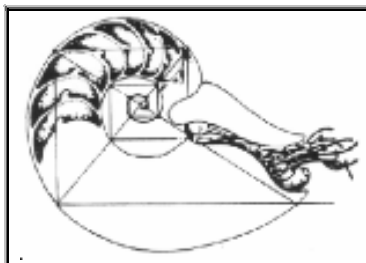

Mathematical Biology Newsletter

Volume 17 #3 – September 2004

The Society for Mathematical Biology

Edited by: Elizabeth H. Scholl

Table of Contents

Forward Ho with Math Bio: The Role of SMB in Meeting Future Challenges

Louis Gross
Departments of Ecology and Evolutionary Biology and Mathematics
University of Tennessee

Several attendees at the Annual SMB Meeting in Ann Arbor asked me to compose my summary comments at the end of the meeting as a note for the SMB Newsletter, so this President's letter is in the format of a brief, and biased, meeting summary. First, the Society owes a debt of gratitude to Trachette Jackson and Patrick Nelson for their outstandingly successful organization of what was the largest SMB meeting ever held. Even with lots of help from students and colleagues, the success of the meeting was mostly due to them, and on behalf of the Society I thank them again for all their hard work.

One of the ongoing meeting activities was a limerick "contest" featuring the talents of two of the plenary speakers, Bard Ermentrout and James Sneyd. While certainly not up to their standards, my contribution was based upon statements made by each of them – Bard stated that "Without an ε lying around you can't do anything!" while James noted that "I always use δ rather than ε so no one expects careful asymptotics!" Thus

There was a bright chap from old Pitt
and a fellow from Auckland with wit
one said its epsilons you need
its deltas the other decreed
and they've livened things up just a bit!

Amongst the many fine talks I attended, I took note of a few other enlightening quotes:

- *There's always something lurking under the simplest looking objects - Mike Waterman*
- *The easy diseases have been done and reductionist approaches are not sufficient to handle the diseases that are left - Gary An*
- *The objective is not to do math, but to contribute to reducing the impact of disease - Alan Perelson*
- *When you state what you can find from your math models, you should also state what you cannot find - Avidan Neumann*

Some meeting themes:

Whether we like it or not, we've become biologists! A large fraction of the presentations started with the biology, used this to motivate the methods and then proceeded to analysis or simulation. This is not a bad thing! Attending talks here was often like getting summaries of courses such as GenBank 101, Calcium regulation 101, Tumor biology 101, HIV 101, TB 101, RNA structure 101, Neurobiology 101, and Plasmids 101. Can you imagine your "biology" colleagues doing PDE 101 or Hopf Bifurcations 101 in their talks?

(continued on next page)

(continued from previous page)

The above is indeed part of another trend in talks presented: start with observations rather than math. Across all the biological fields discussed, data are used to drive the modeling, at least initially. There is a close connection to biological reality, abstracted as necessary, to phrase biologically interesting questions, derive the import of assumptions, and propose new biologically-relevant conclusions/suggestions based upon the math.

Another trend is the impact of our work on practice: we aren't solely theoreticians anymore. Many of the models and analyses we carry out directly impact medical practice, natural resource management, public health policy, etc. Examples presented at the meeting included multi-drug therapy in HIV (Alan Perelson), tumor treatment (Rakesh Jain), and SARS public health responses (David Earn). While it is exciting that our efforts can have direct impacts, this potentially opens up numerous ethical questions - racial profiling in SARS, patient treatment dilemmas associated with Hepatitis C among other diseases (Avidan Neumann). We may need to enhance our political/social assessment skills - no longer can we claim we are simply doing "science".

Numerous talks emphasized the importance of space, and illustrated that 3-d (or at least 2-d) approaches produce new phenomena - tumor biology is very space-dependent (Rakesh Jain); the fundamental mechanisms by which the synapse responds depends upon 3-d geometry (Charles Peskin); the immune response in the lung is spatially dependent (Denise Kirschner); the cortex is a collection of interconnected layers (Bard Ermentrout).

