
Recollections: How I Became A Biochemist

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Bound to be in Biochemistry

Circumstance and happenstance are probably major factors in the choice of a career. In many parts of the world one may be born into a family of bankers and become a banker, or into a baker's family and bake bread for the rest of one's life. The children of immigrants to North America often find themselves following inclinations beyond any of the family's horizons.



During the period when I was growing up, the idea of becoming a biochemist would have been akin to planning a flight to the moon at the turn of the nineteenth century. Even the thought of a University education was outside any realistic dream. When my teenage older brother spurned my father's plans to become an apprentice glove-maker and chose instead to go to high school and beyond to follow his

dream of becoming a mathematician, he became the first member of the known generations of my family to attend university. Most had not been to secondary school. Any formal schooling had been to learn a trade. Education was highly valued, but the cost was outside the reach of their skimpy bank accounts and the bottom line of their mere survival incomes. When I arrived in Montreal from Poland in 1936 at the age of eight, even high school attendance required tuition fees. There was no certainty that when I reached adolescence, I would find a way to attend secondary school as a full-time student. A number of my classmates in the early forties, still on the edge of the Great

Depression, had to take whatever work was available to help their families survive. I had the luck to be with the chosen ranks and was given the opportunity and a scholarship to continue in high school until graduation, without being required to contribute to the family's meagre income. My community was one of working class parents or families of self-employed modest shopkeepers. None of us came from families with professional parents.

By today's student parlance, I would have been considered a swot. My modest demands meant that I did not have to take on after-school jobs to earn money for clothes and cosmetics. I was hopeless at all sports. I was convinced that I had poor hand-to-eye coordination until I learned to play tennis after age 55. I did my homework assiduously and actually loved school. Vacation time was the time to work for extra cash — vista-broadening trips or summer camps were not part of our lives. I was not a 'hit' with my fellow male students, so distraction by teenage male songs did not interfere with my primary focus of doing well in school. Had I been a sought-after 'high school sweetheart' my career path might have taken a different turn. In my high school class of some 35 female teenagers, only one other followed a professional career requiring extended post B.A./B.Sc. university training. Less than a dozen of us continued on to university. For the young males in this school, the picture was quite different — a large percentage went to university and followed professional careers. Indeed, our high school has been immortalized by one of Canada's best known novelists, Mordechai Richler, as Fletcher's High. Some of Canada's outstanding artists, mathematicians, physicians and scientists are (or were) graduates of Baron Byng High School in Montreal.

Reading was a passion from my earliest years, and the trials and successes of the medical men (and the few women) of the century hit a responsive chord from the very first. I savoured the idea of being amongst the group of individuals whose lives were recounted by Paul de Kruif. However, medicine as an ultimate profession was beyond the pale for a mountain of reasons; expense, lack of adequate government subsidies, length of training before beginning to earn a stipend and, perhaps the two most persuasive arguments, the cap to the number of Jews accepted into the local medical school (living away from home was totally unrealistic), and the even fewer number of women admitted into the Faculty, (less than 10% of the annual admission).

During my last two summer vacations in high school, I found work as a nurse's aid in our local (and famous) Montreal Neurological Institute. One of the assigned duties was to bring patients down to the basement of the building where the EEG was conducted. I thought a technical assistant in this area would be my "dream career" and at the end of high school, applied for a posted position in this area as a trainee. An answer from the hospital was slow in coming. I had made no other plans for the post-high school era, except that I knew I did not favour my father's choice of career (a bookkeeper in some small or large shmate factory). He was deadily opposed to a college education for two reasons — the extra financial burden with no additional income and the fact that I would be outside my natural group of potential husbands. I don't know which one concerned him more.

As the deadline for admission to University drew closer and no word from the hospital about the training program, I decided to apply for admission to the University to follow a program in science. Since my brother had already become a 'college boy', my feminist mother could not see why I should be denied the same opportunity. So despite my father's objections, I registered, was accepted but promised to find my own source of money — loans, grants, scholarships and summer jobs, to pay my own fees and out of pocket expenses. The hospital never acknowledged my application and in

1946, I became a science student at McGill University. A new world was opened for me. I loved it — new classes new encounters and anonymity. Just one body amongst many!

