



# The Society for Mathematical Biology

## **SMB NEWSLETTER** **VOLUME 24 #3 - SEPTEMBER 2011**

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The Society for Mathematical Biology Annual Meeting and Conference

July 26-28, 2012

Location: Knoxville Convention Center

<http://nimbios.org/SMB2012/>

Mathematics and Biology: Interdisciplinary Connections and Living Systems

The 2012 Annual Meeting and associated research and education conference for The Society for Mathematical Biology will be held in Knoxville, Tennessee from July 26-28, 2012. The conference theme is Mathematics and Biology: Interdisciplinary Connections and Living Systems and the gathering is being hosted by the National Institute for Mathematical and Biological Synthesis (NIMBioS) and the University of Tennessee. The conference will be held at the Knoxville Convention Center and associated activities will be held at NIMBioS before and after the conference. Further details will be posted here (<http://nimbios.org/SMB2012/>) as they become available. Those with questions may contact the conference secretary, Ms. Chandra Eskridge ([smb2012@nimbios.org](mailto:smb2012@nimbios.org)).



Dear SMB members,

This is my first missive to you as President of the Society for Mathematical Biology. It is a great honor to represent you; I look forward to the next two years, and hope to get to know many of you in person.

I would like to begin by thanking our Past President, Michael Mackey, for his dedication, leadership, and hard work for the SMB over the last two years. A big thank you also goes to the outgoing members of the board, many of whom are continuing to serve. The SMB is fortunate to have so many enthusiastic members willing to pitch in to keep the SMB vibrant and strong.

This summer, many of our members attended our joint meeting with the European Society for Mathematical and Theoretical Biology in the picturesque and historical city of Krakow, the former capital of Poland. The city is rich in sights as well as history: perched on top of Wawel Hill overlooking the Vistula River is a medieval castle, and just steps away is Collegium Maius, Poland's oldest university building dating back to the 15th century. The Collegium Maius belongs to Jagiellonian University, founded in 1364, and host to the conference.

Many thanks to the large team of conference hosts, headed by Professor Ryszard Rudnicki, for their superb organization of both the professional and social components of the conference. The schedule included interesting and stimulating plenary talks, as well as many parallel sessions on a wide variety of topics and questions being investigated under the umbrella of mathematical and theoretical biology.

I was struck by the large number of young people attending the conference; this bodes well for the future of our disciplines. Much to the surprise of many conference delegates, the conference included extensive coffee breaks as well as hot lunches, and a delightful conference dinner in the beautiful countryside just outside Krakow, where we were treated to a folklore evening with traditional Polish cuisine and dancing.

Plans are well underway for the next SMB meeting, chaired by former SMB President Lou Gross, and hosted by the National Institute for Mathematical and Biological Synthesis (NIMBioS) and the University of Tennessee, in Knoxville, TN. Details are available at [nimbios.org/SMB2012](http://nimbios.org/SMB2012).

Classes have started here at the University of Alberta. I always find the fall term invigorating, as new students (both undergraduate and graduate) arrive on campus for the beginning of a new chapter in their lives.

I wish you a very productive and enjoyable Fall.

*Gerda de Vries*





## Recent Events:

Research Experience for Undergraduates (REU) and Research Experience for Veterinary Students (REV), May 31 – July 22. Sixteen undergraduates, five veterinary students, and one high school science teacher recently completed the 2011 NIMBioS REU/REV program at the interface of mathematics and biology.

Investigative Workshop: Individual-based Ecology of Microbes – Observations and Modeling, June 8-10. This workshop brought together researchers interested in applying individual observational and/or modeling techniques to the study of microbial ecology.

Investigative Workshop: Malaria Modeling and Control, June 8-10. Experts in malaria dynamics attended this workshop to discuss modeling malaria transmission and control, with the goal of forming a Working Group to develop a cutting-edge model that incorporates current climate changes, a potential vaccine and the economic burden of malaria-infected countries.

Investigative Workshop: Modeling Johne's Disease, June 8-10. The goal of this workshop was to contribute to the control and ultimate eradication of *Mycobacterium avium* (the cause of Johne's disease) in dairy herds through application of mathematical modeling approaches for better understanding of disease's epidemiology, pathogenesis, and immune responses.

Investigative Workshop: Mathematical Modeling of Metabolism and Body Weight Regulation, June 8-10. Acting as a catalyst for future research in the area of body weight and metabolic regulation, this workshop provided a background on the physiology of human body weight regulation, highlighted some of the recent progress applying methods to modeling human metabolism, food intake, and body composition, and posed open mathematical modeling problems originating from metabolism and body weight regulation research.

Investigative Workshop: Modeling Renal Hemodynamics, June 8-10. This workshop integrated key data and concepts into a multi-scale mathematical model of relevant aspects of renal functions, which can be used to study how the kidney is involved in and impacted by hypertension and diabetes, and how this leads to progressive renal failure.

