

# Mathematical Biology Newsletter

Society for Mathematical Biology

Volume 4, Number 1

February, 1990

## SMB ELECTION RESULTS

**Stuart Kauffman** has been elected President of the Society for Mathematical Biology. **Hans Othmer** and **Michael Mackey** have been elected to the Board of Directors. **Michael Reed** has been elected to a one year term on the board (to finish the unexpired portion of Professor Kauffman's term).



Transfer of the gavel from Simon Levin (right) to Stuart Kauffman.

## MESSAGE FROM THE PRESIDENT

Stuart Kauffman, of the University of Pennsylvania, is the new President of SMB. In a conversation with the Editor, he asked to have conveyed to the membership his enthusiasm about serving as President, and his plans for continuing the growth and development of the Society.

One of Kauffman's principal goals is to continue the membership expansion, and he urged members to get colleagues to join. The Society's membership requirements have been modernized (see membership matters, page 7), and membership remains a terrific bargain.

Internationalization has been a long term goal of the SMB, and has already resulted in one meeting in Oxford, and another planned for Grenoble in January, 1991. Interlocking arrangements with societies in other countries are being explored, as well as the institution of chapters in various countries.

The active joint committee with the American Mathematical Society (AMS) and the Society for Industrial and Applied Mathematics (SIAM), which has arranged this year's meeting in Vancouver (page 2), is hard at work planning future meetings. In recent years, SMB has been meeting in conjunction with large associations, such as FASEB, AIBS, and SIAM. Kauffman is exploring the possibilities of smaller meetings as well, for example at Santa Fe, which could bring together a large portion of our membership.

### **Society for Mathematical Biology**

*Secretary and Newsletter Editor: Michael Conrad (Computer Science Department, Wayne State University, Detroit, MI 48202); President: Stuart Kauffman (Dept. of Biochemistry and Biophysics, School of Medicine G3, University of Pennsylvania, Philadelphia, PA); Treasurer and Newsletter Co-Editor: Torcom Chorbajian (Department of Mathematics and Applied Statistics, University of Northern Colorado, Greeley, CO 80639); Board of Directors: Stuart Kauffman, Nancy Kopell, Simon A. Levin, Michael Mackey, James D. Murray, Hans Othmer, Michael Reed, Michael Savageau.*

# SMB MEETINGS

## CHICAGO MEETING

The 1990 Annual Meeting of the SMB will be held in conjunction with the Society for Industrial and Applied Mathematics (SIAM) Meeting in Chicago during the week of July 16-20, 1990.

One of the themes of the meeting is Mathematical Biology.

**Invited speakers** include:

- **Nancy Kopell**, Networks in Neurophysiology
- **Garrett Odell**, Wanted: Applied Mathematicians to Try the Fruit Fly Challenge

**Minisymposia** have been organized as follows:

**The Geometry and Topology of DNA**, **DeWitt L. Sumners**, Florida State University, Organizer

- The Biological Implications of DNA Topology, **Nicholas R. Cozzarelli**, University of California, Berkeley
- The Topology of DNA Recombination, **DeWitt L. Sumners**
- The Geometry of Supercoiled DNA, **James H. White**, University of California, Los Angeles
- Topological Quantum Field Theory and DNA Topology, **Louis H. Kauffman**, University of Illinois, Chicago

**Algorithms for DNA Sequence Matching and Analysis**, **Daniel Gusfield**, University of California, Davis, Organizer

- An Overview of Old and New Approaches to DNA Sequence Analysis, **Daniel Gusfield**
- Analysis of Restriction Maps, **Webb Miller**, Pennsylvania State University, University Park
- Sparse Dynamic Programming, **Raffaele Giancarlo**, Columbia University
- Sublinear Algorithm for Similarity Searching, **Gene Myers**, University of Arizona

**Moving Ions Through Channels in Biological Membranes**, **Robert S. Eisenberg**, Rush Presbyterian-St. Lukes Medical Center, Organizer

- Ionic Channels in Biological Cells, **Robert S. Eisenberg**
- Ionic Movement in Holes in Dielectrics, **Victor Barcilon**, University of Chicago, and Rush Medical College
- Boundary Conditions for the Diffusion of Ions Through Cell Membrane Channels, **Peter Gates**, **K. E. Cooper**, and **J. L. Rae**, Mayo Medical School
- Langevin Studies of Ion Motion in Framework Electrolytes, **Mark Ratner**, Rush Medical College, and Northwestern University; and **Abraham Nitzan**, Tel Aviv University, Israel

There will also be a **contributed paper session** (see below).

The time and location of the **Board of Directors Meeting** and the **Annual Business Meeting and Mixer** will appear in the Program. Additional information regarding the meeting will be forthcoming from SIAM.

## CALL FOR PAPERS

The SMB is sponsoring a contributed papers session(s) at the SIAM Meeting in Chicago. If you wish to submit a contributed paper, please submit an abstract on the enclosed form and return it to Torcom Chorbajian, Department of Mathematics and Applied Statistics, University of Northern Colorado, Greeley, CO 80639.

## VANCOUVER MEETING

The twenty-fourth annual Symposium on Some Mathematical Questions in Biology will be held on Thursday and Friday, August 2-3, 1990, during the Congress of the International Union for Pure and Applied Biophysics (IUPAB), July 29-August 3, 1990.

The Symposium is sponsored by the American Mathematical Society (AMS), the Society for Industrial and Applied Mathematics (SIAM), and the Society for Mathematical Biology (SMB). **Jack D. Cowan** is the organizer of the symposium and *Neural Networks* is its theme. The program, set out below, will consist of morning sessions, each including three one-hour lectures.

### Program

Thursday, August 2, 9:30 a.m. (**Chairman: Robert Miura**, University of British Columbia)

- *Neurodynamics*. **Jack D. Cowan**, University of Chicago.
- *Learning, Networks, and Approximation Theory*. **T. A. Poggio**, Massachusetts Institute of Technology.
- *Neural Networks, Information Theory and Perception, in Animals and Machines*. **Ralph Linsker**, IBM T.J. Watson Research Center.