Yet another theme is that multiple models/approaches are good. We have become more open to mixing and matching different mathematical approaches. ODE, PDE, Markov processes, structured systems (metapopulations, age/size), agent-based methods may be applied to the same biological questions, and we learn about different aspects of systems from these differing approaches. As true applied mathematicians, we no longer feel constrained by the particular expertise we developed in grad school, but branch out to develop (or collaborate to find) the expertise needed to appropriately address biological questions. The future promises further growth of hybrid or multimodeling approaches, which mix and meld traditional approaches.

Many talks emphasized the importance of math as integrative science. As more and more reductionist-based data become available, the relative importance of mathematical methods to succinctly summarize large numbers of studies will increase (Denise Kirschner provided an example of a network of papers on TB adaptive immune response, Gary An used an agent-based model to make explicit what clinicians have in their head, but which goes further to provide a framework for evaluating what happens when intuition fails). A future direction involves personalized medicine, alluded to in various forms at the meeting (Alan Perelson in analysis of viral blips in HIV; Avidan Neumann in dynamic individualization of Hepatitis C patient response to pegylated interferon). Math is needed for the new field of pharmacogenomics and models will need to be developed to integrate an individual's genetic and physiological data to project personalized impacts of multi-drug interactions.

(continued on next page)

(continued from previous page)

The meeting illustrated as well the potential for forays into further integration. With the exception of the numerous examples Simon Levin provided in his plenary, very few connections with social system modeling were presented, and although there was a special session on mathematical psychology, there is little interaction between communities. As Simon's examples showed, there are great similarities between the agent-based models used for disease spread (at cell population and individual population level), and those used for social systems. Just as ecological economics is fusing fields, we will need to include social systems and economics with the models derived for medical treatment and public health responses.

The presence of two minisymposia sessions on education indicates that educational initiatives in interdisciplinary science are coming into their own and math bio is at the forefront of this. We saw numerous examples of how our membership is leading by dragging the lethargic curriculum common at our universities towards acceptance of the integrative nature of modern life sciences. Publicity about the benefits of quantitative approaches in biology and the new fields of computational biology and bioinformatics provides us a unique opportunity to get our university administrators off their butts to encourage breadth of training and research experiences for undergraduates. NSF and NIH are stepping up to the plate on funding these and we must respond. This is NOT just a US phenomenon though – it is happening in many other countries and SMB can foster this.

Despite the growth of math bio, we are still odd ducks. Math departments don't know how to deal with us; biology departments mostly just tolerate us; joint-appointments, though fine for old-timers, present numerous challenges for newer faculty; new departmental structures (with tenured positions) are slow to develop; the general scientific community thinks of us as statisticians; and while industry may be more supportive, it offers more constrained research opportunities. One partial solution I suggest is that tenure be held at university- rather than departmental-level, to encourage acceptance of interdisciplinarity. What advice can we offer though to the numerous younger researchers entering the field? This is an amazingly exciting time for interdisciplinary science and **you can do it!** There are multiple routes to success and lots of examples of individuals who have explored some of these routes, but you may well find yourself discovering new ones!

From the SMB '04 Meeting: Justin Hsieh, Lou Gross, Patrick Nelson and Trachette Jackson

Future Annual Meetings - Suggestions and Proposals Requested

Lou Gross

The Future Meetings Committee of the SMB Board is charged with establishing policies and making plans for future annual meetings of the Society. The Committee consists of Carl Panetta (Chair), Matthew Miller, and Robin Snyder. At this time, there are no definite plans for meeting sites after the 2005 meeting in Dresden. The Committee would appreciate any comments, suggestions, and proposals from members regarding either particular locations for future meetings, or policies that we should consider in making longer-term meeting plans. The Society has in the past attempted to rotate meeting locations spatially, and to alternate independent SMB meetings with those held jointly with another society. Of course, any particular meeting depends upon the voluntary contribution of time of the local organizers, but given the growth of math biology, there are now numerous research groups around the world that have the capability to organize a meeting.