I decided that a specialization in Microbiology would, at the end of four years and a B.Sc. degree, provide the greatest opportunities for employment. Every hospital and laboratory needed technical microbiologists. Besides, Paul de Kruif's 'Microbe Hunters' was still a part of my vivid memory. Along the way, organic chemistry gave me newfound pleasure. Botany and zoology left me out in the cold — largely because I couldn't draw what I saw — no doubt part of the same problem which led me to fail art in my high school matriculation.

In my sophomore year, the first undergraduate course in biochemistry — taken along with the first year medical students — was part of the curriculum. The instructor, the Chairman of the Department as well as the Dean of Graduate Studies, D. L. Thomson, was charismatic. No one who has ever studied biochemistry at McGill University from the mid-thirties to the late fifties, will ever forget Thomson's spellbinding expositions. For me the combination of organic chemistry, biology and the dynamic events of living cells was like drinking a fine wine, even though at that time I had never had a sip of fine wine! That people could deduce experimentally how a cell carried out its daily business of converting energy, making more of its components, converting all manner of seemingly, stable compounds into the vast variety of the cell's constituents, gave me a tremendous sense of satisfaction. To this day, seeing a beautiful experiment, to establish even the most esoteric fact, fills me with pleasure. I see it as a true work of art and imagination-almost like seeing a beautiful painting. I was hooked! After the first two weeks of the sophomore year, I switched programs and studied Biochemistry as my major. I now knew where I belonged. I also knew that upon graduation I would pursue graduate work to become a member of my favourite club — the Biochemists.

The most distinguished biochemist at the time at McGill University was J. H. Quastel. D. L. Thomson was very supportive and encouraged me

to apply to work with Quastel, who headed the McGill-Montreal General Hospital Research Institute. Curiously, the only problem that concerned Quastel during the interview was not my academic ability or my reasons for choosing to work under his supervision, but rather my marital status. Was I married, was I engaged, did I intend to marry and have children? I wasn't married, I wasn't engaged, I didn't have children, and I managed to assure him that I would solve those problems when confronted with them. (I did in due time.) He accepted me into his lab without ever inquiring why I wanted to be a biochemist or whether I had the academic wherewithal to succeed in the graduate program.

Despite the normal disappointments and tribulations of graduate work, the occasional successes convinced me that I had chosen work which appealed to me at all levels. After obtaining my Ph.D. degree, I was awarded a modest fellowship from the National Cancer Institute of Canada, which permitted me to work for a year at the National Institutes of Medical Research at Mill Hill in England. During my post-doctoral period in England, I acquired a son in addition to training in enzyme induction in Martin Pollock's laboratory studying penicillinase formation. My stay at Mill Hill was abruptly terminated because the Director, Sir Charles Harrington, refused to sign my application for a Fellowship from the National Research Council of Canada to extend my stay. In his opinion, no woman with a young baby could apply herself adequately to the demands of a research program. His major argument was that his own daughter had not been able to do so! Undiplomatically, I responded by telling him I was grateful not to have been born his daughter! I managed to get a small fellowship to work elsewhere for a few months and left the NIMR. At Mill Hill I had the opportunity to meet some of England's most distinguished scientists, which gave me a perspective on science and research I had sorely lacked till then.

My late husband and I had toyed with the idea of taking up residence in England because North America was in the throes of McCarthyism.

However, the openings were few and poorly paid. Eventually we concluded that the opportunities to pursue our respective careers in science and business were better in North America. When Quastel offered me a junior staff position at my old place of work, I was happy to return to Montreal and heated living quarters! Later I joined the staff of the Department of Biochemistry at McGill University, where I have remained in different capacities, including Chair of the Department (between 1980-1990).

Work begun upon returning to Canada on Na⁺-coupled amino acid transport led to the discovery of Na⁺-dependent ascorbate transport in the adrenal and the pituitary glands, and the reason why these glands maintain much higher levels of ascorbate than the blood stream. Isolated plasma membranes of mammalian cells were shown to carry out Na⁺-gradient driven transport, both in the native state and after reconstitution of detergent-solubilized membranes. Later, the studies on the loss of Na⁺-dependent amino acid transport in maturing reticulocytes led to the discovery of a novel method for removing obsolete, but intact, proteins (such as the transferrin receptor) from the reticulocyte plasma membrane. This novel route for the formation and release of small vesicles (exosomes) rich in membrane proteins into the extracellular milieu is now being studied by immunologists in exploring the routes for antigen presentation.