Friday, August 3, 9:30 a.m. (**Chairman: John Rinzel**, National Institutes of Health)

- *Learning and Generalization in Multi-layered Neural Networks: A Statistical Analysis*. **D. Rumelhart**, Stanford University.
- *Growing and Pruning Neural Networks: Relation to Statistical Mechanics*. **Alan Lapedes**, Los Alamos National Laboratory.
- *Perspectives in Computational Neurobiology*. **Terrence J. Sejnowski**, Salk Institute.

For further information about the Symposium, contact the Symposium Conference Coordinator, AMS, P. O. Box 6248, Providence, RI 02940 or by electronic mail: BAV@MATH.AMS.COM. For registration and housing information, contact Mr. L. Forget, Congress Manager, 10th International Biophysics Congress, National Research Council Canada, Ottawa, Ontario, Canada K1A 0R6. Phone: 613/993-9009; Fax: 613/957-9828.

## THE LANDAHL TRAVEL AWARDS

*The Society for Mathematical Biology has funds for partial support of the travel of graduate students to meetings co-sponsored by the SMB, including the SIAM meeting in Chicago (July 16-20, 1990) and the IUPAB (International Union for Pure and Applied Biophysics) meeting in Vancouver, Canada (July 29-August 3, 1990). Graduate students who wish support may apply to: Michael C. Reed, Department of Mathematics, Duke University, Durham, NC 27706. The application, which should be received by May 25, 1990, should include a one-page research summary and one letter from a faculty sponsor.*

## OTHER FUTURE MEETINGS

**Mathematical Aspects of Microbial Ecology.** (May 21-23, 1990, Kellogg Center, East Lansing, Michigan). Michigan State University's Center for Microbial Ecology will host a conference on "Mathematical Aspects of Microbial Ecology". The purpose of the conference is to bring together investigators from the various fields of microbiology, applied mathematics and engineering with the aim of stimulating ideas for further advances in the area of microbial ecology from a quantitative perspective. Funding for the conference has been awarded by the National Science Foundation Science and Technology Center for Microbial Ecology (MSU).

Speakers and topics are as follows: James Bryers, Duke University—"Biofilm Ecodynamics"; Lee Baldwin, University of California—Davis; Douglas Caldwell, University of Saskatchewan—"Difficulties in Analyzing the Kinetics of Bacterial Growth"; Robert Christian, East Carolina University—"Reflecting Improved Information in Simulations of an Estuarine Microbial Food Web"; Arnold Fredrickson, University of Minnesota—"Some Things That We Need to Do if We Are to Understand Microbial Grazing"; Willi Jager, University of Heidelberg—"Microbial Growth in a Spatial Gradient"; Douglas Lauffenburger, University of Pennsylvania—"Quantitative Studies of Bacterial Chemotaxis and its Effect on Microbial Population Dynamics"; Joseph Robinson, Upjohn Company; Lone Simonson, University of Massachusetts—"Mathematical Models of the Dynamics of Plasmids in Bacterial Populations: The Ideal World and Confronting Reality"; Hal Smith, Arizona State University—"Microbial Competition in the Gradostat"; Betty Tang, Arizona State University—"Competitive Coexistence"; Julian Wimpenny, University of Wales (Cardiff)—"Spatial Order in Systems of Microbes".

The organizing committee is comprised of John Breznak and Frank Hoppensteadt (chair), Michigan State University; Fern Hunt, Howard University; Douglas Lauffenburger, University of Pennsylvania; Joseph Robinson, Upjohn Company; Paul Waltman, Emory University.

Conference registration is \$50, with separate hotel and dorm style lodging available at Kellogg Center and Butterfield guest house. For registration information, contact the College of Natural Science, 103 Natural Science Bldg., East Lansing, MI 48824 or call 517/355-1715.

**Latin American Seminar on Applications of Mathematics and Computer Science to Biology.** (October 31-November 3, 1990, La Habana, Cuba.) The National Center for Scientific Research of Cuba and the Latin American Society for the Application of Mathematics and Computer Science to Biology will sponsor its first Latin American seminar. Topics include: mathematical models of biological systems, artificial intelligence in biological research, computer assisted molecular modeling, biological signal processing, and image processing in biological research. Scientific sessions will include conferences, contributed papers, workshops, and poster sessions. Authors should send abstracts (less than 150 words) of their papers before May 31, 1990. The conference fee will be \$100 US, or equivalent in national currency of the home country. Correspondence should be sent to: Dr. Leis Sastre, Departamento de Matematica, Centro Nacional de Investigaciones Cientificas, Apartado 6990, La Habana, Cuba.

**AIBS Symposium on Population and Scarcity.** (April 20, 1990, Baird Auditorium, the National Museum of Natural History, Smithsonian Institution.) During Earthweek, the American Institute of Biological Sciences and the Smithsonian Institution will sponsor a full-day symposium entitled "Population and Scarcity: the Forgotten Dimensions". This symposium will take a hard look at the most important of environmental problems, population. It will consider the critical role that population plays in both generating these problems, and their impact on humanity.

The symposium will take place in the Baird Auditorium, the National Museum of Natural History, Smithsonian Institution, and will feature as speakers Paul Ehrlich, Carl Haub, Herman Daly, Anne Ehrlich, John Holdren, Dan Luten and Garrett Hardin. Registration is \$35.00 and is needed by April 1. If you would like further information and registration materials, please contact Louise Salmon, AIBS Meetings Manager, 730 11th Street N.W., Washington, DC 20001; or call 202/628-1500.

### International Conferences in Prague, Czechoslovakia, 1990.

- Medical Informatics and Medical Education, September 3-7. For information: Dr. Jana Zvárová, CSc., Association of Czechoslovak Medical Societies, J.E. Purkyne, IMIA Conference, P. O. Box 88, Prague 2, CS - 12026, Czechoslovakia.
- Mathematical Approaches to Brain Functioning Diagnostics, September 3-7. For information: J.E. Purkyne, IBRO Symposium, P. O. Box 88, Prague 2, CS - 12026, Czechoslovakia.
- Neuronet '90, September 8-12. For information: NEURONET '90, Institute of Computer Sciences, Czechoslovak Academy of Sciences, 182 07 Prague, P. O. Box 5, Czechoslovakia.