Members are encouraged to contact Carl Panetta (Carl.Panetta@stjude.org) to provide input on the decisions, or discuss the possibilities of hosting a future meeting. Although there is certainly a lot of planning and effort involved in organizing an SMB meeting, the benefits to your local research and student community can be quite large. It is also a fine way to publicize your institution. The Committee can also provide a variety of “tips” for future meeting organizers, based upon the experiences of past organizers, to help ease meeting preparation. As the Board would like to make a decision by the end of January 2005 regarding the 2006 meeting location, please forward suggestions of sites to Dr. Panetta by the end of November 2004. A formal proposal will be solicited by the Committee for sites they deem appropriate for further consideration.

A New SMB Website!

Holly Gaff

Please take a moment to check out the new Society for Mathematical Biology website (http://www.smb.org). Many of the pages are still being completed, but please do let us know if you encounter any difficulties. We tried to keep all of the valid content from the previous website, and we have added many new pages including the top ten most cited articles in the Bulletin of Mathematical Biology (http://www.smb.org/publications/top_ten.shtml). If you or your group had a link on the old website, but you can't find that link on the new one, again, please let me know (at webmaster@smb.org).

We welcome your comments and suggestions. The website is designed to be a resource for the members of SMB. Please feel free to let us know of other pages or topics that you feel would be useful. We will also be sending out specific requests for your input, such as Meredith Greer's request in SMB Digest v04i22 for lists of books. We ask that you help us so we can provide the best service to our members.

CMPD – Computational and Mathematical Population Dynamics

(MPD'7 and Destobio'3 joint meeting)

Sergey Petrovskii

The White Rabbit put on his spectacles.
"Where shall I begin, please your Majesty?" he asked.
"Begin at the beginning," the King said, very gravely,
"and go on till you come to the end; then stop."
(by Lewis Carroll)

It is perhaps not quite in the current fashion but still it does not seem to be a bad idea to begin at the beginning. Although the name CMPD has not been heard before this year, the conference already has a long history. The whole story actually began many years ago, when the 1st Mathematical Population Dynamics (MPD) conference was organized by Marek Kimmel, Ovide Arino and David Axelrod at the University of Mississippi in 1986. Eleven years after that remarkable event, on the other side of the Atlantic, the series of DeStoBio conferences (Deterministic and Stochastic Models for Biological Interactions) was launched by Tanya Kostova in Sofia in 1997. These two respectable "parents" (it was not without a good reason that Tanya Kostova received a title of "godmother" at the CMPD opening ceremony) gave life to this nice "baby" conference that uttered its first words on June 21, 2004 in a beautiful town of Trento in the heart of the Italian Alps.

And good and meaningful words they were, too. The conference was started with a welcome ceremony which was followed by the first plenary lecture delivered to the memory of Ovide Arino by Hassan Hbid, one of his former students. The closing lecture on June 25 was delivered by Simon Levin who gave a wide and, in many senses, impressive view of the state-of-the-art in ecosystem management. In total, the conference consisted of 11 plenary lectures given by distinguished scientists (to name Helen Byrne and Mercedes Pascual just as an example) and of over two hundred contributed talks that were organized into 28 oral sessions and two poster sessions. The topics addressed in the talks and lectures covered virtually all aspects of contemporary theoretical population dynamics, from animals and plants to tumors and cells (more details including the abstracts of the talks can still be found at the conference site, see http://www.unitn.it/events/mpd). The conference turn-out was also impressive: about three hundred participants came from almost forty countries from different parts of the world. One of the participants told me that he succeeded to get in touch with a few people he had dreamed of having contact with for years.

Apart from the outstanding scientific merit, it should be mentioned that the conference was very well organized. The author of these brief notes once made, summarizing his own experience and observations, a list of requirements that an ideal conference should meet. Now, it is my great pleasure to admit that CMPD met every item in the list. In particular, the computer facilities were provided in abundance and everything worked perfectly. All necessary information was found easily and help was immediately provided when required. Also, it was a good idea to place some of the most anticipated lectures in the closing session, which kept most of the conference participants and helped to maintain the exciting atmosphere until the very last moment.