## Upcoming Events:

Request for Support. December 11, 2011, is the deadline for submitting applications for postdoctoral fellowships at NIMBioS. Apply at <http://www.nimbios.org/postdocs/>

Undergraduate Research Conference (UBM), Oct. 21-22, 2011. This third annual conference, to be held at the University of Tennessee Conference Center, provides undergraduates with the opportunity to present their research at the interface of mathematics and biology. Student talks and posters will be featured, as well as a plenary speaker. Application deadline to request funding for the conference is Oct. 7, 2011. For more information about the conference and details about the funding request, visit [http://nimbios.org/education/undergrad\\_conf2011](http://nimbios.org/education/undergrad_conf2011)

Investigative Workshop: Modeling Social Complexity, Feb. 6-8, 2012. Humans' ability to cooperate in large groups of genetically unrelated individuals presents a puzzle to both evolutionary and social theory. Until recently, formal models have ignored the transition from small- to large-scale societies. Application deadline: Sept. 30, 2011. For more information about the workshop and how to apply, visit [http://nimbios.org/workshops/WS\\_social\\_complexity](http://nimbios.org/workshops/WS_social_complexity)

Investigative Workshop: Modeling Dynamic Disequilibrium of Ecosystem C Sequestration, Date: TBA. Application deadline: TBA. The fact that global carbon cycle can potentially be destabilized by various disturbances has gained attention recently, but the quantitative relationship between carbon storage capacity and disturbance regimes has yet to be explored. This workshop will discuss various issues on integration of disturbance ecology with biogeochemistry using mathematical and statistical approaches. For more information about the workshop and how to apply, visit [http://nimbios.org/workshops/WS\\_carbon](http://nimbios.org/workshops/WS_carbon)



## Upcoming Events

MBI Emphasis Year on Stochastics in Biological Systems, July 2011 - June 2012, [www.mbi.osu.edu/2011/scientific2011.html](http://www.mbi.osu.edu/2011/scientific2011.html)

2011 Workshop for Young Researchers in Mathematical Biology, August 29 – September 1, 2011, [www.mbi.osu.edu/wyrm/wyrm2011.html](http://www.mbi.osu.edu/wyrm/wyrm2011.html)

Workshop: New Questions in Probability Theory Arising in Biological Systems, September 12-16, 2011, [www.mbi.osu.edu/2011/ws1description.html](http://www.mbi.osu.edu/2011/ws1description.html)

Workshop: Spatio-Temporal Dynamics in Disease Ecology and Epidemiology, October 10-14, 2011, [www.mbi.osu.edu/2011/sdsdescription.html](http://www.mbi.osu.edu/2011/sdsdescription.html)

Workshop: Stochastic Processes in Cell and Population Biology, October 24-28, 2011, [www.mbi.osu.edu/2011/ws2description.html](http://www.mbi.osu.edu/2011/ws2description.html)

Workshop: Free Boundary Problems in Biology, November 14-18, 2011, [www.mbi.osu.edu/2011/fbpdescription.html](http://www.mbi.osu.edu/2011/fbpdescription.html)

## Job Opportunities

Three-Year MBI Postdoctoral Fellowship [www.mbi.osu.edu/postdoctoral/three\\_year.html](http://www.mbi.osu.edu/postdoctoral/three_year.html)

Early Career Award [www.mbi.osu.edu/postdoctoral/early\\_career.html](http://www.mbi.osu.edu/postdoctoral/early_career.html)

## Call for Applications to Organize Current Topic Workshop

MBI fosters innovation in the application of mathematical, statistical, and computational methods in the resolution of significant problems in the biosciences and the development of new areas in the mathematical sciences motivated by important questions in the biosciences.

MBI encourages members of the mathematical sciences and the biosciences communities to organize MBI programs. Proposals are sought for Current Topic Workshops: stand alone meetings of up to one week.

Applications to organize a Current Topic Workshop may be submitted to the Director ([mg@mbi.osu.edu](mailto:mg@mbi.osu.edu)) or online at [www.mbi.osu.edu/forms/applyctw.html](http://www.mbi.osu.edu/forms/applyctw.html).

Current Topic workshops are easy to organize and are usually scheduled within one year from time of

acceptance. The parameters of a typical workshop are described at [www.mbi.osu.edu/suggestions.html](http://www.mbi.osu.edu/suggestions.html), though MBI is happy to consider different formats. The MBI staff is responsible for all meeting logistics; the workshop organizing committee only determines speakers, participants, and workshop schedule. The deadline for the next competition is Monday, December 12, 2011. Decisions on which Current Topic Workshops to support will be made by the MBI Scientific Advisory Committee and the Committee of MBI Directors.

## SMB on Facebook

Since the beginning of this year, the Society for Mathematical Biology utilizes Facebook to connect with members and friends. While the use of social media by the SMB is still in its infancy, we aim to establish an additional communication platform where Society members and friends interested in Mathematical Biology can exchange ideas and news of interest to the community.

Together with Springer, our publishing partner for the Society's Bulletin of Mathematical Biology, we will inform Facebook friends about ongoing promotions, as well as hot articles in the Bulletin and other relevant journals. We will keep friends informed about ongoing Society activities, forthcoming annual meetings, and Society prizewinners. Our updates from the past annual meeting in Krakow, Poland received positive feedback, and we are pleased to see that Society friends engaged in updating information about interesting talks and submitted photos from the conference and the hosting city.

Internet social media platforms live from interaction, and we would like to invite everybody to join us on Facebook, and share your Mathematical Biology relevant news with others and us. Are you planning or attending an exciting conference, are you editing a special issue on Mathematical Biology, are you writing a textbook, do you have open positions? Share your news on [facebook.com/smb.org](http://facebook.com/smb.org). Our page can be visited without being a registered user, so you don't need a Facebook account to check it out. If you have any questions, suggestions or concerns please talk to us. The Facebook team can be reached at [socialmedia@smb.org](mailto:socialmedia@smb.org). Visit us: <http://www.facebook.com/smb.org>



Have a Facebook Account? Visit us: [www.facebook.com/smb.org](http://www.facebook.com/smb.org). (See previous page for more information regarding SMB's Facebook Page.)

