

Combining Education and Outreach with a Career in Math Biology

Suzanne Lenhart



I feel that I was born to be a math teacher. From an early age, my teachers recognized that I could both do and explain math well. From about the age of 12, I would say that I was going to be a math teacher. With my undergraduate math major, I completed a secondary education training including student teaching. My Calculus I professor, Ralph Grimaldi, convinced me to go to graduate school in mathematics and he taught me a lot more mathematics beyond calculus.

When I was a graduate student at the University of Kentucky, my interest in mathematical biology started with interactions and discussions with Tom Hayden. Then I took a math biology modeling course which was co-taught by Phil Crowley and Tom. Through that course, Phil and I worked on a project modeling and simulating the swimming of eukaryotic flagella. I mostly concentrated on my dissertation on PDEs under the direction of Craig

Evans, but continued my interest in math biology. I would also mention that I was exposed to some material on optimal control theory in my graduate education which later led to one of my main research interests.

At that time, there were very few math post-docs available, so I came to the University of Tennessee (UT), Knoxville, right after graduate school in 1981. When I first came to UT, Tom connected me with Curtis Travis at Oak Ridge National Laboratory (ORNL). I learned some ideas about simple population and epidemiological models from this productive collaboration with Curtis.

I understood that I was hired to contribute to the PDE group at UT, and so at first, I concentrated on that area of research. Fortunately, UT had a strong math ecology group led by Tom Hallam, and opportunities for learning more and contributing in the area of math biology became available.

In 1987, I started a part-time research position at ORNL. This opportunity and the resulting work with my main collaborator, Vladimir Protopopescu, came about by my being flexible and open about working on new areas of applications. Vladimir and I have quite different backgrounds and personalities but our strengths fit together well to form a successful collaborative team. At ORNL, there was always a variety of interesting projects for collaboration, including physical (solid state lasers) and biological (competitive systems) models. Vladimir, Eunok Jung and I received a U.S. patent for using optimal control theory on a circulation model to design compression patterns for cardiopulmonary resuscitation. During this time, I worked full-time at UT and part-time at ORNL (one day a week).

Also in 1987, UT hosted one of the first NSF-funded Research Experiences for Undergraduates summer programs in mathematics. I was a mentor for a student project that first summer, which led to one of my favorite passions, working on research with undergraduates. In 1990, I became the director of the REU in the UT Math Department and continued that role for 15 years. Most of my summer student projects were in mathematical biology. Lou Gross and I began to collaborate which led to some very interesting projects, mostly coming out of his creative ideas. I learned to break off some simpler parts of Lou's big ideas and to collaborate on those parts first. Later Lou and I worked with several UT undergraduates in mathematics and biology on an

NSF funded Undergraduate Biology and Mathematics (UBM) program; we had the luxury of having the time over two years to let students find their own research topics and design experiments.

Continuing my interest in working with students at all levels, the local chapter of the Association for Women in Science helped me to begin to be involved in workshops for middle and high school female students. Later I got involved in running a Math Club at an inner city middle school and began involvement in MathCounts competitions. Later, I helped to train a MathCounts team from Tennessee School for the Deaf. For the last 13 years, I have been co-organizing the Math Club at Bearden High School and have recently been teaching modeling ideas with biological applications to a few students there. As president of the Association for Women in Mathematics, I was able to continue to encourage women and girls to study mathematics.

In the early 1990's, I started to teach an introductory graduate course on optimal control of ordinary differential equations. Having some expertise in optimal theory brought many interesting problems to my door, like when Mahadev Bhat asked me to work on control of beaver populations using data from the state of New York. When Lou and I had some NIH funding for short courses on various topics, John Workman and I developed some simple demonstration MATLAB codes for optimal control of biological models. These codes and the collaboration with John led to our textbook, "Optimal Control Applied to Biological Models."

In the fall of 2007, my collaboration with Lou grew to be even more productive when Lou suggested to Sergey Gavrillets and me that the three of us could take the lead in applying for an NSF Biosynthesis Center. With Lou's creativity leading the way, the National Institute for Mathematical and Biological Synthesis (NIMBioS) was born! Beginning work as an Associate Director for Education and Outreach, I retired from my part-time job at ORNL since it would be difficult to do three jobs. The education and outreach activities at NIMBioS have enabled me to work with Sarah Duncan and Kelly Sturner. Work-

ing with Sarah and Kelly has taught me a lot about biology and about working with young students. I remember when a staff person at the Great Smoky Mountains National Park (GSMNP) asked Sarah and me to make a presentation to a teacher workshop using some salamander data from the park. Sarah immediately knew what to do and suggested investigating biodiversity of salamander populations in two areas of the park over time, and this activity later led to a publication on "Using Probability to Understand Biodiversity" in the NCTM *Mathematics Teacher Journal*. As a result of Lou's commitment directing NIMBioS, I became more involved in teaching courses in mathematics for the life sciences, which lead to our textbook on that topic (with Erin Bodine and Lou). Kelly and I organize the NIMBioS Summer Research Experiences for Undergraduates and Teachers. NIMBioS has also enabled me to work on a variety of interesting research topics, especially on population models for animals, such as the feral hog population in the GSMNP and Johne's Disease in dairy cattle.

My husband said that I do not need to travel much these days because NIMBioS brings the world to me, but I do still travel a lot. With an NSF funded project through Auburn University (cws.auburn.edu/masamu/), I recently traveled to Victoria Falls, Zimbabwe, and started a collaboration on population models with Edward Lungu and several of his former and current students. I am happily continuing my role at NIMBioS. I am a person who is comfortable in a service role, and I hope to continue to serve the mathematical biology community.

About The Author:

Suzanne Lenhart is currently a Chancellor's Professor in Mathematics at the University of Tennessee and Associate Director of Education and Outreach at NIMBioS. She worked as a part-time researcher at Oak Ridge National Lab for 22 years. Her current research interests include models of infectious diseases, invasive species and natural resources. See more here: http://www.nimbios.org/personnel/dir_lenhart

