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MATHEMATICAL BIOLOGY NEWSLETTER

Published by the Society for Mathematical Biology. This issue was prepared by Michael Conrad (editor) and Torcum Chorbajian, with contributions from John Jacquez and Kevin Kirby.

SMB Election Issue

This is the election issue. Brief biographical statements of the candidates are enclosed. Three candidates are running for president (Eugene Ackerman, Simon Levin, and Carol Newton) and five candidates for the Board (Elliot Landaw, Douglas Lauffenburger, J.D. Murray, Michael Savageau, and Alan Weinstein). Please vote for one presidential candidate and two board candidates on the accompanying ballot. Please return the ballot by the date specified on it to Torcum Chorbajian, Department of Mathematics, University of Toledo, 2801 W. Bancroft St., Toledo, Ohio 43606. According to the rules of the Society candidates receiving the highest number of votes shall be deemed elected, up to the number of vacancies.

President's Message (John Jacquez)

This year the Society tried a new format for its ninth annual meeting. The meeting was at Boston University, June 6 and 7. Steve Grossberg and Gail Carpenter organized an all day symposium, "Pattern Recognition in Natural and Artificial Neural Systems" for June 6. The meeting was a great success; the hall was packed with 157 registrants. There was one session of contributed papers on the morning of June 7 at which seven papers were presented to an audience of 27. All in all the attendance was much better than we usually get at our meetings with FASEB as a guest society of the American Physiological Society.

(Michael Savageau and John Jacquez have agreed to organize a meeting at the University of Michigan in 1988, following the format used for the Boston meeting.)

Science at the Annual Meeting (reported by Kevin G. Kirby)

Boston weather was grim, but the tone of the meeting seemed quite optimistic. For the first time, discussion of neuron-like systems seemed to be meeting the leading edge of technology. The re-awakening of interest in "connectionist artificial intelligence" gave the issue of neural pattern recognition a new urgency.

Eight speakers were featured in the program. The morning speakers were David Waltz from Brandeis (and Thinking Machines Corporation), Gail Carpenter, Harold Szu from the Naval Research Labs, and Jacob Schwartz from New York University. Dr. Waltz spoke on pattern recognition and reasoning on the Connection Machine, a massively parallel computer (65,000 processors!) tailored for use in connectionist systems. Dr.

Waltz's view was that traditional rule-based artificial intelligence was demonstrably inadequate, and that an "indisputable" AI would necessarily have connectionist aspects, though these would have to be coupled with a more powerful means of knowledge representation. His talk focussed these issues on the problem of natural language understanding. In the second lecture Dr. Carpenter reviewed some recent results on the Adaptive Resonance Theory developed with Dr. Grossberg. The model is a self-organizing pattern recognition system ultimately described as a system of ordinary differential equations. She presented some features of its two-layer architecture that allow it to learn without an external teacher providing example patterns, and stressed its efficiency.

Dr. Szu began his talk with a rapid survey of traditional image processing and pattern recognition techniques, then presented a new version of an annealing algorithm. Simulated annealing has been used in the past few years as a method to find global minima in a search space of patterns, but has been very inefficient. Dr. Szu showed that by giving up the similarity to thermodynamics in the original model his algorithm could achieve identical results much more rapidly. The last speaker of the morning was Dr. Schwartz, who provdied some empirical grounding for theories of neural associative memory. This lead to an extensive discussion with the attendees about the true variety of neuron types, with Dr. Schwartz maintaining that the variety had been underestimated in traditional models.

In the afternoon four more speakers were featured: David Mumford from Harvard, Stephen Grossberg, Demetri Psaltis from Cal Tech, and Robert Hecht-Nielsen from TRW Corporation. Integrating edge and region information was the subject of Dr. Mumford's talk. He showed how contours could be detected in noisy and blurry images by the minimization of a function. This minimization can be done by annealing, or, with some mathematical restrictions, by hill-climbing algorithms. Dr. Grossberg presented a neural network architecture for perceiving form and color in three dimensions. Using evidence from the study of optical illusions, he showed that this system could serve as a general real-time architecture for pre-attentive vision.

