My Career in Mathematical Biology
A Personal Journey

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In 1959, at the age of 16, I went to the University of Kansas to study mathematics, and looking back I realize I had no clue what I was going to do with it. Nevertheless, KU was a great place to be an undergraduate as the faculty were very student oriented and I had a whale of a good time learning all sorts of mathematics. Then math majors were expected to also take a number of physics courses which I quite enjoyed, along with the philosophy courses that I took, and both have surely shaped my long lasting interest in foundational questions in statistical mechanics and quantum mechanics.

Like many things in life, my interest in mathematical biology was awakened by a totally serendipitous event. I was in the KU book store one day late in my sophomore year, perusing the Dover book section, and found a two volume book entitled Mathematical Biophysics by Nicolas Rashevsky (founder of the Bulletin of Mathematical Biophysics, now the Bulletin of Mathematical Biology). I bought both volumes ($5 for the set!) and started to read through different chapters. I was quite amazed that you could really make mathematical models of biological processes just as physicists made models of the physical world. My advisor (Lee Sonneborn) had an interest in biology and agreed that I could do a reading course under his direction in my junior year using the Rashevsky volumes, and Lokta's book Elements of Mathematical Biology. So that is how I got started.

I finished my degree at KU in January 1963, and really didn't know what I wanted to do. Finally, I landed a job in the research department of Hallmark Cards, and quickly discovered that corporate life (at least the type they had) was not the way I wanted to spend the rest of my career. Eventually I ended up as a graduate student in the Department of Physiology at the University of Washington. The department then, as now, was very quantitatively oriented and my thesis advisor, J. Walter Woodbury, was a physicist turned physiologist. Walt was a wonderful mentor, because he gave me enough slack to do pretty much what I wanted and I learned a lot of physiology in addition to taking much more math and physics to feed my love for those areas. And, most importantly, I learned through his example how to nurture my students.

My Ph.D. was completed at the height of the Vietnam War in early 1968, and after fulfilling my military obligations I went to take an Assistant Professorship in Physiology at McGill University in 1971. Physiology at McGill has a long and rich history of employing quantitatively oriented physiologists which is curious but also very pleasant for someone like me. One of the perks is that I have been able to supervise graduates students in Physiology, Mathematics, and Physics and I have been blessed with many incredibly bright students and postdocs over the years (15 hold academic positions, four are in business, one is a physician, and one is a potter). Though I intended to stay in Canada for only a couple of years, a combination of events has kept me happily in Montréal for almost 40 years. Currently I am the Joseph Morley Drake Professor of Physiology at McGill as well as holding appointments in the Departments of Physics and Mathematics.

Often fellow academics complain about a variety of things in their jobs, but my personal opinion is that being an academic is one of the most privileged of jobs in our society—and being at McGill has been an absolutely marvelous experience for me. I have been left to decide what I will teach, to develop my own administrative initiatives and programmes, to travel as I wish for collaboration, and I have valued colleagues at McGill and other universities around the world. Early in my career Leon Glass was fortunately hired in our department and we have had a significant influence on each others research. Our work on dynamical diseases and our book From Clocks to Chaos has had a major impact in some areas, and I rank the insights from mathematical modeling in hematology and cardiology as two of these. Additionally we have had colleagues like Michael Guevara, Peter Swain, Maurice Chacron and Danny Kaplan who were trained in other than physiology and who have enriched the academic life at McGill beyond all expectations, forming the McGill core of the Centre for Nonlinear Dynamics in Physiology and Medicine (CND) that has been in existence since 1989. The CND and mathematical biology have matured to the point that we are now in the process of launching the Centre for Applied Mathematics in Bioscience and Medicine (CAMBAM), supported federally by MITACS (a Canadian National Centre of Excellence for applied mathematics).

There are all sorts of mathematical biologists. Some of us even work in areas that are seemingly unrelated to biology, and I would rank myself as one of them. However, no matter how strange some of my research appears to someone interested in biology the problems are almost always motivated by biological questions in some fashion or another. One of the most influential encounters of my professional life was meeting the Polish mathematician Andrzej Lasota, for his teaching and our common research has very much cemented together concepts from ergodic theory and dynamical systems theory to enable one to examine the statistical properties of truly chaotic systems.

Mathematical biology has changed dramatically since I first started. In the early 70's going to the Gordon Conference and the Oberwolfach meeting, and talking with all of the key players, was sufficient to bring you up to speed on what the new and exciting stuff was. No more! And, too, as it has evolved and matured, the field has had its share of bandwagons, some of which have died a natural and well-deserved death and some of which have borne fruit and persisted. Such is the case in all areas of science, and it always will be. The important thing for young investigators, in my opinion, is to follow their nose and indulge their curiosity rather than blindly following the crowd in their current stampede whatever it may be.

Selected Publications:

M.C. Mackey & L. Glass. "Oscillation and chaos in physiological control systems", Science (1977) 197, 287- 289.

A. Lasota & M.C. Mackey. Chaos, Fractals and Noise: Stochastic Aspects of Dynamics. Springer-Verlag, 1994.

L. Glass & M.C. Mackey. From Clocks to Chaos: The Rhythms of Life, Princeton University Press, 1988.

M.C. Mackey. Time's Arrow: The Origins of Thermodynamic Behaviour. Springer-Verlag, 1992. Reprinted by Dover Publications, 2003.

M. Santillán & M.C. Mackey. "Why the lysogenic state of phage λ is so stable: A mathematical modelling approach", Biophy. J. (2004) 86, 75-84.

C. Beck & M.C. Mackey. "Could dark energy be measured in the lab?", Phys. Lett. B (2005) 605, 295-300.

M.C. Mackey & M. Tyran-Kamińska. "Deterministic Brownian Motion: The effects of perturbing a dynamical system by a chaotic semi-dynamical system", Phys. Reports (2006) 422, 167-222.

M. Santillán & M. C. Mackey. "Quantitative approaches to the study of bistability in the lac operon of Escherichia coli", J. Roy. Soc. Interface (2008), 5, S29-40.

M. Santillán & M. C. Mackey. "A proposed mechanism for the interaction of the segmentation clock and the determination front in somitogenesis", PLoS ONE (2008), 3(2): e1561. doi:10.1371/journal.pone.0001561.

C. Foley & M.C. Mackey. "Dynamic hematological disease: A review", J. Math. Biol. (2008), 58, 285-322.

C. Foley & M.C. Mackey. "Mathematical model for G-CSF administration after chemotherapy", J. Theor. Biol. (2009), 257, 27–44.