My Career in Mathematical Biology
A Personal Journey

Simon Levin

Like many others who belong to SMB, as a young student I was fascinated with mathematics, mostly because it brought order to an otherwise chaotic world. When I finished my undergraduate work in mathematics in 1961 at The Johns Hopkins University, I was just getting started with mathematics- there was much more that I needed to learn. So I turned down a fellowship to study operations research at Hopkins, and enrolled as a mathematics graduate student at the University of Maryland. Studying mathematics was fun, but it did not seem like math alone was going to be enough for me for a lifetime; I wanted to use my mathematics to do something useful. Maryland was a good environment for that, and several faculty in the Institute for Fluid Dynamics and Applied Mathematics were interested in biology. Furthermore, the Director, Monroe Martin, who happened to be my advisor, was very supportive of my reaching out to biological applications. Therefore, although my thesis focused on relatively classical problems in partial differential equations, I used my time at Maryland to begin reading biology, and at Monroe Martin's suggestion went on to U.C. Berkeley on an NSF Postdoctoral Fellowship to work with George Dantzig.

Dantzig will be well known to many readers, but primarily for his foundational work in operations research, and especially his development of the simplex method for linear programming. What attracted me to work with Dantzig was not linear programming, but rather his new interest in biological systems, and especially the active transport of sodium across red blood cell membranes. The postdoc was a wonderful opportunity to learn biology, and to benefit from an exciting community at Berkeley, at the height of the Free Speech Movement. George Dantzig was a terrific mentor, and a model for the way I would deal with my students; but I also made a good friend in Hans Bremermann, one of the most original of mathematicians wrestling with the new challenges of biology. Over the next five or six years, first as a postdoc and later as an Assistant Professor of Mathematics at Cornell, I was often advised that it was foolish to waste my mathematical talents on such things- I had heard similar discouragements even as an undergraduate; at those later times, I drew great strength from the examples of those like Dantzig and Bremermann, who were unafraid to leave the comfort of highly successful careers in pure and applied mathematics, and to follow their scientific curiosity. That lesson has served me in good stead repeatedly throughout my own career, and is the basis of the way I mentor graduate students. A career built on someone else's curiosity is likely to come crashing down; a student must find his or her own way, and pursue personal passions.

A first visit to the Gordon Research Conference in Theoretical Biology and Biomathematics in 1968 was a life-changing experience for me, and my annual pilgrimages to New Hampshire for a decade or more after that were an opportunity to exchange ideas with a fantastic group of regulars, including Lee Segel, Jack Cowan, Nancy Kopell, Stu Kauffman, Alan Perelson and George Oster, all life-long friends and pioneers in theoretical biology (http://www.smb.org/governance/other.shtml). Cornell was a world

leader in ecology, the perfect place for me to develop my interests in that topic, and I was warmly welcomed into the midst of the Section of Ecology and Systematics, one of the first ecology departments in the world to recognize the changing face of the subjects towards a more quantitative base. I agreed in 1974 to become Chair of the department, delighted that my natural history colleagues would entrust their future to a congenital mathematician.

I moved to Princeton in 1992, largely because I saw it as a way for me to expand my basic research further into the policy dimension, and was the Founding Director of the now-flourishing Princeton Environmental Institute (currently directed by long-time colleague, Steve Pacala). My research now is largely split between basic work on collective phenomena in ecological systems and parallel work in understanding collective decision-making in socioeconomic systems, with a view towards addressing problems of the Global Commons (See my 1999 book, Fragile Dominion). I have invested a great deal of my time in four international organizations over the last quarter-century, each of which has repaid me many times, allowed my own research to grow, and enriched my life. These are the International Center for Theoretical Physics in Trieste (http://www.ictp.trieste.it/), The Beijer Institute of Ecological Economics (http://www.beijer.kva.se/) in Stockholm, The Santa Fe Institute (www.santafe.edu/), and the International Institute for Applied Systems Analysis (www.iiasa.ac.at) Vienna. I encourage all readers to find out about these wonderful organizations, which provided the foundations for me to study the problems of complex adaptive systems and apply what I learn to solving ecological problems. I have also enjoyed interactions in recent years with DIMACS (dimacs.rutgers.edu), based at Rutgers, which, under the inspired leadership of Fred Roberts, has provided a fantastic venue for developing the applications of mathematics in biology and elsewhere.

For me, and for many of my students, the only path to applying my mathematics to biology was to become a biologist, fully embedded in a department in which others could provide the range of experiences and challenges that forced continual intellectual growth on my part, and constant ground-truthing of my theoretical ideas. For others, however, such a transition would not make sense; not only do I endorse the validity of such alternative paths, but I benefit a great deal from the advances of my colleagues who continue to provide the rigorous mathematical underpinnings for what I do. We need a whole assortment of researchers who span the spectrum from fundamental mathematics to highly applied work, and SMB is the ideal venue for fostering partnerships across the landscape.

I had the good fortune of being President of SMB (two years before becoming President of the Ecological Society of America) at a crucial time (1987-89) in its development, and have been delighted to see its growth ever since. Carole and I continue to enjoy life in Princeton, a good base for visiting our children and grandchildren. I also *qvell* in the accomplishments of my former students and postdocs, many of whom have been leaders in SMB (including two presidents, Alan Hastings and Lou Gross). There is little greater satisfaction than seeing one's students and favorite organizations flower; seeing them do so together raises that gratification to a higher level.

Selected publications of Simon Levin:

Durrett, R. and S. A. Levin. 2005. Can stable social groups be maintained by homophilous imitation alone? Journal of Economic Behavior and Organization. 57:267-286.

Levin, S. A., J. Dushoff and J. B. Plotkin. 2004. Evolution and persistence of influenza A and other diseases. Special Issue of Mathematical Biosciences 188: 17-28.

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Kareiva, P. and S. A. Levin, eds. 2003. The Importance of Species: Perspectives on Expendability and Triage, Princeton University Press, Princeton, NJ.

Levin, S. A., Editor-in-Chief. 2001 Encyclopedia of Biodiversity, Five Volumes, Academic Press, San Diego.

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