The two final talks emphasized new technologies for the implementation of neural networks. Dr. Psaltis showed how the formidable number of connections required in brain-like systems could be achieved by using optical connections. He mentioned a 100x100 array of optical switches fabricated at Cal Tech capable of picosecond switching times (but unfortunately consuming an enormous amount of power). Dr. Hecht-Nielsen described the ADAPT machine developed by TRW. The latest version of the machine can handle neural nets with 250,000 elements and over five million connections. The system has a fully-developed operating system specialized for the investigation of neural models.

The second day of the Society meeting was devoted to seven contributed papers. The topics presented concerned pattern processing using continuous intraneuronal dynamics, pattern recognition in hierarchical neural models and in the immune system, and mathematical topics such as Latin hypercube sampling and the numerical solution of large but sparse structured problems.

Business at the Annual Meeting (reported by Michael Conrad)

Board of Directors' meetings were held on both the 6th and 7th, and the Society business meeting was held on June 7. In attendance at the June 6 Board meeting were: John Jacquez (President), Torcum Chorbajian, Michael Conrad, Alan Perelson, Lee Segel (editor designate of the Bulletin), and Eugene Ackerman (editor of the Biophysical Journal).

John Jacquez announced that Lee Segel had been elected editor-in-chief of the Bulletin of Mathematical Biology by a mail ballot of the board, with all votes being positive. Dr. Segel will take over as editor effective July 1. There will be a three month overlap period with Hugo Martinez, which should ensure continuity in the handling of manuscripts.

The first issue discussed at the meeting was Bulletin policies. Eugene Ackerman described the operations of the Biophysical Journal, which is currently handling about 400 manuscripts per year. The general feeling was that a three year term for the Bulletin editor would be appropriate, and that a one year lead time for choosing a new editor would be desirable. A doubling of the term should be possible, if mutually desired by the editor and the SMB Board. Lee Segel described some of the policies he would like to institute as editor, including a possible name change for the Bulletin (see Segal, below).

The next agenda issue concerned reimbursement for travel to the Annual Meeting for Society officers and members of the Board. The bylaws state that directors may not receive salaries, but may receive reimbursement for attending society meetings. The policy has been erratic in the past, with no reimbursement in recent years. The issue was voted on by mail ballot prior to the meeting. Reimbursement up to $350 will be possible for officers and Board members who state that they cannot obtain funds elsewhere.

Committee appointments were brought up. Lee Segel will automatically replace Hugo Martinez on the publication board. For the time being the current committee structure of the Society will stay in place. Alterations will be made by mail ballot. Professor Roberto Kampfner will assume the position of the SMB liaison with the Society Latino-Americana de Biomathematica. (Dr. Kampfner's address is: Department of Computer Science, Wayne State University, Detroit, Michigan 48202).

The 1987 annual meeting will be organized by Paul Rapp. The SMB will be a guest society of the American Physiological Society. The meeting will be held during the period March 31 to April 4 in Washington, D.C. Neural modeling and computation will be the probable theme. There will be a contributed paper session.

Torcum Chorbajian made the annual treasurer's report. This reflected a balance of $60,000. Income for the fiscal year was $29,303 and expenses were $24,662 (expenses included legal, Pergamon Press, FASEB, editorial expenses for the Bulletin, and newsletter mailing). The scholarship fund was used to bring four students to the annual meeting. This fund, which comprises more than half of the balance in the treasury, is

restricted and can only be used for scholarships. Dr. Jacquez added the information that the Boston meeting will cost the Society between $2500 and $3000, mostly to pay airfare of speakers. These monies will be transferred to the Center for Adaptive Systems. Dr. Chorbajian was commended for his effective management of Society funds.

The annual business meeting was held on June 7, following a very intense and well received contributed paper session. Unfortunately, in the break following the session our quorum of ten Society members slipped away. Only nine Society members could be collared, and in lieu of admitting some new members to the Society on the spot it was not possible to declare an official business meeting. Dr. Jacquez proceeded with the meeting nevertheless, emphasizing that it was not an official meeting. Some of the points discussed included the Lee Segal appointment, the fact that elections will be carried out during the summer, and that there are two vacancies on the Board of Directors. Dr. Jacquez commented on the success of this year's meeting and observed that we should repeat the format in '88 and possibly in all subsequent meetings.

