My Career in Mathematical Biology
A Personal Journey

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My Path to Mathematical Biology: A Random Walk?

I was born in Puerto Rico and spent my early years in a busy small town, Humacao, named after Taino Chief Jumacao. My parents were both medical doctors who visited Puerto Rico on vacation, saw a need, and decided to stay on the island. I learned early to seek challenge as my parents did, retraining from internal medicine and ob-gyn to general surgery and anesthesiology, respectively, and operating a small farm during W.W.II, when there was a dire shortage of beef, milk and eggs. Beginning in elementary school I learned to question convention from Marina L. Molina, a school teacher and poet with an enthusiasm for learning, who sat reading on her front porch with a 38 caliber revolver under a light shawl on her lap "to show to any unruly passerby that might approach without permission".

My first interest in mathematics was probably stimulated while tracking hurricanes as they formed west of Africa and headed over the South Atlantic Ocean toward the Caribbean. This not only taught me to plot position on a map, but also prediction of a storm track and introduced me to English, since most of the radio stations that provided detailed weather information broadcast in English. My first investigation in physiology may have been with a pet rabbit, although I have been told that it did not end well for the rabbit. As a teenager I had an interest in billiards (applying geometry to hit two balls with a third with a force and direction that would leave the balls well-positioned for the next shot). Thirty-one, a variant of blackjack, made it profitable to card count and estimate probabilities. Sports such as basketball taught me discipline and the importance of angles, both in use of the backboard and in running plays, and helped me develop lasting friendships at school, work and conferences.

After several years of high school study on the U.S. mainland, my interests led to work as a laboratory technician during summers in Puerto Rico. The head technician would train students in the lab's work at the beginning of the summer, before s/he took a vacation. Doing chemical analyses taught lab technique, how to follow a recipe, as well as development of rapport with patients, whom one stuck with needles, and hospital staff, who wanted the results "pronto". It also allowed students to advance in skill and responsibility and taught instruction of others.

At a small arts/science/engineering school, Manhattan College, in New York City I majored in mathematics and minored in biology and chemistry. Fortuitously, during my third year IBM offered a computer course at a nearby women's college in a recruitment effort. It led me to become interested in numerical analysis, and resulted in several years of work at a Navy research laboratory, the David Taylor Model Basin (now the Naval Ship Warfare Center in Carderock, MD). At the same time I began graduate work at the University of Maryland under the direction of Ron Strauss until his untimely death at the age of 38. (Ron produced two mathematics progeny and over 115 grandchildren!)

The years at the Model Basin were great fun, working with many dedicated mathematicians and scientists in several disciplines, including

Betty Cuthill, Joanna Schot, Harry Polachek, Charlie Dawson, Feodor Theilheimer, Kent Meals, Joe Johnson and Lenny Mockapetris. We also collaborated with several laboratories including the Oak Ridge National Lab, which was an early proponent of mathematical biology. This introduced me to multidisciplinary research.

When Marvin Shapiro, a mathematician at the National Institutes of Health, suggested that I might join a fledgling group of mathematical and computational scientists at the Division of Computer Research and Technology (now the Center for Information Technology), I jumped at the opportunity to apply mathematics in biology.

The laboratory directed by Gene Harris was composed of statisticians, mathematicians and computer scientists who collaborated with NIH bench scientists. This lead to completion of work initiated at the Model Basin on techniques to analyze time series (with Chia Chang), which resulted in a text and suite of computer programs that was used to instruct investigators in the analysis of biological data. It also allowed me to work with a dedicated neurosurgeon, Maitland Baldwin, who would describe in detail the surgical procedure underway to all within earshot.

Work with John Stephenson (SMB President 1983-5; see http://www.smb.org/governance/presidents.shtml) led to research at the National Heart, Lung and Blood Institute on kidney physiology and membrane transport and thirty years as "guest worker" at the Mathematical Research Branch (now the Laboratory of Biological Modeling) of the National Institute of Diabetes, Digestive and Kidney Diseases. John was an engaging, insightful biophysicist who helped his fellows to develop their scientific insight, and was the first to postulate mathematical models of the mammalian urine concentration mechanism. MRB was founded by John "Zim" Hearon - since lead by John Rinzel and now Artie Sherman - all well-known to many SMB members. To date, LBM continues to focus on research that includes computational neuroscience, integrative physiology, and computational chemistry. See http://lbm.niddk.nih.gov/sherman/tmp/A brief history of LBM (MRB) [6 final].pps for a brief history of LBM and mathematical biology at NIH. Collaboration at NHLBI, in particular with Mark Knepper and Bob Balaban, as well as with fellows and former fellows, has resulted in work in mathematical and integrative physiology that has advanced the field.

I have learned along the way that internships are valuable in learning about one's likes and dislikes prior to making a larger investment in time and energy, and that being an integral part of a work/research group is a key to success in interdisciplinary research. We must encourage students to broaden their exposure to the sciences, so that they are better prepared for interdisciplinary work. Co-op programs broaden the experience of students when they include rotation among disciplines. Post-Bac programs prepare students for graduate work after their undergraduate years. However, both lengthen the time to complete a degree program. On the other hand, thoughtful mentoring can direct students to a goal earlier in their professional development, and I have seen the most success when mentoring is an integral part of a training program. Thus, I am especially pleased to see SMB lead in outreach, education and mentoring programs that we should all support.

See http://mrb.niddk.nih.gov/ray/Pubs.Ray.html for a brief list of publications.

Ray Mejia with Lou Gross, John Jungck and Torcom Chorbajian at the SMB Annual Meeting 2010