My Career in Mathematical Biology
A Personal Journey

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How does one become a mathematical biologist? The answer to this question is as varied and eclectic as the variety of current practitioners of this broad field. But in my own case, the route was uniquely simple. Growing up in an academic family with a mathematician father and a biologist mother made for the right mixture of influences. My father was forever proselytizing about the beauties of (pure) mathematics. (At the time, his circle of functional analysts and geometers viewed applied mathematics rather distastefully.)

My mother had the exotic and attractive profession of a marine botanist. Her field trips to the beaches of Israel, Nova Scotia, and Australia were interspersed with microscopy, classification, and culture collections. As a child, I loved to help in the careful work of mounting specimens of algae that she had collected. The plants were unfurled in a tub of water, carefully transferred onto thick paper, swathed in newsprint or blotting paper, and pressed for several days until dry. This preserved their beautiful feathery branching shapes. If you have ever seen the slimy-looking lumps of green and brown seaweed strewn on a beach after a storm, you would likely agree that mounted algae are a huge aesthetic improvement on Mother Nature!

More portable mathematics

Surprisingly, although my mother loved her profession, her advice was to follow my father's path into mathematics. The reasoning went something like this: Women tend to be the ones having babies. Babies and long hours in the lab don't mix very well. Mathematics can be carried home in a briefcase, whereas animals, plants, and chemicals have to stay in the field or the lab. Parental advice notwithstanding, I did eventually earn a bachelor of science in mathematics, while keeping up an active interest in the life sciences.

Four years later, then a graduate of Dalhousie University in Nova Scotia, I noticed an advertised fellowship for graduate work in "biomathematics," a word that was as intriguing as it was unfamiliar. I applied, and this set me on the path that has led me to my current vocation, where the loves of both parents merge. I did my MSc degree in Dalhousie's biomathematics program, which for about a decade was located in a little "Red House" on Halifax's Robie Street. (The program eventually disappeared, sadly, in the mid 1980s.) My then-supervisor, Robert Rosen, had hailed from the Rashevsky school of biomathematics, a philosophical branch not too concerned with biological realities and, as it turned out, much more controversial than was known to me at the time. (To this day, I am still amazed by the level of hostility directed at the historic practitioners of that branch of the field.)

Beyond Dalhousie, my education continued as a Ph.D. student in the applied mathematics department of the Weizmann Institute of Science in Israel. Under the influence of Lee Segel, a renowned applied mathematician, I was ushered into the (currently more mainstream) branch of mathematical biology that combines applied mathematics with a keen interest in true biological applications. As his graduate student, I learned mathematical methods and increased my appreciation of quantitative biological problems.

To aspiring students of mathematical biology, a word of advice is in order: There can never be too much mathematics in a good math-biology education! The more techniques you practice in the formal setting of graduate school, the easier it is to become proficient in those mathematical techniques and have them available to you later. As for learning the biology, this, too, is a vital aspect of the interdisciplinary field I work in. However, learning biology is inherently a lifelong occupation: Advances in biology occur at such rapid pace (relative, say, to mathematics) that the best preparation is learning how to read the literature and how to talk to biologists.

Mathematical biology has expanded enormously in the last decade, but when I was ready for a job in the early 1980s this was not the case. The field was viewed as a "too soft" version of applied mathematics and "irrelevant" to biology.

Bridging either gap was a hard sell to prospective employers. The first years after my Ph.D. were rocky; I almost got to a point of quitting before I eventually found a "real job." For 8 years, I held on to tenuous visiting appointments at two Ivy League American universities. But neither Brown nor Duke, where I had been a visiting assistant professor, considered me for the tenure track.

Coincidentally, that was the time when my husband was a graduate student and I became a young mother with a family to support. The lowest point in my career came with the realization that I was excluded from consideration for a position at Duke because "I had not responded to an advertisement," according to my supposed mentor, who had conveniently kept me in the dark about this opportunity. The loss of trust was no less disappointing than the missed chance to enter a competition for a desired position.

An exciting research environment

With hindsight I can now see that that forced dislocation resulted in the job that I have come to love at the University of British Columbia (UBC), in the city that is now my home, Vancouver. The university's atmosphere is incomparably better, and the city itself is vastly more liveable--even spectacular--than other places I have worked. I managed to earn tenure and have settled into a happy and productive career. My home, the department of mathematics at UBC, is an exciting research environment, where talented people of all persuasions (in pure and applied math) hold mutual respect and admiration. Our department is known for its open and democratic procedures, and for an atmosphere of collegiality and harmony that is seldom broken. We now have seven women faculty members (none in the underclass of instructors or sessionals) and, as of this year, five mathematical biologists.

UBC has a longstanding history of mathematical biology, but prospects have improved dramatically since my arrival. The Pacific Institute for Mathematical Sciences (PIMS) here in the Western provinces has been one significant factor in building recognition for the importance of interdisciplinary science based on mathematics. Through PIMS, we have sponsored workshops in mathematical biology, a regular seminar series, and postdoctoral positions and space. More recently, PIMS has also helped to foster a new initiative called the Mathematics for Information Technology and Complex Systems (MITACS), a project under the Canadian Network of Centers of Excellence program. This program, funded by the Canadian government and private industry, nurtures connections between mathematical scientists and application areas.

One such team focusing on biomedical modeling is based here at UBC, with close working connections at Simon Fraser University, the University of Calgary, and other institutes. In our collaboration on diabetes, for example, data generated by experimental colleagues contribute to modeling and building a concerted mathematical effort at understanding the disease. MITACS funds graduate student and postdoctoral opportunities, as well as travel and participation in network annual meetings and elsewhere.

Opportunities in mathematical biology are now excellent. Universities in North America and throughout the world are hiring in such interdisciplinary programs. (UBC hired two excellent young mathematical biologists last year.) There are also great graduate training programs, including several in Canada, two of which are at the University of British Columbia and the University of Alberta. The interested reader will find many other programs across Canada, North America, and worldwide.

My research interests are eclectic. Currently, I work on three directions: (1) cell motility and the cytoskeleton, (2) modeling of physiology and diseases (such as autoimmune diabetes), and (3) swarming and aggregation behaviour in social organisms. This is the wonderful part of being a professor: Once the "dues are paid" and the early years after a Ph.D. survived, it is possible to work on interesting topics of your own choosing. Yes, it gets hectic. Teaching, research, and service can be stressful when demands for limited time and energy pile up. But how many people can say that they are working on a variety of interesting new things every day?

Imagine being a professor at a great university, with wonderful colleagues. Imagine getting paid to do something you love. Imagine having a great family life, despite the challenge of balancing career and family. Imagine waking up every day with the realization that you have incredible luck and good fortune to be living this life. Then you'll be imagining the way I feel.

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