The second Board of Directors meeting was convened immediately following the business meeting. In attendance were: John Jacquez (President), Torcum Chorbajian, Michael Conrad, and Alan Perelson. M. Conrad reported on the status of the newsletter. The newsletter could in the future be used to form a communications link between mathematical biologists and societies of mathematical biology in different parts of the world. This would require some initial subsidy on the part of the Society. The newsletter might also accept advertising to defray some costs. Whether this will be allowed will be put to a mail ballot of the Board. John Jacquez discussed possible collaboration with the French Society for Mathemtical Biology.

Lee Segel: New directions for the Bulletin, possible name change

Since 1977 Lee Segel has been Dean of the Faculty of Mathematical Sciences at the Weizmann Institute of Science. He was a Guggenheim Fellow at the Weizmann in 1971-72 and the following year took up the chairmanship of the Applied Mathematics Department there. Segel did his undergraduate work at Harvard College, was a Fulbrights scholar at Cambridge University in the years 1954-55, then returned to Cambridge, Mass., to do his PhD at MIT. From 1960 until his move to the Weizmann he was a professor of mathematics at Rensselaer Polytechnic Institute. He has had visiting appointments at MIT, Cornell Medical School, and during the period 1978-79 was Vinton Hayes Senior Fellow at Harvard University.

Excerpting from Alan Perelson's nomination letter,

"As you can see from Lee's CV, he is on the editorial boards of a number of theoretical biology journals, and he has worked in a wide variety of areas. He developed the Keller-Segel chemotactic equations and really began the whole field of modeling populations of chemotactic cells. He has worked on ligand-receptor binding problems both in the context of

cooperative enzymes and in the context of signal transduction mechanisms across biological membranes. He has done work in developmental biology related to differentiaton in Dictyostelium and reaction-diffusion models of pattern formation, in ecology, in molecular biology (replication and recombination in mitochondrial DNA), in neurophysiology (Nernst-Planck-Poisson euqations, neurotransmitter release, facilitation), in polymerization theory, in cell adhesion, in kidney modeling (standing gradient hypothesis), and in sensory transduction mechanism and adaptation mechanism involving receptor modification (the current molecular hypothesis). He has expressed interest in immunology (we have done one short joint paper many years ago) and hopes to devote time to this field in the coming years. I think his breadth of interests is enormous, his accomplishments in theoretical biology substantial. He has an international reputation in both applied mathematics and in biology, both as a researcher and as an educator."

At the Society board meeting in June and during a recent telephone interview with the newsletter editor, Segel discussed the editorial policies that he plans to follow. The "optimal" paper would combine theory and experiment, but this is not meant to discourage people who are doing purely theoretical work from submitting papers. Even purely experimental papers might be published under some circumstances if they were relevant to theory. Segel used the hypothetical example of an experimental paper that "shot down" the Turing-Rashevsky theory of morphogenesis.

Both at the Board meeting and in our phone interview Dr. Segel indicated that he would like to change the name of the Bulletin, possibly to the Bulletin of Theoretical and Experimental Biology. This was discussed at length at the meeting and a variety of opinions were expressed. All agreed that the opinions of the Society membership should be solicited in advance of any such move. Segel emphasized that he would welcome such comments.

Dr. Segel plans to appoint a new editorial board, a prerogative of the editor. He also plans to change the Bulletin's statement of purpose. The current statement is: "The Bulletin is devoted to publication of research that contributes to the physicomathematical foundations of biology in their most general scope, except purely statistical material." Dr. Segel did not have his new statement of scope at phone side, but tentatively it is: "The Bulletin is devoted to publication of research that employs theoretical approaches in close actual or potential relation to experiment to increase our understanding of biology."

Lee Segel's address is: Department of Applied Mathematics, Weizmann Institute of Science, Rehovot, Israel. He should be reachable through the following bitnet address: MAWEINTR @ WEIZMANN or MAWEINTR %WEIZMANN,BITNET, and through the following ARPA net: CAROL @ WISDOM (an acronym for Weizmann Institute of Science, Department of Mathematics).

(Please send any reactions to the proposed name change to John Jacquez, Department of Physiology, The University of Michigan Medical School, Ann Arbor, MI 48109, with a duplicate to Lee Segel. Comments will be

summarized in a future issue of the newsletter if the response warrants.)