A separate remark should be made regarding the work done by the local organizing committee led by Mimmo Iannelli and Andrea Pugliese. The conference success was to a large extent guaranteed by the atmosphere of hospitality and effectiveness created by them. It is simply amazing how the people from the local team managed to care about so many different things in such a short time providing their generous help and ensuring that everything went on smoothly. On behalf of all the CMPD participants, I would like to thank the conference organizers, especially Mimmo Iannelli and Andrea Pugliese, for the wonderful work they did. We all believe that this joint meeting may initiate another good tradition in the field. Neither the date nor the place of the next conference in the series has not been specified at CMPD but we hope it will take place soon enough.

A Report on CMPD and a Thank You

Ruth Baker

I would like to thank the SMB for providing the necessary funding for me to attend the Conference on Computational and Mathematical Population Dynamics in Trento, Italy. The conference touched upon a wide variety of areas including Epidemiology, Ecology, Cancer Modelling, Pathology, Physiology and presented topics from these fields using an equally wide range of mathematical methods: Deterministic Models, Stochastic Models, Network Models and Branching Processes to name but a few. It provided an ideal opportunity to meet and interact with peers and more experienced modellers from a wide range of countries and backgrounds and a chance to present my work and receive useful feedback from a number of participants.

Report on the International Conference on Differential Equations and Applications in Mathematical Biology, 2004

Miranda I. Teboh-Ewungkem, Department of Mathematics, Lafayette College

The fourth International Conference on Differential Equations and Applications in Mathematical Biology was held at the Malaspina University-College in Nanaimo, British Columbia, Canada from July, 18-23, 2004. There were about 65 attendants with 47 presentations, from about 20 different countries namely, USA, Canada, Israel, New Zealand, Italy, Greece, Mozambique, Hungary, Norway, France, Japan, Iran, India, Netherlands, Bulgaria, Poland, Cote d'Ivoire and Saudi Arabia.

The conference was sponsored by PIMS (Pacific Institute for the Mathematical Sciences). Three members of PIMS, Fred Brauer, Thomas Hillen and H. Freedman, each gave 45 minute long talks. Two other speakers, namely Odo Diekmann and M. Mimura, also gave 45 minute talks. All other talks were 30 minutes long.

The conference started with an opening ceremony on Monday and a welcoming speech from the president of Malaspina University-College. There were also speeches from the PIMS Director and Fred Brauer. We had talks from 9:35-3:00 PM with a lunch break in between. Then there was a mini tour to the Pacific Biological Station in Nanaimo, British Columbia, from 3:30-6:00 PM. From there we went to a beach by the Ocean.

Tuesday was a full day of presentations and on Wednesday there was the main tour to the mountains. On Thursday there were more presentations and the banquet and the conference ended on Friday with a half day and the closing ceremony took place from 10:30-11pm.

Topics discussed were in the field of Mathematical Biology: Epidemiology, Fisheries, Physiology, Chemotherapy and Cancer, Differential Equations: (Ordinary, Partial and functional Differential Equation), Complex Dynamical Systems, Image Processing, Mathematical Ecology and Evolution.

I gave a 30 minute talk on Tuesday and attended talks in every topic. They were very informative. My abstract can be found in the book of abstracts on page 27. It was a nice conference with its small size giving the opportunity for great interaction.

The conference was very beneficial to my continuous growth towards research. I got to meet, learn from and seek advice from Fred Brauer.

I thank the SMB for partially supporting me to attend this conference.

First Women's Luncheon at the Annual Meeting of the Society for Mathematical Biology

Ann Arbor, MI, 2004

by Rebecca Tyson and Janet Andersen

The first Women's Luncheon at the Annual Meeting of the Society for Mathematical Biology grew out of a suggestion by Ramit Mehr for a forum to discuss women's issues in mathematical biology. Rebecca Tyson and Janet Andersen organized the event, and funds for the luncheon itself were generously donated by ADVANCE, a University of Michigan NSF program run by Abigail Stewart.