See July 1989 *Newsletter*, page 3 for complete details. If you have misplaced the July *Newsletter*, write to Torcom Chorbajian for a copy of page 3.

**European Meeting for Mathematical Biology.** (January, 1991, Grenoble, France). For further information write to: J. Demongeot, IMAG, BP 53, F-38041, Grenoble Cedex, France. See also July 1989 *Newsletter*, page 3.

**Animal Conflicts—ESS Workshop.** June 5-9, 1990, Bonn, West Germany. The term "Animal Conflicts" refers to studies of the effects of behavioral and other characteristics of individuals of populations on the evolutions of those populations, with Maynard Smith's ESS (Evolutionarily Stable Strategy) formulations being the starting point for much of the work. The intent of the workshop is to share recent theoretical and applied research insights. For further information, please contact either of the organizers:

Bernhard Thomas SUPRENUM GmbH Hohe Str. 73 D-5300, Bonn, West Germany	Gordon Hines Dept. of Mathematics & Statistics University of Guelph Guelph, Ont., Canada, N1G2W1
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**Ninth Pacific Coast Resource Modeling Conference.** June 13-16, 1990, University of Montana, Missoula. The purpose of the conference is to provide a forum for presentation of recent progress in the mathematical modeling of renewable resources. Invited speakers include:

- **Colin Clark**, University of British Columbia, *Economic Dimensions of Sustainable Development*.
- **John Beddington**, Imperial College, London, *The Exploitation of Elephants in Africa: Sustainable and Non-sustainable Harvesting*.
- **Peter Berck**, University of California—Berkeley, *Empirical Resource Economics*.
- **Daniel Goodman**, Montana State University, *Model Validation: Valid for What?*
- **Bryan K. Williams**, USFWS Migratory Bird Program, *Modeling and the Management of Migratory Birds*.

A Panel Discussion entitled *Models as a Bridge between Concept and Data*, will feature **Ray Hilborn**, University of Washington, **Jon Schnute**, Pacific Coast Biological Station—Nanaimo, and **Marc Mangel**, University of California—Davis.

For further information, contact: Professor Robert McKelvey, Department of Mathematical Sciences, University of Montana, Missoula, MT 59812-1032, USA. Tel: 406/243-6222; Fax: 406/243-2327.

**1990 Gordon Research Conference in Theoretical Biology and Biomathematics**, June 11-15, 1990, Tilton School, Tilton, NH. Scott E. Fraser, Chairman; James P. Keener, Vice Chairman.

#### Program:

Monday, June 11, *Developmental Biology*, **George Oster**, Chair.

- **J. Murray**, Oxford, *Models for Biological Pattern Formation*.
- **G. Oster**, Berkeley, *Morphogenesis in Developing Organisms by Cell Rearrangement*.
- **G. Odell**, Seattle, *Pattern Formation in the Early Drosophila Embryo: A Testable Model*.
- **W. Brandts**, Toronto, and **J. Frankel**, Iowa City, *Experiments and Models of Pattern Formation in a Unicellular Organism: Tetrahymena*.

Tuesday, June 12,  
*Endocrinology*

- **J. Rinzel**, Bethesda, *Synchronization of Beta-cell Oscillations and Secretion*.
- **A. Goldbetter**, Brussels, *Mechanisms of Calcium Oscillations and Their Role in Secretion*.
- **E. Knobel**, Houston, *The Hypothalamic Clock and the Control of Biological Rhythms*.

*Hematology*

- **M. Mackey**, Montreal, *Non-linear Dynamics and the Modeling of Blood Cell Production*.
- **A. Fogelson**, Salt Lake City, *Platelet Aggregation*.

Wednesday, June 13, *Neurobiology*, **James Bower**, Chair.

- **C. Grasky**, San Francisco, *Experiments and Models of the Organization of Somatosensory Cortex*.
- **C. Gray**, Frankfurt, *Experimental Analysis of Oscillatory Responses in the Neocortex*.
- **M. Wilson**, Pasadena, *A Structural Model for Information Flow in the Olfactory Cortex*.
- **A. Cohen**, Ithaca, *Experimental Studies of Spinal Motor Control Circuits*.

- **B. Ermentrout**, Pittsburgh, *A Model for the Control of Motor Pattern Generators*.

Thursday, June 14

*Molecular and Cell Biology*, **Scott Fraser**, Chair.

- **Z. Agur**, Tel Aviv, *Improving Antiviral Chemotherapy: Mathematical Models and Their Experimental Verification*.
- **J. Tyson**, Blacksburg, *Gene Regulation in Parvo Virus*.
- **J. Mahaffy**, San Diego, *Cell Replication in a Simple System: E. Coli*.

*Ecology*, **Peter Kareiva**, Chair

- **P. Kareiva**, Seattle, *Dispersal of Insect Populations*.
- **B. Shaeffer**, Tucson, *A Non-Linear Dynamics Approach to Population Modeling*.

Friday, June 15, *Transport and Locomotion*, **James Keener**, Chair

- **M. Reed**, Durham, *Axonal Transport*.
- **S. Vogel**, Durham, *Life in Moving Fluids*.
- **H. Crenshaw**, Durham, *Helical Locomotion of Micro-organisms*.
- **L. Fauci**, Durham, *Swimming Micro-organisms*.

**The Canadian Society for Theoretical Biology (CSTB).** June 14-16, 1990, Halifax, Nova Scotia, Canada. As a Guest Society of the Canadian Federation of Biological Societies (CFBS), the CSTB's proposed program includes:

June 15 8:30-11:30 am	<i>Mathematical Models of Biological Systems</i>
1:30-4:00 pm	<i>Dynamics of Biological Systems</i>
4:30-6:00 pm	<i>Annual Society Meeting and Roundtable Discussion on the Nature and Future of Theoretical Biology</i>
June 16 8:30-11:30 am	<i>A Mosaic of Current Research</i>

Submissions for papers to be presented are to include camera-ready one page abstracts, which should be submitted to the Program Chairman: Dr. Gordon S. Hines, Department of Mathematics and Statistics, University of Guelph, Guelph, Ontario N1G 2W1, Canada. Phone: 518/824-4120x3104 or x2155.