Literary Events

Lotka-Volterra Approach to Cooperation and Competition in Dynamics Systems. Edited by W. Ebeling and M. Peschel, Akademie-Verlag, Berlin, 1985. (Thirty-one papers, primarily focusing on the Lotka-Volterra approach to nonlinear systems and the connection to strange attractors.)

Dynamic Analysis of Enzyme Systems. Katsuya Hayashi and Naoto Sakamoto, Japan Scientific Societies Press, Tokyo and Springer Verlag, Berlin, 1986.

Position Available

PHARMACOKINETICS/RISK ASSESSMENT. Applications are invited from persons with Ph.D. to conduct research involving mathematical modeling aimed at incorporation of pharmacokinetic data into health risk assessment. Position will also involve consulting on specific risk assessment projects. Send application, c.v., and have three letters of recommendation forwarded to: K S CRUMP and Company, Inc., 1201 Gaines, Ruston, LA 71270.

PLEASE READ THE INFORMATION PROVIDED BY THE SMB CANDIDATES (FOLLOWING PAGES) AND RETURN THE ACCOMPANYING BALLOT TO TORCUM CHORBAJIAN.

EUGENE ACKERMAN

Personal Data:
Born: July 1920. Married. Children and grandchildren.

Degrees and Appointments:
B.A. Swarthmore College 1941; Sc.M. Brown University 1943; Ph.D. University of Wisconsin 1949; Post doctoral in Biophysics: University of Pennsylvania 1949-1951. Assistant Professor of Physics to Professor of Biophysics: Pennsylvania State University 1951-1960. Staff Consultant in Biophysics: Mayo Clinic and Mayo Foundation 1960-1967. Professor of Laboratory Medicine and Pathology, University of Minnesota 1967-present.

Sabbatical Leaves: 1957-1958 University of Pennsylvania, Johnson Research Foundation; 1974-1975 University of Washington, Department of Laboratory Medicine.

Societies:
Society for Mathematical Biology; Biophysical Society; American Physiological Society; Association for Computer Machinery; Engineering in Medicine and Biology Society; Minnesota Academy of Science; Sigma Xi; Phi Beta Kappa; Fellow of American College of Medical Informatics.

Current Graduate and Research Appointments:
Director of Graduate Program in Biophysical Sciences; Member of Graduate Faculty in Biomedical Engineering; Member of Graduate Faculty in Computer Science; Director of National Resource for the Simulation of Stochastic (Monte Carlo) Population Models; member of Postdoctoral Training Faculty in Medical Informatics.

Publication Activities:
Author of over 130 technical articles and book chapters; author or coauthor of three textbooks; past member of Editorial Board for American Journal of Physiology; Editor of Biophysical Journal 1983-1987.

Statement concerning the Society of Mathematical Biology:
The Society continues to be a small society, so small that its future is problematic. It is important that Society continue to grow; this requires not only suitable publicity, but expanded services of the Society for its membership. These services consist of three activities, all of which have recently been strengthened. These are the publication of the Bulletin, the Annual Meeting, and the Newsletter. All of these should continue to be modified so that they better serve the Society of Mathematical Biology by representing the membership and providing services that the members want and use. It is important that the Society of Mathematical Biology recognize the need to continue to evolve and at the same time to maintain its unique focus and areas of specialization.

Simon A. Levin

Simon Levin received a B.A. in Mathematics from the John Hopkins University in 1961, and a Ph.D. in Mathematics from the University of Maryland in 1964. In 1965, he was appointed to the faculty of Cornell University, where he currently holds the Charles A. Alexander Professorship in Biological Sciences and directs the Ecosystems Research Center. His primary research interests are in ecology and evolutionary theory.

