dragons there may have been, but we passed them by.

ACKNOWLEDGEMENTS

This chapter is dedicated to Dr. Daniel who sadly passed away on June 27, 2022, just 3 months short of his 97th birthday. This would be his last contribution to science and education. My first scientific paper (on the subject of potassium-ATP ratios in smooth muscles) was published with him 50 years ago, in 1972.

After the first cohort had settled in, many students took part in spreading the word. Several publications emerged about the program—these were not cited in the text and so I have added a list of these below (see Bayley, 2008; Rangachari, 1994; Toulouse et al., 2012). In addition, descriptions of the initial program can be found in the undergraduate [calendar from 1989](#) (page 69).

NOTES

1. In the comments about designing the program, I mention Magellan and academic calendar dragons. Ferdinand Magellan was an intrepid Portuguese explorer who is regarded as the first European to navigate from the Atlantic to Asia. In old maps, uncharted or hostile territories were indicated by the Latin expression—*hic sunt dracones* or “here be dragons”—warning navigators about potential dangers. The comment is made that in academic circles, skirting the calendar is fraught with complications for both students and faculty and that these entities have a stifling effect on learning.

NOTE ON CONTRIBUTORS

E. E. Daniel (September 23, 1925–June 27, 2022) was an eminent pharmacologist, teacher, and political activist. Born in Chattanooga, Tennessee, he was drafted into the US army during World War II, served on the Western front, returned to the US as an amputee, and got his MA from Johns Hopkins and a PhD in pharmacology in 1952. He his strong political views ran afoul of the prevailing sentiments in the US expressed by the Democrat McCarthy, and he sought refuge in a more liberal Canada. He came first to the University of British Columbia as an assistant professor and then at the ripe age of 36, chair of pharmacology at the University of Alberta from 1961–1972. He moved to McMaster University in 1975 and set up a novel Smooth

Muscle Research Program in 1978. He was instrumental in setting up a PBL co-op program for undergraduates in 1989. He retired as professor in the Department of Biomedical Sciences in 1994 and remained as professor emeritus before returning to the University of Alberta in 1998 where he was an adjunct professor in pharmacology until 2010. He received numerous awards, nationally and internationally, served on the editorial board of several journals, and was a reviewer for numerous grants and publications. He served as the president of the Faculty Association. He remained politically active, committed to challenging irrational political decisions long after retirement. Despite his extensive research commitments, he was active in teaching (graduate, medical students and undergraduate students). He spearheaded the initiative that established the first co-op programme at McMaster University, the Hons. Biology-Pharmacology Co-op Programme, the subject of his chapter. A [tribute](#) written by several of his former graduate students and colleagues provides more comments on his contributions.

P. K. Rangachari, professor emeritus (medicine), came to McMaster University on a Canadian Heart Foundation Scholarship in 1981 just for a year that stretched out to several decades. When he got his faculty position at McMaster, he had little formal teaching experience as he had spent over a 15-year period in research labs in Canada, USA, France, and India. Having either slept, doodled, or day-dreamed through most lectures, he had little enthusiasm for formal teaching. He thought that problem-based learning was a joke, till he sat in on one of Daniel's tutorial sessions with the medical students and saw first-hand how much they had learned without benefit of formal lectures. This Damascus moment altered Rangachari's career path, and he became more interested in teaching. He continued his basic research on smooth muscles and epithelial transport but became involved in teaching students in medicine, nursing, rehab science and undergraduate students in the Faculty of Science, the Arts and Sciences Program and the BHSc(Hons) Program. He received the President's Award for Teaching Excellence, the Ontario Confederation of University Faculty Associations Award, 3M National Teaching Fellowship, Claude Bernard Lectureship of the American Physiological Society, and the IUPHAR Education Teaching Excellence Award at the World Congress of Pharmacology in Kyoto. His publications span both basic biomedical sciences and education. He has co-authored several books—*The Design of Smooth Muscle*, *Problem-Based Learning in Medicine*, *Students Matter: The Rewards of University Teaching*, and *Student-Centred Learning: Subversive Teachers and Standardised Worlds*.

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