Please send abstracts for receipt by April 30 to allow time for reviewing and program preparation.

For the general CFBS program and registration and accommodation forms, contact: CFBS, 575 King Edward Avenue, Ottawa, Ontario K1N 7N5, Canada. Phone: 613/234-9555; Fax: 613/234-6667.

**Third Annual ICNRMA**, October 11-13, 1990, Cornell University, Ithaca. The Third Interdisciplinary Conference on Natural Resource Modeling and Analysis will be held at the Statler Hotel on the Cornell University Campus. Invited speakers include:

- **Ngo Van Long**, Resource Economics, McGill University.
- **Sten Nilsson**, Forestry, Swedish University of Agricultural Sciences.
- **Francis Clarke**, Mathematics, University of Montreal.
- **Pete Loucks**, Water Resource Engineering, Cornell.

For further information, please contact Professor Jon Conrad, 310 Warren Hall, Cornell University, Ithaca, NY 14853; telephone: 607/255-7681.

**ICIAM 91.** The Second International Conference on Industrial and Applied Mathematics, July 8-12, 1991, Washington, DC. Presentations are solicited in all areas of applied and computational mathematics, computer science, applied probability and statistics, scientific computing, and applications in engineering and the biological, chemical, and physical sciences. Invited presentations include:

- *Generation of Biological Pattern and the Formulation of Morphogenetic Flows*, **James D. Murray**, Oxford and University of Washington.
- *Mathematical and Computational Models of Vision*, **Michael Brady**, Oxford.

For further information, contact: ICIAM 91 Conference Manager, c/o SIAM, 3600 University City Science Center, Philadelphia, PA 19104-2688, USA. Phone: 215/382-9800; Fax: 215/386-7999; E-Mail: [iciam@wharton.upenn.edu](mailto:iciam@wharton.upenn.edu).

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## HONORS

**James Murray**, F.R.S., Director of the Centre for Mathematical Biology at the University of Oxford received the Naylor Prize for Applied Mathematics from the London Mathematical Society, the British equivalent of the American Mathematical Society. This is a major mathematics prize, and marks an encouraging recognition for mathematical biology in the world of mathematics. Professor Murray gave the Naylor Prize Lecture in November, 1989.

In an interesting contraposition, **Simon Levin**, the Charles A. Alexander Professor of Biological Sciences, Section of Ecology and Systematics; and Director, Center for Environmental Research, Cornell University, is President-elect of the Ecological Society of America. This perhaps marks an equally encouraging recognition for mathematical biology in the world of biology.

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## ANNOUNCEMENT

The Institute of Applied Mathematics at the **University of British Columbia** has announced programs for the M.Sc. and Ph.D. degrees in Mathematical Biology. Research areas include animal behavior, ecology, neurobiology, nonlinear dynamics and chaos, morphogenesis, pattern formation, immunology, and neural networks. Information may be obtained from: The Director, Institute of Applied Mathematics, The University of British Columbia, Vancouver, Canada, V6T 1Y4.

## INTERNATIONAL CONFERENCE OF DIFFERENTIAL EQUATIONS AND APPLICATIONS TO BIOLOGY AND POPULATION DYNAMICS

(Contributed by Stavros Busenberg)

The interaction between mathematics and biology is one of the basic themes of our society, and it was also the theme of a conference that was held during January 10-13, 1990 in Claremont, California. Over 150 researchers, representing 17 countries and five continents, gathered in Claremont to talk about their current work, to hold workshops, to discuss common interests, to renew old friendships, to start new collaborations, and also to celebrate the 65th birthday of Ken Cooke in whose honor the conference was dedicated. Ken's fruitful scientific career started some forty years ago and has been marked by a steady flow of original contributions which have influenced the development of both fields spanned by the conference. Two of the many tributes paid to his work during the conference, one by Jack Hale and the other by Simon Levin, stressed Ken's admirable ability to pick the right problems at the right time and make pioneering contributions in both delay differential equations and in mathematical biology.

There were 64 talks given, seven of which were delivered during hour long plenary sessions, and two evening workshops were run. It is not possible to sum a meeting of this scope in a few paragraphs, but it is perhaps worthwhile to mention briefly some of the scientific highlights, leaving the exciting details to the conference proceedings that will be published later this year. The conference started with a talk by Ken Cooke who gave an overview of recent work which he found to be "picturesque and inviting", and which included recent studies of epidemic models involving vertical transmission and those for AIDS, and work on the stability of delay differential equations with piecewise continuous arguments. The other main speakers were Karl Hadeler, Mimmo Iannelli, Simon Levin and Paul Waltman taking about new directions in mathematical biology; and Jack Hale, Jean Mawhin, and George Sell speaking about advances in differential equations and dynamical systems. The topics of the plenary talks on biomathematics were homogeneous delay equations and models for pair formation in demography and epidemics by Karl Hadeler; a survey of age structure in epidemics tracing the history of this topic and describing several major new results by Mimmo Iannelli; a stimulating discussion of the problem of what constitutes relevant detail in models of structured populations by Simon Levin; and an overview of examples and results on persistence and their significance in model ecosystems by Paul Waltman.

The conference was supported by a grant for the National Science Foundation which provided partial travel support for young research workers and graduate students. The vitality of the field was underscored by the number of young people who attended and by the wide international level of participation.

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## 1989 ANNUAL MEETING

The 1989 Annual Meeting of the Society was held in conjunction with the American Institute of Biological Sciences (AIBS) Meeting in Toronto during the week of August 6-10. Business and board meetings were held on Monday, August 7.