## Mathematical Biology Workshop at Sweet Briar College in Virginia

*Robin Lee Davies*

Twenty-five mathematicians and biologists gathered at Sweet Briar College from June 12 to 18, 2011, for the MAA PREP workshop "Mathematical Biology: Beyond Calculus." The workshop was organized by Raina Robeva, Terrell Hodge, and Robin Davies. Robeva and Davies are members of the Departments of Mathematical Sciences and Biology, respectively, at Sweet Briar College, and Hodge is a member of the Department of Mathematics at Western Michigan University. Ten participants registered as institutional teams, most consisting of a biologist and a mathematician, while the remainder registered individually.

After a welcome dinner on Sunday evening, the organizers gave an overview of the planned events and goals for the week, including the development of take-home projects. On Monday morning, following a welcome by Sweet Briar College Dean Jonathan Green, the work began in earnest. The plenary speaker, Reinhard Laubenbacher of the Virginia Bioinformatics Institute at Virginia Tech, delivered a keynote address entitled "Trends in Modern Mathematical Biology," followed by a discussion of

mathematical models in biology by Raina Robeva. In the afternoon, the mathematicians went to the genetics laboratory with Robin Davies while the biologists had mathematics class with Raina Robeva and Terrell Hodge. Both groups reported increased understanding of the other discipline, and the mathematicians achieved impressive electrophoretic separation of DNA fragments.

On Tuesday, invited speaker Holly Gaff, of the Department of Biological Sciences at Old Dominion University, introduced agent based modeling and rapidly had all participants exploring NetLogo. Sessions on linear algebraic approaches and Boolean network modeling added to the participants' mathematical biology toolboxes and provided starting points for several take-home projects. During the remainder of the week, the organizers offered on-demand sessions on such diverse topics as Groebner bases and BLAST (the Basic Local Alignment Search Tool of the National Center for Biotechnology Information) and the participants formed working groups based on mutual interests and constructed their take-home projects. After a banquet on Friday evening, the workshop ended on Saturday with presentations of the take-home projects. Topics included Boolean models of bacterial gene expression control systems, agent-based models of virtual and real ecosystems, phylogenetic analyses, and models of infection patterns and hormone network control. The presentations were outstanding and included in most cases a demonstration of a functional take-home product. The organizers were delighted with the many positive comments they received from participants and hope to offer another workshop in 2013.



Sweet Briar College Workshop Attendees



## EpiRep 2011

*Yoram Louzoun*

Recognition of intra-cellular viral antigens is mediated by CD8 T cells. These T cells recognize antigens through interactions between the T cell receptor and peptides presented by MHC molecules. Recently significant advances have been performed in the modeling of MHC-peptide binding. These mathematical models allow for the precise prediction of epitopes presented to the cellular immune system. These predicted epitopes, and the detailed repertoire of epitopes presented by viruses, open the way for second level mathematical models of the interaction between the immune system and viruses. These models are a typical case of multi-scale modeling, where the coming to age of models at a given level open the way for detailed higher level models.

These subjects are studied by many mathematical biology groups (including Utrecht, Copenhagen, UC San Diego, Imperial College and Bar Ilan University). The SMB funded the EpiRep 2011 ([peptibase.cs.biu.ac.il/EpiRep2011/index.htm](http://peptibase.cs.biu.ac.il/EpiRep2011/index.htm)) workshop at Bar Ilan University to discuss all the mathematical and biological details of these models. The workshop contained multiple round table sessions where technical issues were raised in an open discussion, followed by more formal presentation sessions where the different groups as well as multiple experimental groups presented their results. This division allowed for the combination of wide views of the models and experimental results often presented in conferences, with a detailed technical analysis more typically performed in small workgroups.

This combination was found to be very fruitful for the elaboration of multiple basic issues in mathematical immunology, such as the relation between epitope presentation and T cell activation, the importance of the different stages of epitope processing. The discussion also clarified the important open questions in the domain. Following the workshop, the participants decided to attempt to perform a continuation workshop within a couple of years.

## Luigi Maria Ricciardi

Word has arrived of the death of Prof. Luigi Maria Ricciardi. He died in Naples, Italy, after a short illness. Prof. Ricciardi was a leader in the applications of stochastic processes as biological models. He was the author of the seminal “Diffusion Processes and Related Topics in Biology” (Lecture Notes in Biomathematics, Vol. 14. (1977)), which demonstrated the importance of stochastic processes in neurobiology. More recently, his work on myosin dynamics showed that molecular motors cannot be understood without stochastic models. In addition to his many collaborators in both the United States and Italy, he also had long term collaborations with several faculty members in Japan including S. Sato at Osaka University.

After completing his degree with Eduardo Caianiello, Luigi Ricciardi was Assistant Professor of Mathematical Biology at the University of Chicago. Subsequently, he was a faculty member at the Universities of Turin, Salerno, and Naples. At Naples, he was director of the graduate program in applied mathematics. Prof. Ricciardi was very active in several series of conferences including the European Meetings on Systems and Cybernetics, the EUROCAST meetings, and the series of conferences on Biomathematics and Related Computational Problems that he arranged at sites in the Naples area including the Isle of Capri and Vietri sul Mare.