About 80 women and 3 men participated, representing all career levels from the undergraduate to the senior professor. As soon as everyone had filled their plates with food, two speakers addressed the assembly, providing their own insights into some of the issues currently challenging female mathematical biologists.

The first speaker, Ramit Mehr from Bar-Ilam University in Israel, has long been an advocate for women in the United States and in Israel. One of Ramit's many contributions is a resource page for women on the SMB website (www.smb.org/resources/women.shtml). In her talk, she identified four major issues working women face: Discrimination, Sexual Harassment, Family-Career Balance and the Glass Ceiling. Her discussion of these issues was cogent and constructive. When dealing with discrimination, Ramit suggested using humor rather than aggression. A woman's best defense against sexual harassment is to educate herself about the signs and, if it does occur, to get help as soon as possible. The family-career balance continues to be a challenge, and Ramit advised women to simply take all the help they can get. The Glass Ceiling is still very real, and will likely take a long time to disappear. Women are succeeding in breaking it however, and Ramit pointed out two important behaviors: first, one needs to be aware of what it takes to succeed at the stage one is at as well as at the next level, and second, one should never hesitate to ask for advice. The latter works two ways: take all the mentoring you can get, and then give back to others! Finally, Ramit summed up her message in the three phrases: Be Focused, Take Good Care of Yourself and Enjoy Life!

Janet Andersen's talk offered a personal perspective on switching careers and finding collaborators. Janet began her working career as a high school teacher. She later obtained a Ph.D. in pure mathematics. This she managed to do while also raising two small children with her husband. She is now at Hope College where she has been expanding her network of scientific colleagues through meetings and collaborations. One of her collaborators, Leah Chase, a neurobiologist, took the time to come to the SMB meeting with Janet and talk about some of the fruits of their collaboration. Janet stressed that setting up successful collaborations takes a fair amount of effort. She suggested three key ingredients to success: learn about the research areas of colleagues in various departments, advertise one's own interests to anyone who will listen, and finally, be willing to collaborate. The latter point may sound obvious, but collaborations must be nurtured, meaning that one must take the time to listen and to share. One must also be comfortable working as a novice when learning a new field.

(continued on next page)

(continued from previous page)

After the talks, participants at each table were asked to discuss the question assigned to their table. The four discussion questions were:

- What are the barriers to getting students interested in careers in mathematical biology?
- What are the barriers to having post-docs and faculty work in the area of mathematical biology?
- In what ways, if any, are these barriers different for women and/or underrepresented groups?
- What can we as a group or the SMB as an organization do to minimize these barriers?

The discussion at each table was animated and constructive, and though the time allotted was a little tight, every table managed to come up with interesting thoughts to share with the entire assembly.

With regard to the first question, three important points were made:

- There is a lack of knowledge concerning the existence of mathematical biology as a field.
- There are still many communication issues between the two separate fields of mathematics and biology, especially at the level where students are introduced to them.
- There is still some reluctance among faculty to embrace cross-disciplinary fields, and so students who might be interested in such fields may not be getting necessary encouragement.

A couple of groups pointed out that cultural differences in the ways men and women communicate may lead to unintentional discrimination. Also, mathematical biology is still an emerging discipline and hiring committees have trouble deciding where mathematical biologists “fit”.

Some very useful suggestions were made as to how we as members of SMB might overcome some of these difficulties – many of which aren't limited to women! As one example, we could follow the model of the Society for Neurobiology which has an annual Neurobiology Awareness Week. During that week members are encouraged to do a number of things, including visits to local schools. Educational resources are made available to members through the society's website, so that anyone interested in giving a talk has easy access to presentation materials for various age groups. The website also has science project ideas appropriate for school-age children.

Rebecca and Janet would like to thank everyone who attended the women's luncheon and made it such a successful event. We look forward to this gathering again at future SMB annual meetings. If anyone is interested in helping to organize a women's luncheon at the 2005 meeting, please let us know. We would especially appreciate some local help from the Dresden community!