As reported by Marc Mangel, who organized the scientific part of the program, "...the SMB co-sponsored, with SIAM and the AMS, the 21st edition of 'Lectures of Mathematics in the Life Sciences.' The symposium was held in conjunction with the meeting of the American Institute of Biological Sciences. The topic was *Sex Allocation and Sex Change: Experiments and Models*. Speakers included Paulette Bierzychudek (The adaptive advantage of sexual reproduction in plants), Sabin Lessard (Population genetics of sex allocation), Donna Fernandes (Sex allocation in simultaneous hermaphrodites), Peter Petraitis (Dynamics of sex change in *Capitella*), Chris Petersen (Sex allocation in simultaneous hermaphrodites: testing local mate competition theory), and Curt Lively (Male allocation and the cost of sex in a parasitic trematode)". As indicated above, the symposium was organized by Marc Mangel, and the resulting volume will be edited by him. Publication is anticipated sometime in 1990.

The Board Meeting included a general review of the Society's status as well as specific reports of the officers and committee chairs. Simon Levin, in the President's report, noted that Pergamon Press provided \$5000 to help defray the cost of the Oxford meeting (see below) and that three students were awarded Landahl Fund support to attend this meeting. He reviewed a number of the meetings which the Society has been or will be co-sponsoring, in particular the European Meeting on Mathematical Biology to be organized by Vincenzo Capasso and scheduled for January, 1991, in Grenoble, France. The Program Committee for the 1990 SIAM National Meeting has requested that the SMB co-sponsor a symposium tentatively titled "Symposium on Mathematics of Biological Problems", to be held in Chicago in the period July 16-20, 1990. Jack Cowan's proposal for the 1990 AMS-SIAM-SMB Symposium on Some Mathematical Questions in Biology, on the topic "Neural Nets", is moving forward. The meeting is planned as a two-day satellite session of the 1990 IUPAB (International Union for Pure and Applied Biophysics) Congress, to be held July 29-August 3, 1990, in Vancouver, Canada.

The Secretary's report included a review of pertinent Society documents over the past three years. As it currently stands, the Society has 376 members. The possibility of a Bylaws review was raised, in particular, revisions that would open the Society more to influences from the membership. It was noted during this part of the discussion that the SMB has sought professional recognition by established professional societies. This policy, initiated by George Karreman and John Stephenson (two former Presidents) led initially to affiliations with FASEB and during the Presidency of Simon Levin to additional affiliations with AIBS, AMS, and SIAM. The question arose as to whether the undoubted success of this policy may have to some extent been at the expense of the identity of the Society meetings; some early stand-alone meetings attracted more participation from Society members. The possible

advantages of moving to a format that might allow for a more vigorous exchange of ideas among Society members was discussed. Other issues considered at this juncture were the balance between the national and international goals of the Society, and the balance between funding goals (which are primarily national) and the international goals.

The next item was the Treasurer's report, by Torcom Chorbajian. The Society's assets presently comprise \$75,205 (a \$9000 increase over last year). Approximately \$35,000 of this is dedicated to the Landahl Scholarship fund. The interest has been used to fund student travel awards. Book advertisements in the Newsletter have provided a small increment to these funds; the main source are Society dues.

Further items included the *Newsletter* report, the Committee Chair reports (membership, finance, publications, nominations), and the problem of membership in SMB for citizens of countries without hard currency. The possibility of nonvoting status (with Newsletter privileges) is being considered. Simon Levin then turned the meeting over to Stuart Kauffman, the new President.

M. Conrad, Secretary

## OXFORD MEETING

(communicated by Carlos Castillo-Chavez)

On July 4-7, 1989, the Fifth Conference on the "mathematical theory of the dynamics of biological systems" was organized by R. W. Hiorns for the Institute of Mathematics and its Applications, at Keble College, University of Oxford, England. A very popular workshop on mathematical biology was held on July 4th. J. Gani, S. A. Levin, R. M. May, and J. Murray led very stimulating sessions that focused on active areas of research including developmental biology, epidemiology, community and landscape ecology, and population biology. M. Mangel organized "classics day," sponsored by the Society of Mathematical Biology. Classics day vividly illustrated the past and current impact of the work of Turing in developmental biology (J. Murray), Hodgkin, Huxley, and McCulloch-Pitts in neurophysiology (J. M. Rinzal and J. D. Cowan), Fisher, Wright, and Haldane in population genetics (W. Provine), Kermack and McKendrick in epidemiology (R. M. Anderson), Hutchinson, Lindemann, and Skellam in ecology (R. M. May), and Gordon, Schaefer, and Hotelling in bioeconomics (W. J. Reed).

Research sessions were conducted on July 6 and 8 with papers covering a variety of topics in all the above areas. Sessions were held on the harvesting, control, and regulation of biological populations and systems, on developmental biology, physiology and medical systems, on the evolutionary dynamics of biological systems, and because of its timeliness, a special session on the epidemiology of AIDS. This session showed the extensive amount of research completed over a very short period of time in models for the transmission of HIV. The work on social mixing and pair formation received considerable attention.

One of the most remarkable features of this meeting was its truly interdisciplinary nature. Biologists and mathematicians shared the forum and continuously interacted. The quality of the research and the presentations were uniformly high and clearly showed the

growth and maturity that the field has reached over the last decade. The IMA and the Society of Mathematical Biology deserve to be congratulated for sponsoring meetings of this caliber.

A forthcoming issue of the *IMA Journal of Mathematics Applied to Medicine and Biology* will include some of the contributions, and the classic papers will be published in two issues of the *Bulletin of the Society for Mathematical Biology*. Contributions from several research groups in AIDS epidemiology have been collected in a recent comprehensive volume entitled *Mathematical and Statistical Approaches to AIDS Epidemiology* published by Springer-Verlag in its Lecture Notes in Biomathematics (Volume 83) edited by C. Castillo-Chavez.



From left, James Murray, Simon Levin, Jack Cowan and R. W. Hiorns at the Oxford Meeting

## MATHEMATICAL BIOLOGISTS MEET IN GDR

(Communicated by Michael Conrad)

An International Symposium, *Mathematical Models of Cellular Processes*, took place from November 19th to 23rd, 1989, in Holzgau, GDR, about ten days after the fall of the Wall. The symposium was organized by the Society of Physical and Mathematical Biology of the GDR and sponsored by the International Union of Biochemistry (IUB). Reinhart Heinrich chaired the organizing committee.