Levin is managing editor of the Journal of Mathematical Biology and of the book series Biomathematics and Lecture Notes in Biomathematics, and a member of the editorial boards of the Journal of Theoretical Biology, Evolutionary Theory, Mathematical Modeling, Discrete Applied Mathematics, and Natural Resource Modeling. He is a member of the Health and Environmental Research Advisory Committee of the Department of Energy; the Commision on Life Sciences of the National Research Council; the Board on Basic Biology, National Research Council; and the Board of Directors of the Hudson River Foundation. He is also Vice-Chairman (Mathematics) of the Committee of Concerned Scientists, a member of the Public Affairs Committee of the Ecological Society of America, and formerly was a member of the Councils of the Society for Industrial and Applied Mathematics and the Ecological Society of America. He was Chairman of the Gordon Research Conference on Theoretical Biology and Biomathematics in 1971, and from 1973-79 was Chairman of the AMS/SIAM Committee on Mathematics in the Life Sciences.

Statement

I believe that the Society for Mathematical Biology can play a leadership role in advancing the development of theoretical approaches to biology, and in the integration of theory and experiment. As President, I would seek to broaden the membership base of the Society, and to develop special interest groups in biologically-defined subareas. I would endeavor to expand the national and international representation of the Society, and to have it serve a role as liaison with federal agencies and officials interested in encouraging the development of mathematical models as alternatives to using animals and natural systems for experimentation. I would seek to develop an active meetings program, including affiliations with established fixtures such as the Gordon Conference and appropriate international meetings. Finally, I would seek to broaden the Society's publications programs by strengthening the Bulletin and seeking complementary arrangements with other major periodicals and publication programs.

CAROL M. NEWTON

Curriculum Vitae

CAROL M. NEWTON, M.D., Ph.D.

Birth date: November 25, 1926
Oakland, California

Marital Status: Single

Education and Experience

A.B.	(Physics) Stanford University, 1947
M.S.	(Physics) Stanford University, 1949
Ph.D.	(Physics, Mathematics minor) Stanford University 1956
M.D.	(Medicine) University of Chicago, 1960
1985-	Professor, Dept. of Biomathematics, School of Medicine, UCLA
1967-1985	Associate Professor to Professor/Chair, Department of Biomathematics, School of Medicine, UCLA
1972 -	Associate Professor to Professor, Radiological Sciences, then Radiation Oncology, School of Medicine, UCLA.

Currently, member of Advisory Committee to the Director of NIH; Editorial Board of Modeling Methodology Forum, American Journal of Physiology. In the past: Chair, Department of Biomathematics, UCLA; Board Member and Membership Chair, Society for Mathematical Biology; President, ACM's Special Interest Group on Biomedical Computing.

LANDAW, ELLIOT M.; b. Paterson, NJ May 11, 1948. Education: Rutgers College, BA (Biological Sciences) 1968; Univ. of Chicago, MD, 1972; Univ. Calif., Los Angeles, PhD (Biomathematics), 1980. Internship & Residency: UCLA Medical Center (Pediatrics), 1972-75. Certification: American Board of Pediatrics, 1977. Professional Experience: Asst. Prof. Biomathematics and Pediatrics, UCLA School of Medicine, 1980-85; ASST. PROF. BIOMATHEMATICS, UCLA SCHOOL OF MEDICINE, 1985- . Editorial Board: Am. J. of Physiology, Modeling Methodology Forum, 1981- . Membership: SMB, Biometric Society, SIAM, ASA, AAAS. Research interests: identifiability and optimal experiment design for compartmental models; nonlinear regression; modeling/estimation applications in pharmacokinetics, ligand-receptor analysis, membrane transport, pediatrics. Mailing address: Dept. Biomathematics, AV-617 CHS, UCLA School of Medicine, Los Angeles, CA 90024 U.S.A.; phone (213)-825-6743.

J.D. Murray, B.Sc.,Ph.D.,(St. Andrews), M.A.,D.Sc.,(Oxford), F.R.S.
Director, Centre for Mathematical Biology and Professor of Mathematical Biology,
Mathematical Institute,
University of Oxford

Between 1956-1970 I lived for many years in the United States and was on the faculties of Harvard (Eng.), University of Michigan (Eng.) and NYU (Math.). I was a Guggenheim fellow in Paris in 1967. Shortly after returning to Oxford in 1970 my research was exclusively into mathematical biology. I was appointed Director of the newly created Centre for Mathematical Biology in 1983. I regularly visit the United States and have had visiting professorships, for example, at Cal Tech, M.I.T., Utah and S.M.U. and was the Stan Ulam Visiting Scholar at Los Alamos National Laboratory in 1985. I have also held visiting professorships at Heidelberg, Florence and in Taiwan.