Rebecca's email: rtyson@ouc.bc.ca
Janet's email: jandersen@hope.edu

Report on the Gordon Research Conference on Theoretical Biology and Biomathematics

Patricia Theodosopoulos

The broad scope and vitality of the scientific research exhibited at this year's Gordon Research Conference on Theoretical Biology and Biomathematics in Tilton, NH made it an extraordinary experience. As a physician with a laboratory research background, my education in the theoretical approach to biological and ecological questions has been a profoundly different and valuable educational experience.

Basic biological science tends to be reductive in its approach to scientific questions and the focus is often on the function of a single or small subset of biological molecules. In medicine, the interest is usually in the translation of this functional understanding to the development of novel therapies in disease treatment. The difficulty in this approach is that the application is often necessarily attempted outside of a broader biological context. Although the need for innovation and the lack of complete understanding of the complex underlying machinery require these "leaps of faith", the application of theory and modeling is gaining a new appreciation among basic scientists in all disciplines. This is because the theoretical approach attempts to filter the functional details and to identify only those which are essential to place into the broad framework of a model system. If successful, the model elucidates the drivers of the large scale behaviors of the system and future behavior of the system can be predicted from myriad starting conditions.

The possibility of a deeper understanding of biological complexity is now possible.

The sessions of the Gordon Conference prove just how diverse are the emerging contributions in biology. While the use of mathematical models and theory are now well accepted in the field of ecology, the session on applications to spatial components in these processes showed that this field continues to evolve. The field of physiology was well represented with sessions on biological motors and neurobiology. A continually emerging field was also highlighted in the session on the application of models to understand the complex and nonlinear behaviors in the pathways of the human immune system. The session on the modeling in biofluids and biological gels demonstrated the potential applications of this area as it progresses. In addition, the modeling of gene regulatory networks has already found an important role in understanding and predicting disease behavior and pathogen evolution and these were highlighted in sessions on emergent species as well as the session on transcriptional control in gene networks.

Beyond the science, the most beneficial aspect of the Gordon Conference for me is that it is organized to promote contact between the participants. I was able to take part and witness many lively discussions and make the acquaintance of bright, motivated researchers with whom future collaborations may grow.

Graduate Student or Postdoctoral Position in Theoretical Immunology

IRIS, Karolinska Institute, Stockholm, Sweden

The Strategic research center for studies of Integrative Recognition in the Immune System (IRIS), Karolinska Institute, Stockholm, Sweden, is planning to hire a graduate or postdoctoral student, to work on formulating **mathematical and computational models of inter-cell communication in the immune system.**

The Center (see http://www.iriscenter.se/): Front our vision statement: "The cells and receptors of the immune system communicate to make decisions ultimately influencing health versus disease, or even life versus death, in a variety of medical conditions and treatments. The main vision behind this center is to understand recognition and regulation in complex systems in inflammation and immunity, integrating several gene products and frequently also events occurring at a level beyond patterns of gene and protein expression, based on intracellular distribution and membrane topology of receptors. A multidisciplinary approach is launched to study the regulation of several cell types involved in inflammation, e g NK cells, T cells, dendritic cells, but also the regulation by targets such as epithelial cells and bacteria."

The position: Good background in mathematics and biology, and good computer programming skills, are essential. Experience in mathematical and computational modeling of biological systems or processes is highly desirable. The planned work includes theoretical immunology research, and help in training the experimentalists in IRIS in basic theoretical methods. The duration is up to four years (2005-2008) with possible opportunities for continuation. The desired start date is January 1st, 2005 or soon afterwards. The conditions and benefits will depend on the appointee's degrees and qualifications. Application review will continue until the position is filled.

The location: IRIS is part of the Microbiology and Tumor Biology Center (MTC), which is situated at the Solna campus of the Karolinska Institutet (KI), Stockholm, Sweden. Research at MTC is performed in the following areas: Biomedical Ecology, Clinical Microbiology, Immunobiology, Infectious Disease Control, Tumor Biology and Infection Biology. The latter area includes the subtopics Bacteriology, Parasitology and Virology. Another novel field of interest is Gnotobiology. MTC is also the host of a Center of Excellence in Immunoregulation sponsored by the Foundation for Strategic Research. It is called the Iris center. More information can be found at this address: www.iriscenter.se

Education at MTC involves both Undergraduate and Postgraduate students. MTC also provides a number of services organized as Core Facilities to support the research staff in their work. The candidate will be affiliated with the center, but will receive most of her/his training and perform a large part of the work under the supervision of Dr Ramit Mehr in Bar-Ilan University, Israel. Training will depend on the appointee's prior experience and will be aimed at giving the appointee a good basis in theoretical immunology.