Holzgau is a small (as the name suggests) logging village about fifty minutes from Dresden and a few hundred yards from the Czechoslovakian border. The most notable feature, aside from the lovely mountainous countryside, is the recreational and educational hotel of the DDR Academy of Sciences. The village consists of few pleasantly scattered houses, centered around a kiosk commemorating the recent fortieth anniversary of East Germany. About a hundred delegates attended, representing the U.S., various Western and Eastern European countries, the USSR, and Japan. Despite the isolation, the atmosphere of the meeting was unavoidably electric with the recent political events. Just as notable is the fact that the discussion of scientific questions was not in any way diminished. Evidently the excitement of the times served to energize scientific thinking, a phenomenon confirmed during my post meeting week in East Berlin.

The thirty-seven talks and numerous posters, though covering a diversity of topics, imparted as a whole a single overriding impression: the degree of detail and empirical correlation of the models. The reason is undoubtedly connected to the fact that modeling the red (blood) cell was a major theme. The evening lecture of Virgilio Lew (Physiological Laboratory, Cambridge University) was one example along this line of empirical mathematical models, and one that was also striking for its tight integration of theory and experiment. The attractiveness of the red cell to the animal physiologist is perhaps somewhat like the pull of *E. coli* for the microbiologist—and for the modeler its relative simplicity opens up the possibility of truly quantitative models that put biochemical kinetics and concepts of cell morphology to the test. One could wonder, during some of the presentations, to what extent the correlation between theory and experiment represented general features as opposed to data fitting or possible lack of uniqueness of the models. But these are unavoidable difficulties, and could not, or at least should not, subtract from the recognition of definitive progress made. A number of interesting talks could even build on this empirical modeling base to inject a new level of testable analysis to ideas about the design and evolution of biochemical reaction systems.

One project which in the next years will certainly percolate to the attention of the biochemical modeling community was presented by Evgenij Selkov, of the Biophysics Institute in Pushchino (near Moscow). This is the data bank for enzymes and metabolic pathways. Selkov has created a group of about fifty individuals to extract biochemical data from the literature and enter it into a data bank that would be generally available, somewhat analogous to the nucleotide sequence data banks. One clear difference is that kinetic data is more implicit in the literature, and therefore more difficult to extract, than sequence data. Like sequence data it should ultimately provide a powerful base for new discoveries about the function and evolution of biological systems.

The conference organizers had for obvious reasons been pretty busy for the three weeks preceding the meeting, caught up in massive political events. Probably no one was more amazed than they that it proceeded with far fewer deviations from the program than might be expected at such a meeting in ordinary times.

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## MEMBERSHIP MATTERS

By a majority vote of the Board of Directors, the SMB membership requirements have been simplified so that it will no longer be necessary to submit the titles of two publications to become a full member. This brings the criteria for membership in the SMB more in line with other similar scientific societies. The category of Associate Member will no longer be relevant and those members who are currently listed as Associate will be listed as Full Members and as such will have full voting privilege. Henceforth, the only relevant categories of membership will be Full and Student. This change is reflected in the new membership application form, one of which is enclosed with the *Newsletter*. You are welcome, indeed encouraged, to make additional copies of this application form and distribute them to your colleagues.

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## MATHEMATICAL IMMUNOLOGISTS MEET IN KIEV

(communicated by Richard Weinand)

An international workshop, "Mathematical Modelling in Immunology and Medicine," was held in Kiev, Ukr. S.S.R. from August 28 through September 7, 1989. The workshop was attended by approximately 50 invited participants, representing a variety of disciplines that included Mathematics, Biology, Immunology, Chemistry, Computer Science and others. The scope of the Workshop covered a rather complete spectrum of important topics in immunology, and focused on the use of mathematics and computers in dealing with both the practical and theoretical aspects of understanding, diagnosing and treating immunological disorders.

The workshop was overly long in one respect, spanning an 11-day period, which prevented a number of invitees from attending. The extra time was put to good use, however, in that it provided many opportunities for the participants to really get to know each other and become involved in many lively discussions outside of the formal workshop setting. This was particularly valuable, since the simultaneous two-language presentation format (Russian and English) made it very difficult to follow the talks given during the primary sessions. The extra time also provided ample opportunities for the workshop participants to take part in a number of cultural/social events that were made available.

The workshop was clearly a successful one, and the members of the Organizing and Programming Committees are to be congratulated on a job well done. A preliminary plan to hold another international workshop in approximately two years was agreed on.

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## THEORETICAL BIOLOGISTS MEET ON MARS

(Communicated by Michael Conrad)

The meeting may have taken place on Mars, but in reality it is just as likely that it took place somewhere else in the universe at some other point in time. It was sponsored by the Council of All Beings (CAB), which provided the teleportation tickets that served to bring theoretical biologists from all regions of the cosmos to a particular communication locus. The most popular hypothesis is that the teleportation mechanism is connected to what here on Earth is known as Bell's theorem. Local hidden variable theories are impossible. So it is impossible to recapture a classical picture of the world without admitting immediate connections between distant events. If one does not feel the need to recapture such a classical picture one is still obliged to accept distant connections (as in the EPR paradox), but such obligation seems on our planet to be more easily accepted as an insight than as a burden for those with this attitude. Of course, no actual messages could be transmitted among distant observer/participants in the meeting. No matter. It is a sort of tickle that one has to accept. (The alternative, for obvious reasons less popular hypothesis, is that the transmission

of information is blurred by teleportation lag. In plain language, your correspondent fell asleep at the crucial moment.)

The power of both of the above hypotheses is that they completely explain one of the main phenomena of science: the existence of partially worked out, unclear, or fragmentary explanations and observations. But I can assure the reader that the multitudinous disquisitions lose not an iota of fascination (quite the contrary) as a consequence of the definitive conclusions, if any, having been lost.