Prof. Ricciardi was major professor for Charlie Smith, Henry Tuckwell and Paul Cull among many others. He was a humanitarian, a teacher, and a friend. He will be sorely missed. He will be commemorated (in Italian) at a meeting at the University of Naples Federico II on October 11. He will also be memorialized at the International Conference, “BIOCOMP2012 - Mathematical Modeling and Computational Topics in Biosciences”,



dedicated to the memory of Professor Luigi M. Ricciardi (1942-2011) that will take place from June 4 to June 8, 2012, in the same location (Lloyd's Baia Hotel, Vietri sul Mare, Italy) where BIOCOMP2002, BIOCOMP2005 and BIOCOMP2007 were held under his leadership.

## 2011 Janet Anderson Prize



The Janet L. Andersen Award for Undergraduate Research in Mathematical or Computational Biology was established by BIO SIGMAA, the mathematical and computational special interest group of the Mathematics Association of America (MAA), in honor of our colleagues and friend, Janet Andersen. Until her untimely death in November 2005, Janet Andersen was Professor of Mathematics at Hope College in Holland, Michigan. She joined the Hope faculty in 1991 after completing her master's and doctoral work in algebraic geometry at the University of Minnesota. At Hope, she pioneered an interdisciplinary course in mathematical biology, was a research mentor for students in the field, and worked through several organizations such as the BioQuest Curriculum Consortium, the MAA, and the Society for Mathematical Biology, to broaden undergraduate exposure to mathematical biology. This prize for best math biology poster by an undergraduate at the MAA MathFest honors her efforts.

### Sepideh Khavari

I am a senior graduating in December 2011 from Youngstown State University with a double major in mathematics and economics. I plan to continue my studies by attending graduate school to pursue a Ph.D. in mathematics. I was born in Iran and attended a high school with an intensive focus on mathematics and science courses. Instead of pursuing post-secondary education in Iran, I decided to move to the U.S., due to the greater educational and career opportunities available to women in this country. Originally, I was planning on attending medical school. However, as I took more math courses in college, I realized I gravitated more towards mathematics because of its logical structure. Although I love pure mathematics, I am also fascinated by how it can be applied to solve real world problems. This is exactly the reason I participated in biomathematics

research at YSU over the past two years. We have a wonderful undergraduate mathematical biology research program at YSU that is funded by the NSF. During the first year of my research, I investigated changes in the gene expression of E-coli when they are exposed to toxic materials (e.g., selenite). This year, my research dealt with a theoretical analysis of the time-to-peak response in biological systems. My work was inspired by a recent paper by Theis et al. (2011). My recent research has applications in the pharmaceutical field for designing drugs with extended release-time, chemotherapy treatments, and metabolism of toxic materials inside bacterial cells. For example, the model predicts the concentration of toxic selenite inside the cell and its metabolism to non-toxic elemental selenium over time. My mentors for this research were Dr. George Yates and Dr. David Pollack.

### James Peiskee

I was born and raised near Tyler, Texas, and continued my education at Tarleton State University in Stephenville, Texas. My original major was Engineering Physics, but after three years of classes I changed to Mathematics with a minor in Physics. Both mathematicians and engineers are problem solvers, but I find the problems of mathematicians more interesting. Upon changing majors I was eager to begin some kind of research, so my adviser steered me towards a relevant current subject: the persistence of cholera in underdeveloped countries and refugee camps despite the existence of effective prevention methods. I have been working with Dr. Garza since August 2010, and will continue to do so for the remainder of my time at Tarleton. After graduating this December, I plan to attend graduate school for pure mathematics. I continue working with fellow student Amber Dayhare on the project, and our faculty mentor is Javier Garza.



Anderson award winners: James Peiskee (left) and Sepideh Khavari (right)

# My Career in Mathematical Biology

## A Personal Journey

### Leah Edlestein-Keshet



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.

From AAAS Highwire Press, ScienceCareers.org Feb 20, 2004. Reprinted with permission from AAAS.

# Reports from the 8th ECMTB/SMB Meeting June 28 - July 2, 2011 Krakow, Poland



*Submitted by Hannah Callender*

As someone who is blessed enough to travel for my career, nothing is more delightful to me than learning and experiencing new cultures. This year, as I traveled to the 8th European Conference on Mathematical and Theoretical Biology and Annual Meeting of the Society for Mathematical Biology (June 28-July 2), I was surprised beyond what I thought was possible. Not only was the conference stimulating and full of energy, which was to be expected for me, but the beauty and vibrance of the city and hospitality of its people were astonishing. This year's meeting brought over 1000 mathematicians and scientists together in what has come to be one of my favorite cities in the world, to discuss a wide range of current topics in mathematical biology.

Five lectures were held a day before the official conference date, covering topics from the evolution of age-structured populations, to branching problems in finite populations, to discussions on models of cancer invasion, mechanistic models in ecology, and current problems in epidemiology. The official meeting then began with the first plenary speaker, Peter Swain, who spoke on "Stochasticity in biochemical networks." This lecture provided an excellent introduction to several mini symposia throughout the week, three of which were specifically focused on modeling stochastic systems.