Contact:

Dr. Ramit Mehr
Faculty of Life Sciences
Bar-Ilan University
Ramat-Gan 52900
ISRAEL

Phone: 972-3-531-7990
Fax: 972-3-535-1824
email: mehrra@mail.biu.ac.il
http://repertoire.ls.biu.ac.il

Postdoctoral Position in Electrophysiological Aspects of Human Epileptic Seizures

Department of Surgery, University of Chicago

A two-year postdoctoral position is available to study the electrophysiological aspects of human epileptic seizures. The successful candidate will have an M.D. or Ph.D. with additional expertise or aptitude to develop software for the analysis of invasive subdural recordings from epilepsy patients. Research questions address prediction of the location and timing of seizures, the effects of medication withdrawal and seizures on cortical organization, and the biological substrates of language. The candidate would be expected to obtain subsequent support through submission of federal grants. Experience with time series analysis, spectral analysis, and open source software tools and development required. Other experience that would be especially favored: medical image data segmentation and registration, integration of electrophysiological data with imaging data, python, GTK and VTK. The appointment will be with the Department of Surgery at The University of Chicago, which is an equal opportunity employer.

Applications should be sent electronically to John D. Hunter with a cover letter and CV in plain text or PDF format (jdhunter@ace.bsd.uchicago.edu), or by mail to John Hunter, PhD, Pediatric Neurology MC 3055, The University of Chicago, 5839 S Maryland Ave Chicago, IL 60615

Attendees of the Gordon Research Conference, 2004. Chair: Raymond Mejia, Co-Chair: Timothy C. Elston.

Row 1: Lee Segel, Sally Blower, Robert Guy, Timothy Elston, Raymond Majia, James Keener, Bard Ermentrout, Graciela Ana Canziani, Ramit Mehr, Michael Neubert

Row 2: Ayaz Hyder, Horst Malchow, Sean Sun, Renato Casagrandi, Roger Cooke, Paul Bressloff, Jeffrey Smith, Kasia Rejniak

Row 3: Patricia Theodosopoulos, David Murillo, Adrianna Dawes, Necmettin Yildirim, Jon Reinitz, Eduardo Sontag, Erik Rauch, Yujiro Yamada, Abby Todd, Laura Sontag, Miriam Nuno

Row 4: Fabio Sanchez, Ted Theodosopoulos, Judith Miller, Naoto Morikawa, Julie Simons, Sarah Cunningham, Chao-Ping (Cherrie) Hsu, Romulus Breban, David Wilson, Sookkyung Lim, Michael Palace, Miki Hirabayshi

Row 5: Tuan Dinh, Xiao Wang, Janet Best, Carlos Castillo-Chavez, Claudia Neuhauser, Kim Cuddington

Row 6: Amir Assadi, Stephen Turner, Leah Keshet, Usman Shakil, John Can Drie, Frank Hilker, Ariel Cintron-Arias, Charlie Smith, Alain Franc

Row 7: Eric Cytrynbaum, Andrew Fernandes, Virginia Noonburg, David Swigon, Alan Hastings

Row 8: Alan Weinstein, Hector Romero, Rudy Horne, Xujing Wang, Bruce Gardiner, Bradford Peercy, C. Dennis Thron, Edward Pate, Aaron Fogelson, Philip McQueen, John Bodnar

Row 9: Uri Hershberg, Peter Roper, Can Kesmir, John Jungck, Stephan Morgenthaler, David Adalsteinsson, Michael Simpson, Nick Cogan, Isaac Klapper, Todd Shaw, Stephen Coombes