My research in biology has principally been in facilitated diffusion, wave motion in the BZ reaction, ecological models (spatially dependent), spatial spread of epidemics, parasitology, reaction-diffusion models, animal coat and butterfly wing patterns, and the development of mechanochemical mechanisms for the generation of biological pattern and form.

I am currently on the Editorial Boards of: J. Theor. Biol., J. Math. Biol., J. Maths. Appl. in Medic. and Biol., Acta Biotheoretica, Lect. Notes in Biomath., Biomathematics Series (Springer), and have been involved in organising meetings in theoretical biology since 1976.

Douglas A. Lauffenburger
Associate Professor
Department of Chemical Engineering
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Philadelphia, PA 19104

I have been active in research in the field of theoretical biology since my days as a graduate student at the University of Minnesota, where I received my PhD in chemical engineering, under the direction of Professors Rutherford Aris and Kenneth Keller, in 1979. My thesis involved mathematical modeling and analysis of the effects of cell motility and chemotaxis on population dynamics in microbiology and immunology. I have been on the faculty at Penn since 1979, and my research interests have expanded to span a wide range of cell behavioral phenomena, including cell adhesion, intracellular receptor/ligand processing, angiogenesis, and immune killing processes in addition to continuing investigations of chemotaxis and cell population dynamics. My work has actually comprised a combination of mathematical and experimental studies, often in collaboration with biological and medical scientists, resulting in publications in a variety of theoretical and experimental biology journals such as *Journal of Cell Biology*, *Journal of Immunology*, *Biophysical Journal*, *Cell Biophysics*, *Microbial Ecology*, *Journal of Theoretical Biology*, *Journal of Mathematical Biology*, *Mathematical Biosciences*, and *Bulletin of Mathematical Biology*.

I am very interested in the continuing growth of theoretical approaches to understanding of phenomena in the biological and medical sciences, by bringing appropriate mathematical analyses to bear on relevant experimental observations. I found my recent role as vice-chairman of the 1986 Gordon Conference on Theoretical Biology and Biomathematics to be a particularly stimulating and satisfying one in this regard, and would look forward to more opportunities to further this aim within the auspices of the Society of Mathematical Biology.

MICHAEL A. SAVAGEAU

Training in mathematics and biology: B.S. University of Minnesota (1962), M.S. University of Iowa (1963), Ph.D. Stanford University (1967), Postdoc. UCLA (1967-68) and Stanford University (1968-70). Positions: Assistant Professor (1970-74), Associate Professor (1974-1978), Professor (1978-) and Interim Chairman (1982-85), Department of Microbiology and Immunology, The University of Michigan, Ann Arbor; Visiting Professor, Max Plank Institut für Biophysicalische Chemie, Göttingen, West Germany (1976-77), and John Curtin School for Medical Research, Australian National University, and CSIRO Division of Computing Research, Canberra, Australia (1983-84). Consultant: NIH, NSF, Office of Technology Assessment, Upjohn and Synergen. Editorial board: Mathematical Biosciences. Fellow: NIH, Fulbright, Guggenheim and Australian National University. Publications: One book, 10 reviews and 57 papers in scientific journals. Courses: Cellular and Molecular Networks, and Synergistic Systems. Member: AAAS, Am. Chem. Soc., Am. Soc. Microbiol., Biophys. Soc., IEEE, Soc. Gen. Physiol., SIAM and Soc. Math. Biol. Current interests: Nonlinear formalisms in biology; mathematical and computer methods for their analysis; applications involving function, design and evolution of cellular and molecular networks, with emphasis on accuracy and regulation of gene expression.

ALAN M. WEINSTEIN

I received my AB in Mathematics from Princeton (summa cum laude) in 1971 and my MD from Harvard (cum laude) in 1975. After clinical training and certification in internal medicine, I became a research fellow with John Stephenson at the NIH Section on Theoretical Biophysics. There I examined mathematical models of epithelial water transport. In 1980 I moved to Cornell Medical College, where I am now an Asst. Prof. of Medicine (Nephrology) and an Asst. Prof. of Physiology. I have been developing models of the renal proximal tubule with the objective of understanding the regulation of solute and water transport by this structure.