There were eight plenary talks in all, whose topics were as varied as the 94 mini symposia and the 17 themed sessions, many of which had three

to eleven separate sections. Other plenary speakers, each of whom were equally as fascinating as the first, included Uri Alon (Weizmann Institute of Science) "Design principles of biological circuits"; Marek Kimmel (Rice University) "Heterogeneity of proliferating cell populations: Models and data"; Sylvie Méléard (École Polytechnique, Paris) "A rigorous model for adaptive dynamics of Mendelian diploids"; Rob Phillips (California Institute of Technology) "Random Walks in Physical Biology"; Michael C. Reed (Duke University) "Serotonin Metabolism in Health and Disease"; Julie Theriot (Stanford University Medical School) "Quantitative analysis and modeling of cell shape during rapid movement"; and Hiroki Ueda (RIKEN Center for Developmental Biology, Japan) "System-level Understanding of Biological Timings".

In addition to the wide selection of sessions throughout each day, on Friday evening over 130 postdocs and students gathered to present their posters. This was an excellent opportunity for students to show off their research in the welcoming and supportive environment we mathematical biologists have come to pride ourselves in being able to establish. The students showed pride and excitement in their achievements, and many spoke about the amazing opportunity this conference was for them.

While this meeting welcomed many top researchers in mathematical and theoretical biology, a number of leaders in mathematical biology education helped lead two well-attended sessions on interdisciplinary undergraduate education. The discussions in these sessions were quite lively, as we shared ideas ranging from novel tools for engaging our students both inside and outside the classroom, to what goes into a stand alone major in mathematical biology, to issues of how we might best assess the quality and success of our efforts to train future mathematical biologists. One recurring theme of these sessions was the importance of reaching across disciplines to collectively develop curricula based on what is being taught in other courses. There were many varying opinions on these issues, but it was refreshing to see such discussions at the meeting.

While many enjoyed the energy and enjoyment to be had inside the walls of the conference building of Jagiellonian University, with all the hustle and bustle of conference attendees, coffee breaks full of Polish delights, and student workers scrambling furiously to ensure everything ran smoothly, there

was just as much excitement for the myriad of things to do in the city, whose Main Market Square was a ten-minute walk from the university. Within the square, you could shop for any souvenir imaginable, have your choice of more restaurants than you could count (well, maybe we could count them, but we might starve before we finished), and have access to some of the best jazz in Poland. One piano bar in the Square, complete with classic jazz hits in English and witty banter in Polish, provided quite an evening's entertainment for some of the conference attendees.

On Thursday afternoon conference attendees boarded busses and embarked on one of three excursions: The Royal Route - Krakow's main promenade in the olden days traveled by Kings, which leads from the Barbakan and Floriańska Gate, through the Main Square with Sukiennice and the St. Mary's Church to the Wawel Castle, the seat of Polish kings; a tour of the Memorial and Museum Auschwitz-Birkenau, a concentration camp established in 1940 that became the largest center for the immediate, direct extermination of Jews; and a tour of the historic Salt Mine in Wieliczka, the only mining site in the world functioning continuously since the Middle Ages. After an afternoon of excursions, we loaded into our tour busses for yet another adventure, the conference banquet. The location was a beautiful lodge with a traditional grand hall, where guests were greeted at the door by young men and women in Polish attire who later provided an evening full of dancing and musical entertainment. Some conference attendees, perhaps after consuming modest amounts of complimentary wine and Polish beer, even joined in on some of the dancing.

This year's meeting also marked a changing of the guard for SMB, as our former president, Michael Mackey, passed on the sash to our 17th president, Gerda de Vries. We would all like to thank Michael for all he has done for the SMB throughout his presidency, and we are looking forward to what is in store under Gerda's leadership. We would also like to extend thanks to the organizers of this meeting. There were very few glitches, which alone is an amazing feat, but whenever there were minor issues, such as technical difficulties, they were often solved within seconds. The organizers definitely set the bar high for future meetings.

Overall this was one of the best meetings I have ever attended. From the perfect location and gregarious hosts to the invigorating talks and

breathhtaking scenery, I left wanting more and eager to return to yet another SMB annual meeting. See you in Knoxville!



### 2011 Prizes

**Art Winfree Prize:** The second biennial Art Winfree Prize, established to honor a theoretician whose research has inspired significant new biology, was awarded to John Tyson in recognition of his paper "Temporal Organization of the Cell Cycle"

**Reinhart Heinrich Awards:** The Reinhart Heinrich Award, presented annually to the student submitting the best doctoral thesis in any area of Mathematical and Theoretical Biology, was awarded to Thomas Maiwald for his thesis "Mathematical modeling and in silico labeling with PottersWheel" and to Tina Toni for her thesis "Approximate Bayesian Computation for parameter inference and model selection in systems biology"

**Lee Segel Prizes:** The second biennial Lee A. Segel Prize for Best Student Paper in the Bulletin of Mathematical Biology was awarded to Barbara Boldin in recognition of her paper "Persistence and Spread of Gastro-Intestinal Infections: the Case of Enterotoxigenic Escherichia coli in Piglets"

The second biennial Lee A. Segel Prize for Best Paper in the Bulletin of Mathematical Biology was awarded to Brynja R. Kohler, Rebecca J. Swank, James W. Haefner, and James A. Powell in recognition of their paper "Leading Students to Investigate Diffusion as a Model of Brine Shrimp Movement" The Lee A. Segel Special Prize for Best Research Paper in the Bulletin of Mathematical Biology was awarded to W. Brent Lindquist and Ivan D. Chase in recognition of their paper "Analysis of Winner-Loser Models of Hierarchy Formation in Animals"



Field trips on Thursday were offered to visit Auschwitz (above) or the Wieliczka Salt Mine (below).