There is not enough silicon on earth to store the titles of even a fraction of the presentations made. One can only hope to vaguely capture a few common threads or overriding themes. One which attracted considerable attention was initiated by a speaker (or quasi intersubjective communicator, as they are called) who reported a theorem which transmitted through the teleportation mechanism and translated as nearly as possible to earth notation comes through as something that might read: *parent, child, mod  $x^2 + 1$ , broken homomorphism*. As received this is mere symbology and embarrassing to report if it did not confirm in such a convincing way one, the other, or both of the hypotheses proposed above.

Such messages seem inordinately clear at initial reception; the problem is that the process of reading them introduces a multiplier effect. An initially distinct message is split into two, and the two into four, and so on, all assuming equal weight in the mind of the beholder. It becomes necessary, despite all the traumas of teleportation, to perform an experiment, do a calculation, or consult some volume of forgotten lore. Having just moved my own abode here on Earth, one such volume appeared in a pile beside my desk, fortuitously rescued by the move from the lower recesses of some inaccessible bookcase: The Development of Mathematics, by E. T. Bell (McGraw-Hill, 1945). The entry, "modulus" in the index leads us to a possible clue: "For the particular modulus  $x^2 + 1$ ...Cauchy found that his 'residues' R had all the formal properties of complex numbers, his 'x' taking the place of 'i.' He was thus enabled to construct a wholly 'real' algebra abstractly identical with (having the same structure as) that of complex numbers."

Sherlock Holmes would undoubtedly be able to deduce from this clue that the quasi communicator who transmitted the above fragments had worked out some formal definition of heredity as a structure preserving map. Probably he thought that the abstract identity between something so apparently different as the complex number system and an algebra of reals (even just integers) could be an introductory illustration of his claim that all the multitudinous beings in the universe were alternative realizations of a similar developmental map. But, at the same time he must have wished to emphasize the different realizations and the maps that give rise to them were not isomorphic or even homomorphic in the strict sense. The manifest differences in realization must themselves be a result of the action of the map. And even more important, the map itself should be a product of evolution. "Parent" and "child" clearly reflect this essential historical character of heredity, and of the hereditary mechanism itself. Probably our communicator thought that the degree of similarity between the developmental



map of parent and child would be very great, but that this similarity might not necessarily be transitive. A concept of broken homomorphism would be necessary to encompass a large class of existing organisms with a common ancestor; by adding or subtracting an acceptably small number of elements to the structure the strict homomorphic relationship could be recaptured.

Actually some other information followed the message that could not be expressed with a word processor. All messages are accompanied by cosmic background static. But it is not always pure noise; it often conveys a distinct impression, somewhat like a Jackson Pollack painting might abstract, say, an autumn scene. The background static following our message definitely indicated strong CCC (cosmic cacophonous controversy).

"Maybe the organisms on your planet are all generated by the same basic map. But on my planet the invariant part is pretty deeply embedded, and not even entirely invariant." "No, it's just that your coding is wrong." "Oh, you can always concoct some code that will show that everything is the same as everything else. But how useful is it?" "It is important to make precise definitions, otherwise how can we make sense out of observations?" "Which is more important for determining the course of evolution, the invariant part or the variable part?" "Can't you see from the vast parallelisms of living beings present at this meeting and the parallelisms of all the civilizations represented that there must be some common, determinative underlying structure?" "Can't you see all the differences?" "We have the facts, made the discoveries; you're just not using the right method." "We can agree on a lot of the facts; but every different civilization, with its own unique heredity, has its own context for cognizing them. That's clear from this discussion." "You think your conclusions about method are obvious. But your historians of science didn't do their homework." "What about the basic laws of physics? There's no heredity there. All you are talking about is embedded mappings." "That's the physicists on your planet; on our planet nonhereditary systems are treated as a special case." "The universe has children" (general laughter). "Say, who's legitimate around here anyway?"

It's all very humbling. To attend a meeting with some of the greatest minds in the cosmos, and to be sucked into such a sleep state throughout by the terrible force of jet lag. But inspiring too, with enough upflickerings of the eyelids to know that there's work to be done, fun to be had. I strongly recommend the reader to attend the next meeting. For information just dial toll free 1/3 on your phone (without approximation).

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## SIAM Student Paper Competition

If you know of a student who should be included in the competition, here are the details:

- The student authors of the three best papers in applied and computational mathematics submitted to SIAM will be invited to attend SIAM's Annual Meeting in Chicago, July 15-20, 1990.
- Each winner must present his or her paper at the meeting.
- Each winner will receive up to \$750 to offset expenses.
- The winners will be awarded a calligraphed certificate at a prize ceremony at the meeting.

- Papers must be singly authored to be eligible for consideration.
  - To qualify, an author must be a student in good standing who has not received his or her Ph.D. at the time of submission.
- Authors are asked to consider SIAM journals when submitting their work for publication. **Submissions must be received by SIAM on or before April 2, 1990.**

Submissions which can be mailed or faxed must include:

- an extended abstract (3-4 pages), double-spaced, in English
- the signature of the author
- a statement by the student's faculty advisor that the paper has been prepared by the author indicated and that the author is a student in good standing
- a short biography of the student
- a letter of recommendation from the student's advisor or department chair

Submissions will be judged on the basis of originality, applicability, and clarity of exposition.

Winners will be notified by May 30, 1990.

**If you have any questions, please contact:** Allison Bogardo, SIAM, 3600 University City Science Center, Philadelphia, PA 19104-2688. Telephone: 215/382-9800. E-mail: [siam@wharton.upenn.edu](mailto:siam@wharton.upenn.edu). Fax: 215/386-7999.

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## LITERARY EVENTS

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Artificial Worlds Modeling of Biological Systems. This special issue of *BioSystems* (Vol. 23, No. 2,3, 1989), edited by Michael Conrad and Mateen M. Rizki comprises a series of computational models of complex biological systems. The models either involve the construction of explicit artificial worlds or illustrate the range of abstractions pertinent to computational modeling in biology. Topics include evolution, ecosystems, immune system, brain models, evolution of cultural systems, biochemical systems, and methodology of modeling.