After a lifetime in the field, I realize that the die to enter biochemistry was cast when I switched programs in my sophomore year and never found other venues either more appealing or worth trying to swim up another stream.

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Addendum

In addition to revisiting the events which drew me into biochemistry, this is an opportunity to reflect on events which shaped my views on biochemistry at McGill, including my views on the participation of women in the discipline over the course of forty years.

From the earliest days, women have been present in visible numbers in biochemistry at McGill. A woman, Evelyn Anderson, was amongst the first three or four to be granted a Ph.D. degree in biochemistry in the mid thirties. During Collip's thirteen-year tenure between 1928 and 1941, twelve men and two women received graduate degrees. During my ten-year tenure as Chair (1980-1990) of the Department, nearly 50% of the graduate student population was female. In the twenty-first century, the number has risen to over 50%. At present in 2005, there are 75 woman and 56 men registered in the graduate program at McGill. This rise in women's participation follows the pattern also seen in the number of women acquiring degrees in medicine and law in the last 25 years.

However, the impact of the increase of women in medicine and law is much more evident than the rise of women in the professorial ranks of University Departments of Biochemistry. It is true that it is no longer novel to have a female as Chair of Biochemistry in universities in North America but it is still relatively rare. Nor do I believe that all problems for women will melt away when more are offered a Chair! There are female Deans and even Principals, but the swelling in the academic ranks in Canada has not reflected the growth of the number of women in the graduate student body. No one would expect a linear relationship, given the long lag time between qualification and being a candidate for a position. However, the gender gap in hiring for tenure track positions seems to be closing at a snail's pace. At a recent meeting of the Chairs of Biochemistry Departments of North America (which includes Canadians) over sixty Chairs participated, four of whom were women. Twenty years ago, when I participated, we were 3-4. The numbers speak for themselves.

During my term as the Chair, I followed closely the number of applications for positions which crossed my desk. Far fewer were from women than would be expected from their number in the trained pool. The feeling arose that even if eligible, they were reluctant to apply without some specific encouragement from an individual who was interested in

that particular woman's career. But mentors are not a common commodity. Furthermore, women's professional lives get heavily entwined with their personal lives. They are in the forefront in supporting the needs of spouses and children, even with helpful partners. Does an academic career in our highly competitive system, requiring both external, competitively acquired research money and the challenge of tenure considerations, become an unacceptable burden for many? Has the growth of the commercial biotechnology industry in Canada (and elsewhere) opened up other professional opportunities for women, which make fewer personal demands in all facets while probably being more lucrative? Perhaps to some the latter positions may lack the "cachet" of university professorships, but they do provide an opportunity to follow a career and have economic independence. This view is consistent with, but hardly proof of, the view that while the majority of female Ph.D. graduates do maintain professional lives, there are relatively few knocking on the doors and being admitted through the doors of traditional Biochemistry Departments.

There is another factor which may influence women's careers at universities. Overall, women fare better in academic careers when they remain at the institution in which they obtained their original training (or had postdoctoral experience). Too frequently, when they move away, it is more likely that they follow a partner's career than an invitation to fill a position. Then they must find their way around a new environment, where they know few people who have developed faith in their abilities over many years of contact. This may play a role in many men's careers as well, but more frequently a man's move is based on an invitation to relocate, where it is important for the recruiters to help the "new man" to succeed. These opinions are based on observations through a narrow window, seen from a career of over forty years in the Biochemistry Department at McGill. The issue has been discussed with similar conclusions in a book published by Rutgers University Press (1996) called *Creative Couples in the Sciences*. Perhaps the time has come to undertake a thorough statistical study of the career choices of

woman with Ph.D. degrees in Biochemistry countrywide. Are women selecting themselves out of academic careers or they being selected out as in the past? If there is interest in changing the present status, we need up-to-date information. From a personal perspective, with the rapid expansion in the number of participants in the field, the relative position of the female “professoriate” is ebbing away despite their keen interest in basic biochemical research as viewed by their large numbers in the graduate student body.

Leaving the gender issue and considering the growth of our discipline in Canada, one cannot but applaud the growth in stature and the scientific quality of the work currently carried out by Canada’s biochemists. Few Canadian biochemists had a high profile in the international community when the Canadian Biochemical Society was launched in 1957. The majority of western countries have not witnessed growth of the discipline comparable to that seen in Canada. Most universities across the country can name members in their departments who are recognized in the forefront of their respective specialities. We still suffer from the fact that our country is huge, and interaction between individuals with common interests is north to south rather than east to west. That, too may change with better communications, but will not overcome the high density of scientists in common areas to the south of us, right across the continent.