*Submitted by Chelsea Liddell*

Presenting at the 2011 ECMTB conference was an extremely educational experience. I arrived in Poland with Erin Dauson, very jet lagged, but happy to be off a plane. We successfully managed the Polish train and bus system, and found our hostel at about 1am. The first day of the conference was a blur of talks, but in subsequent days, with more sleep, I began to enjoy the presentations and the poster session. I learned a ton about mathematical ideas I had never heard about, and realized how broad the application of mathematics to biology actually is. Everything from ecology to epidemic prevention to cancer treatment can, and has, been analyzed mathematically. My subject seemed very simple compared to all the other topics, but I knew it well, and enjoyed presenting my slides. Several people even came up to me afterwards and asked about my research. I was glad to have been able to experience this gathering of so many people who are interested in the application of mathematics to biology. Thanks to the National Science Foundation, the Neukom Institute, the Society for Mathematical Biology, and the New Hampshire Experimental Program to Stimulate Competitive Research for allowing me to attend the conference!

*Submitted by Rachelle Miron*

From June 28th to July 2nd, 2011, the 8th European Conference on Mathematical and Theoretical Biology and the Annual Meeting of the Society for Mathematical Biology got together in Krakow, Poland for a week filled with great presentations and fun. Most days started at 8:30am with either plenary talks or mini-symposiums and were filled with plenty of exciting new research (and a lot of food!) until about 7pm.

This is the third time that I have attended the Society for Mathematical Biology meetings, but my first meeting that included the European Conference on Mathematical and Theoretical Biology. The two conferences meet every 5 years and this year was quite an exceptional experience. Everything about the conference was different; there were many more participants (I think about a thousand), many more talks and way more food. Every day at around 10:30–11am and again at around 4:30pm we had short breaks with coffee, tea, juice, water and desert. What was most impressive was during the first coffee break on the first day of the conference, there was a wide spread of finger foods, fruit and desert, coffee, tea, juice and wine. It was very impressive!

The conference started on Tuesday, June 28th with early registration on Monday. I wasn't able to attend the Introductory Lectures on Monday but was told by several participants that they were very interesting and insightful. On Tuesday morning Peter Swain gave the opening lecture on stochasticity in biochemical networks in a very big lecture hall in the Auditorium Maximum of Jagiellonian University. Almost every afternoon from 11am–1pm and from 2:30–4:30pm there were mini-symposia and section lectures. There were a wide range of topics including cancer, tumor growth, population dynamics, epidemics, immunology, neuroscience, genetics, ecology and infectious diseases just to name a few.

One of the talks that sparked my attention was given by Carrie Manroe about a model for the spread of Rift Valley fever in livestock with vertical transmission. Not much mathematical research has been done regarding this topic and she introduced and spoke about an interaction model between livestock and mosquitoes. She included vertical transmission since this is the only way the virus survives and spreads itself every year. Another interesting presentation was given by Barbara Boldin about within-host viral evolution in heterogeneous

environment: the insight into the HIV co-receptor switch. She talked about how HIV switches its binding sites from CCR5 to CXCR4 co-receptors when invading host cells. One of my favorite talks was given by Max von Kleist concerning a mathematical modeling framework to assess the impact of antiviral strategies on HIV transmission. He explained the best strategies for using anti-viral treatment with pregnant women, i.e., whether it's better to give nevirapine to the mother pre or post child birth, during breast feeding or only to the child, or to both.

Everyday from 1–2:30pm lunch was served. Again there was a large quantity of food mainly consisting of meat, pasta and rice. The vegetarians were on a full carbohydrate diet this week! Delicious stuffed vegetables were served for a few days along with excellent deserts and fruit.

From 5–7pm there were either more mini-symposia and section lectures or plenary talks (plenary talks on Friday and Saturday). Many found the days were so filled with information and connections with peers that they were thoroughly exhausted by the end of the day.

Thursday and Friday mornings each consisted of 3 more plenary lectures. The organizers of the conference arranged for us to have time off on Thursday afternoon for three different outings. You could either go to the Royal Route, the historic Salt Mine in Wieliczka, or the Memorial and Museum Auschwitz-Birkenau. I heard that both the royal castle and the salt mine were wonderful to see. The salt mine had hundreds of stairs to descend with beautiful salt carvings to be seen on each floor on the way down. I personally chose to attend the Auschwitz Museum because I believed it would be a once in a lifetime experience, and it definitely was. The tour offered a guide who was able to truly describe the unbelievable and painstaking life these men, women and children endured. I would highly recommend it to anyone with an interest in society and history to attend.

After the outings came the conference dinner which was held in a beautiful majestic castle. On our way in, we were met by workers dressed up in historical outfits serving shots of vodka. The dinner was extravagant, and free drinks were offered all night. During the dinner there was about an hour of Polish dancing that got many people out of their seats and running around the dining hall. Towards the end of the night, there was a live band and hundreds of

people dancing till the wee hours. The night was well planned and a great deal of fun.

The poster session was held Friday night from 8–10 pm. The posters were set up in the lunch room all week which was very convenient, but unfortunately some were sort of tucked away in such a way that people could not see them. In my opinion the poster session was a little late; I think more interest in this session would have been gained if it was during the day. There was a good turnout regardless and wine and food was served.