Newton to Aristotle: Toward a Theory of Models for Living Systems, ed. by John Casti and Anders Karlqvist, *Mathematical Modeling*, No. 4, Birkhäuser, Boston, 1989, 284 pp. Eight authors challenge received approaches to science from biomathematical, systems theory, physical, economic, and linguistic points of view. About half the chapters present illustrative model constructions.

Chaos, Ordnung und Information, Werner Ebeling, Urania-Verlag, Leipzig, 1989, 118 pp. (in German). A distinguished statistical physicist looks at phenomena ranging from the cosmos to the computer (and of course organisms on the way) in an elegantly written popular book.

Evolution of Complex Systems, Rainer Feistel and Werner Ebeling, VEB Deutscher Verlag der Wissenschaften, Berlin, 1989, 248 pp. This is a condensed and slightly modified version of Physik der Selbst-organization, a major work by Ebeling and Feistel. The new book is in English (unfortunately the older book has not been translated).

Strange Attractors in BioSystems, V.P. Gachok, Kiev Science Publishers, 1989, 237 pp. (in Russian). Gachok is a researcher at the Institute for Theoretical Physics in Kiev. This monograph reviews his very thorough work of the past decade on biochemical reaction systems. Topics include: theory of dissipative systems, dynamics of glycolysis, kinetics of cellular growth and morphogenesis, kinetic models of steroid transformations, mathematical model of polyenzyme systems, connection between steroid dynamics and bioreactors.

Object-oriented Simulation with Hierarchical, Modular Models: Intelligent Agents and Endomorphic Systems, Bernard P. Zeigler, Academic Press, San Diego, 1990, 416 pp. An endomorphism is basically a self-embedded model, including a self-model. The applications are mainly to robotics. But the multifaceted approach to modeling and the ideas clearly illustrate the pertinence of computer science methods to biological systems. This is the third in a series of important books by Zeigler in the field of modeling and simulation.

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## IN MEMORIAM

### **R. Balasubramanian** (communicated by M. Conrad)

Z. A. Rafi has informed the *Newsletter* that Professor R. Balasubramanian passed away this past summer. I had the pleasure of several times meeting Balasubramanian during a sabbatical at the Molecular Biophysics Unit of the Indian Institute of Science at Bangalore in 1984, and later at the University of Madras, where Balasubramanian was a professor in the Department of Crystallography and Biophysics. In the last years he was also a Nehru scholar. The striking feature of Balasubramanian was his extremely logical approach to scientific problems. He was an x-ray crystallographer and theoretical quantum biochemist by background, coming out of the school of Ramachandran. The origin of life was his major theme at the time of our first meeting. He had a structural, two pocket theory that was developed on the basis of quantum chemical calculations, but that suggested in a highly impressive manner an adaptor that, like t-RNA, could bind to both a codon and to an amino acid. Subsequently he turned to neural models, again with a high degree of precise logic. Unfortunately the computer facilities available to him were insufficient to do the type of simulations he desired. His most recent work, with Rafi, was titled, "A New Technique in Computer Modeling of Space-filling Molecular Graphics with Transparency Effect, Due to Partially Stripped Surfaces," which appeared in *BioSystems* (Vol. 23, No. 1). It dealt with the problem of molecular modeling with limited computational resources, a problem not faced at the moment by scientists in countries such as the U.S., but manifestly faced by Balasubramanian. It had Balasubramanian's characteristic Occam's razor style.

### **Aristid Lindenmayer** (communicated by Pauline Hogeweg)

Prof. Dr. Aristid Lindenmayer died on October 30th, 1989; we lose in him a truly unique (mathematical) biologist. He was born in Hungary and studied biology and chemistry at the University of Budapest. In 1948 he emigrated to the USA and obtained his Ph.D. in plant physiology at the University of Michigan, Ann Arbor, in 1956. His way to mathematical biology was through logic and the philosophy of science. A post-doc with the logician J.H. Woodger influenced his further career profoundly. While Woodger sought the

axiomatisation of biological theories, Lindenmayer tried, as he put it, to axiomatise plant development. His seminal papers, in which he introduced 'developmental systems,' later called 'Lindenmayer systems' or 'L-systems,' appeared in 1968 in the *Journal of Theoretical Biology*. In the same year he came to Utrecht, the Netherlands, as Professor of the Philosophy of Biology, which was a dual appointment to the faculties of Biology and Philosophy.

During the 21 years that he worked in Utrecht, he devoted most of his time to the study of L-systems. Originally he introduced L-systems for the description of the development of filamentous algae, i.e. one-dimensional structures in which intercalary growth occurs. The L-system formalism has the form of a parallel string rewriting system, and as such can be fruitfully compared to sequential generative grammars. The mathematical theory of L-systems has been studied extensively; Lindenmayer 'monitored' these studies as a *pater familias*, and tried to stimulate the interest in biologically interesting properties of L-systems, like growth functions. Moreover, he applied L-systems to the description of actual biological development: a recurring object of study was the structure of inflorescences, including the branching pattern and the flowering order. He was primarily concerned with devising consistent formal systems for the description of development and he spent much time and effort on generalizing one-dimensional L-systems to 2 and 3 dimensions. Several proposals have appeared in the literature. In addition to mathematicians, another group of non-biologists have become interested in L-systems: the computer graphics people. The 'database amplification' properties of L-systems (and generalizations thereof) are an attractive feature in such a context.

If one sees the strings of symbols generated by L-systems, it may be hard to believe that these have anything to do with 'plants;' if one sees some of the pictures generated from these strings, it may be hard to believe that they have nothing to do with 'plants.' Whatever one's view, Lindenmayer has added interesting systems to our universe and he devoted his life, up to the very end, to the development of these systems. He was a real scientist.

### **Thomas Bronikowski** (communicated by John Linehan)

Dr. Thomas Bronikowski, Professor of Mathematics at Marquette University, Milwaukee, Wisconsin died June 30, 1989 at the age of 56. Dr. Bronikowski's research interest was in mathematical models of non-respiratory functions of the lung.