The issue of adequate financial backing is always with us. It is unlikely that our researchers will ever find all the funding to fulfill their aspirations. I suspect, even without having the data, that the number of practitioners keeps increasing faster than the money put into the kitty. I believe it is unrealistic to think that the growth in funding will ever meet the demands. But certain aspects of the funding to university-based researchers needs re-examination. Only two, which are close to my heart, will be addressed.

The first issue is funding for ideas, which are not on the mainstream and where little preliminary data are available. A university should be and, in the past has been, the place to examine entirely

new ideas and concepts without reference to their immediate commercial or medical value. In recent years, the interest and pressure has been to commercialize, often putting to use information and concepts discovered in a previous era. Universities and governments have encouraged commercialization. Universities have set up expensive offices to help commercialize the research findings of the staff in all fields. By and large, these commercializations are based on work originally driven by the individual’s curiosity which created an unexploited pipeline of information. Now with the emphasis on “putting out a product” the pipeline is being emptied. Less attention and funding is given to examine “off the wall” ideas which may be fruitful in years to come — or fall with a thud. I consider such undertakings to be a fundamental aspect of university-based research. No commercial enterprise will do it. Would today’s research councils support Faraday’s original tinkering on electricity before he had practical evidence for his ideas? Peter Mitchell was fortunate to have private funds to follow his insight on the chemiosmotic hypothesis in the era when the majority of biochemists recoiled from the notion of being “electricians” and his work was not considered realistic. A special fund is needed to support imaginative ideas which are too “young” even for seed money. The university is the natural home for this type of exploration. In the normal processing of grants to research councils, both private and public, such applications would not be considered. Another venue is needed to foster the development of the earliest stages of ideas which may — or realistically may not — expand the frontiers of knowledge without the criterion of the birth of a commercial product.

The second issue is the active reclamation of productive scientists who lose their footing and research grants in the middle of their careers. These not infrequent occasions create problems both for the individual and the department. The problem in my view is particularly acute for the well-established individuals who, after a number of productive years, suddenly find themselves without funding in an active research community. Young investigators also face serious problems if they can-

not get external funding in research-oriented environments. However, these are not the subjects of my concern in this commentary. In my experience loss of funding in mid-career affects university teaching departments and the core staff more than in affiliated research institutes. Research institutes frequently have funding in their endowments or from public money raised during financial campaigns to support their research. Such funds can be and are used to help their members over the rough spots. University departments have basic budgets which fail to meet even operating costs. It's not uncommon for a department to restrict the availability of free pencils to stay within budget, let alone find financial support to keep a research project going.

Lack of participation in the research life of a Department, especially where the latter forms a major time commitment of its staff, leads to demoralization of the individual and the department. Reinstatement is important for the individual himself/herself and for the research life of the Department as a whole to maintain the natural cohesiveness of being an "equal amongst equals". The support required to ameliorate this problem need not be extensive and must be time-limited, but should provide more than the six months or so to return to an external funding agency with a new application. The amount of "security" funding might reflect a small fraction of the total research budget that the departmental members bring into the university. Often short-term interest is accrued on research grants which are not available to the departments. Some of the money should be made available to the department to save a research career of a heretofore successful and productive researcher. Most of us, who are involved in research and are faced with the challenges of a changing technology, are anxious about stumbling and tripping. Few escape a long research career without a few "downs". As someone now "out the door" who no longer has worries about finding funds for students or expensive reagents and supplies, a vivid memory remains of the occasions when an able colleague lost funding and was faced with fading into the woodwork. Such individuals, I believe, need inside support to provide an oppor-

tunity to retool and revise the research approach and even get a preliminary set of data. How much time would be necessary? This judgement is going to reflect the confidence of the department in the individual's progress and ability, as well as the available money. The bottom line is money is required for this purpose. We all chose experimental work when we joined this profession. One fumble should not close the chapter on a productive career.

In closing this addendum on my entry into biochemistry with my views after I have gone out the door, I never regretted my choice of career. There have been frustrations, disappointments and the occasional truly exciting moments. What I do regret is the sparseness of same gender colleagues with whom to "gossip" about science in daily interactions. This is an aspect of a career in biochemistry that few men face.