The closing talk was presented by Sylvie Meleard about a rigorous model for adaptive dynamics of Mendelian diploids. Anyone I spoke to found that the conference was very well organized and filled an absurd amount of great talks and events. I always look forward to the SMB conference and as usual this year was very impressive and as much fun as always!



The conference dinner was held in a beautiful hall (above). Entertainment was provided by Polish dancing (below).



## Positions Available

### Post-doc: Mathematical Epidemiology

We are seeking a postdoctoral fellow in infectious disease modeling to study the epidemiology and ecology of infectious agents characterized by intermittent shedding and environmental persistence (such as *Escherichia coli*, *Salmonella* and *Vibrio cholerae*). The postdoc will join the group of Dr. Ivanek at Texas A&M's College of Veterinary Medicine and Biomedical Sciences (CVMBS) in College Station, TX. In this position, teaching is not expected but possible; the candidate could assist in graduate level teaching of mathematical modeling at the CVMBS. The position is open until filled. It is for one year with possible extension subject to successful performance and the availability of funds. How to apply: Please submit your (i) curriculum vitae, (ii) a brief statement of research interests and goals, and (iii) contact information for three references to Dr. Ivanek ([rivanek@cvm.tamu.edu](mailto:rivanek@cvm.tamu.edu)). Please note that due to the high volume of applications, only short-listed candidates will be contacted. More about Dr. Ivanek's lab can be found at [vetmed.tamu.edu/ivanek-lab](http://vetmed.tamu.edu/ivanek-lab).

### Post-doc: Persister Cell Formation

This post will be part of a multidisciplinary project that aims to decipher the molecular mechanisms underpinning the observation of persister cells in *Campylobacter jejuni* (Cj). The hired candidate will focus on the system dynamics analysis and in silico evolution of molecular systems that can underlie persister cell formation and will also analyse the interaction between signalling and metabolism in the persister phenotype. These theoretical analyses will be performed in conjunction with experimental and bioinformatics work that will focus on the characterisation of the persister phenotype. Further information and application details are available here; <http://job-lin-mul-102.eduserv.org.uk/job/ADC502/associate-research-fellow>

### PhD: Evolution of RNA Virus

Identification and Modelling of Non-Coding Sequence Constraints in the Evolution of RNA Viruses. University of Edinburgh, 3 year studentship starting January 2012, Supervisors: Prof. Peter Simmonds, Dr. Nick Savill, Prof. Paul Sharp. Contact:

Nick Savill ([nick.savill@ed.ac.uk](mailto:nick.savill@ed.ac.uk)), \*DEADLINE: 18TH SEPTEMBER 2011\*, Project description: In addition to their clinical importance as aetiological agents of human, animal and plant diseases such as hepatitis C, AIDS and swine flu, RNA viruses provide unique opportunities to investigate evolution in action, both observationally in their circulation between infected individuals but also as a practical laboratory model where processes of selection and drift can be directly investigated. Frequently large population sizes and high mutation rates additionally provide RNA viruses with a finally textured fitness landscape in which even extremely subtle selection pressures can be detected and modelled. The aim of the studentship is create a new paradigm for evolutionary reconstruction where these additional, non-coding constraints can be modelled. We are looking for someone with exceptional mathematical and computational skills.

### Post-doc: Bacterial Biophysics

Postdoctoral positions in bacterial biophysics are available at MIT and Rutgers. We seek 2-3 talented individuals to be part of an exciting new project on bacterial biophysics. The positions will be in the context of an NIH-funded project that combines the experimental and theoretical study of transient behaviors of biological systems. The lead PIs are Eduardo Sontag (Rutgers) and Roman Stocker (MIT). Other members of the team, with whom the individuals will also have the opportunity to interact, are Tom Shimizu (AMOLF) and Uri Alon (Weizmann). Subject to satisfactory progress, there is an opportunity for continued funding for several (3-4) years. We plan to make two appointments. (1) One appointment will be with Roman Stocker's group at MIT ([web.mit.edu/romanstocker](http://web.mit.edu/romanstocker)) and will involve work on bacterial chemotaxis using microfluidic devices. (2) One appointment will be with Eduardo Sontag's group at Rutgers ([www.math.rutgers.edu/~sontag](http://www.math.rutgers.edu/~sontag)) and will involve theoretical aspects of bacterial biochemistry and dynamics, with an emphasis on the formulation of both individual-level and population-level models. Interested individuals are encouraged to send a CV, a brief statement of research interests, and names of 2-4 potential references to [sontag@math.rutgers.edu](mailto:sontag@math.rutgers.edu) or [romans@mit.edu](mailto:romans@mit.edu). We would like to fill the positions as soon as possible.

### Post-doc: Comp & Systems Biology

Postdoctoral opportunities in computational and systems biology in the Center for Genome Dynamics at The Jackson Laboratory (<http://www.genomedynamics.org>). Center investigators use computation, mathematical modeling, and statistics to understand the genetics of complex traits. Requires Ph.D. (or equivalent) in quantitative field such as computer science, statistics, applied mathematics, or in biological sciences with strong quantitative background. Programming experience recommended. More details at <http://www.jax.org/careers> (Job ID 2311). The Jackson Laboratory is an Equal Opportunity Employer/Affirmative Action Employer.

### Post-doc: Maths/Algorithmics for Biology

Two postdoctoral positions of 1 year each with possible extension to a second year are available in the INRIA BAMBOO Team led by Marie-France Sagot in the framework of an ERC project, SISYPHE, on the mathematical and algorithmic exploration of symbiosis in biology. <http://pbil.univ-lyon1.fr/members/sagot/htdocs/team/projects/sisyphe/sisyphe.html> We are seeking highly qualified and motivated applicants in mathematics and/or algorithmics, with a strong interest for biological problems. Alternatively, candidates with a background in theoretical biology and an extensive training in mathematics and/or algorithmics are also welcome. The applicants should have an open mind, enjoy working in close interaction with a team and daily interacting with students and researchers from different disciplines. We are interested in a range of topics related to the symbiotic relationship, and the evolutionary and functional implications of this relationship. The postdoctoral fellows will elaborate mathematical models and algorithms to analyse both publicly available and newly produced data. The specific project will be established together with the candidate. The group is international with English as a common language. Please send your detailed application with the usual documents to: [Marie-France.Sagot@inria.fr](mailto:Marie-France.Sagot@inria.fr).

### Post-doc: NeuroMATHComp group

The NeuroMathComp group is part of INRIA and CNRS, two major government French Research Institutes. Members of the group are actively conducting research in mathematical and

computational neuroscience. The group is funded through several European grants (BrainScales, ERC NerVi, Keops, FACETS-ITN). We are currently looking for five excellent postdoc candidates in four areas: 1) Neural field models for motion perception (2 positions); 2) Meanfield methods in neuroscience (1 position); 3) Solving Partial Differential Equations and variational problems with networks of spiking neurons (1 position); 4) How to interpret the neural code to identify image and video categories? (1 position) To learn more about our research and these postdoc offers go to [www-sop.inria.fr/neuromathcomp](http://www-sop.inria.fr/neuromathcomp) and follow the "Job offers" link.

### Post-doc: Biomathematics

Postdoctoral Research Position in Biomathematics is available in the Department of Mathematics and Statistics, University of Guelph. Outstanding, highly motivated candidates are invited to apply for a postdoctoral research position in the application of game theoretical or related approaches to common pool resource problems, the emergence of groups and social norms, and/or human cooperation. Potential applications include topics in sustainability science, cultural health, and social health. The successful applicant will have a strong quantitative background including a Ph.D. in mathematics, physics, engineering, computer science, or a related field. The applicant will be based in the laboratory of Professor Chris Bauch ([www.uoguelph.ca/~cbauch](http://www.uoguelph.ca/~cbauch)) in the Department of Mathematics and Statistics and will collaborate with Bauch and colleagues. The applicant will have access to resources such as the newly established Infectious Diseases and Ecological Systems (IDES) Computational Laboratory. The position is free from teaching obligations although there may be opportunities to teach undergraduate mathematics courses if the applicant so wishes. The initial appointment is for one year with automatic renewal for a second year if performance is satisfactory. To apply, please send a cover letter, research statement, representative publications, and a CV including names and contact details of three references to Professor Chris Bauch ([cbauch@uoguelph.ca](mailto:cbauch@uoguelph.ca)). Applications received prior to September 30, 2011 will receive priority but applications will be considered until the position is filled. The position is to start in Fall 2011 or Winter 2012.

# The Future of Math Biology



Michelle L. Wynn  
University of Michigan Medical School

Sofia D. Merajver Lab  
and Santiago Schnell Lab

## What attracted you to mathematical biology?

My interest lies in working at the interface of experimental and theoretical biology. Mathematical biology is an important component of the research I would like to do.

## What is your current research project?

I am studying the regulation of cancer cell metabolism in breast cancer.

## What specific areas are you interested investigating?

I am interested in building predictive multiscale models of cancer.

## What do you hope to do after graduation?

I would like to continue to work in cancer research and to develop more expertise in multiscale modeling.

## What advice will you give to an undergraduate interested in a mathematical biology career?

Do not underestimate the complexity of biology. Challenge yourself by taking some advanced biology courses. If possible, try to gain undergraduate research experience working on a joint theoretical and experimental biology project at your university.

## What inspires you scientifically?

I am most inspired by hypothesis driven mathematical and computational research that has a direct impact on experimental research. I am not interested in modeling as a purely academic exercise. I would like to use mathematical modeling to make meaningful predictions that can be leveraged clinically.

## Why did you join the Society for Mathematical Biology?

To network with other students and scientists who share similar research interests.

Sofia Merajver and Santiago Schnell, Michelle's PhD advisors, say: "Michelle is both enthusiastic and motivated. She sets very high ethical standards and works extremely hard and successfully to achieve them. She is the kind of student a faculty member would not only never forget, but one that we would view as a true future leader in our own field."

## Nominate your student!

"My Future is Math Biology" is a new column intended to highlight graduate students in mathematical biology. Do you want to nominate a student from your research group? Please send your nomination to: [schnells@umich.edu](mailto:schnells@umich.edu).

## Editor's Notes:

We invite submissions including summaries of previous mathematical biology meetings, invitations to upcoming conferences, commentaries, book reviews or suggestions for other future columns. The deadline is the 15th of the month prior to publication.

The SMB Newsletter is published in January, May and September by the Society for Mathematical Biology for its members. The Society for Mathematical Biology is an international society that exists to promote and foster interactions between the mathematical and biological sciences communities through membership, journal publications, travel support and conferences. Please visit our web site: <http://www.smb.org> for more information.

Holly Gaff, Editor, [editor@smb.org](mailto:editor@smb.org)