

Courant, NYU (Dec 2003)
Mount Sinai (Dec 2003)
University of Chicago (Feb 2004)
Berkeley MSRI: Mathematical Neuroscience
(Mar 2004)
Conference "From Neurophysiology to
Phenomenology: Mathematical Models of
Visual Perception", Academia delle Scienze of
Bologna, Italy (July 2004)

Paul's recent publications:

- J. S. Lund, A. Angelucci and P. C. Bressloff. □
□ Anatomical substrates for functional □ □
□ columns in macaque monkey primary visual □
□ cortex. *Cerebral Cortex* 12:15-24 (2003).
- P. C. Bressloff and J. D. Cowan. Spherical □
□ model of orientation and spatial frequency □
□ tuning in a cortical hypercolumn. *Phil.Trans.* □
□ *Roy. Soc. Lond. B* 358: 1643-1667 (2003).
- P. C. Bressloff and S. Coombes. Saltatory □
□ waves in the spike-diffuse-spike model of □
□ active dendritic spines. *Phys. Rev. Lett.* 91: □
□ 028102 (2003).
- P. C. Bressloff, S. Folias, A Prat and Y-X Li. □
□ Oscillatory waves in inhomogeneous neural □
□ media *Phys. Rev. Lett.* 91:178101 (2003).
- P. C. Bressloff. Spatially periodic modulation □
□ of cortical patterns by long-range horizontal □
□ connections. *Physica D* 185:131-157 □ □
□ (2003).
- P. C. Bressloff and J. D. Cowan. Functional □
□ geometry of local and horizontal □ □ □
□ connections in a model of V1. *J. Physiol.* □
□ (Paris) 97: 221-236 (2003).
- P. C. Bressloff. Pattern formation in visual □ □
□ cortex. In: *Methods and Models in* □ □
□ *Neurophysics. Les Houches Lectures* □ □
□ (2004).
- P. C. Bressloff. Euclidean shift-twist □ □
□ symmetry in population models of self--□ □
□ aligning objects. *SIAM J. Appl. Math.* □ □
□ 64:1668-1690 (2004).
- P. C. Bressloff and S. E. Folias. *Front* □ □
□ bifurcations in an excitatory neural network □
□ *SIAM J. Appl. Math* 65:31-151 (2004).
- S. Folias and P. C. Bressloff. Breathing pulses □
□ in an excitatory neural network *SIAM J.* □
□ *Dyn. Syst.* 3: 378-407 (2004).

Aaron Fogelson:

Aaron gave talks at University of Michigan, as the Distinguished Lecturer in Mathematical Biology, the University of Arizona, IGERT Summit, and the XVIIIth International Fibrinogen Workshop at University of North Carolina, Chapel Hill. He attended the Gordon Conference on Theoretical and Mathematical Biology, where he organized a session on Biological Fluids and Gels.

Aaron has two papers about to be published:

- Robert Guy and Aaron Fogelson, 'Stability of □
□ Approximate Projection Methods on Cell-□
□ Centered Grids', *Journal of Computational* □
□ *Physics*, to appear.
- Aaron Fogelson and Robert Guy, 'Platelet-□
□ Wall Interactions in Continuum Models of □
□ Platelet Aggregation: Formulation and □ □
□ Numerical Solution', *Mathematical Medicine* □
□ and *Biology*, to appear.

Jim Keener:

Jim's PhD student, Brynja Kohler, completed her thesis "T lymphocyte population dynamics in health and autoimmunity." He gave lectures at Texas Tech University, Harvey Mudd College, Hope College, Calvin College, Vanderbilt, Mississippi State, Bullitt Lecture - University of Louisville, Indiana University, Notre Dame, University of Illinois, Auburn University, University of British Columbia, Southern Methodist University, the Gordon Research Conference, and a short course at the Santa Fe Institute. Jim was honored with promotion to Distinguished Professor of Mathematics.

Jim's publications:

- M. Dumett and J. P. Keener, A Numerical □ □
□ Method for Solving Anisotropic Elliptic □ □
□ Boundary Value Problems in 3D, *SIAM J.* □
□ *Sci. Comp.* 25, 348-367, (2003).
- J. P. Keener, The topology of defibrillation, *J.* □
□ *Theor. Biol.* 230, 459-473 (2004).
- N. Cogan and J. P. Keener, The role of the □
□ biofilm matrix in structural development, □
□ *Mathematical Medicine and Biology*, 21, □
□ 147-166 (2004).

IGERT Newsletter

Integrative Graduate Education and Research Training



IGERT graduate students: back row, left to right: John Zobitz, Courtney Davis, Aaron McDonald; middle row, left to right: Ben Sukow, Katherine Fitzgerald, Amber Smith, Karin Leiderman, Molly Kelton; front row, left to right: Nesy Tania, Giau Huynh, Lindsay Crawl. Not pictured: William Nesse.

Welcome to this our second IGERT/Math Biology Newsletter. The purpose of this newsletter is to summarize the training and research activities of the past year. In addition to our active regular schedule (2 journal clubs, a weekly seminar and five lab group meetings), this year we held a one day Math Biology Summit at Fort Douglas and we traveled as a group to Tucson for the first ever Utah-Arizona IGERT Summit.

Other exciting developments include the award of a NSF-RTG training grant. This grant will provide support for undergraduates, advanced graduate students, and postdocs engaged in cross-disciplinary research in mathematical biology. The combination of IGERT and RTG support makes the Math Biology program at the University of Utah one of the most comprehensive training and research programs in the country.

The new first year IGERT graduate students are Lindsay Crawl (Harvey Mudd), Giau Huynh (University of New Hampshire), Molly Kelton (Vassar College), and Karin Leiderman (University of New Mexico). The five IGERT-supported students beginning their second year are Courtney Davis (Trinity University), Katherine Fitzgerald (Carleton College), Amber Smith (Colorado School of Mines), Ben Sukow (University of Colorado) and Nesy Tania (UC Davis and Cornell).

Our new IGERT postdoc is Laura Miller (NYU) who studies the flight of small insects. Laura will work with Tom Robbins to mentor the first and second year journal clubs.

Departing Graduates

Bob Guy:

Bob's thesis was entitled "A Continuum Model of Platelet Aggregation: Closure, Computational Methods, and Simulation.

Bob attended the Gordon Research Conference in Tilton, NH; June 2004, and SIAM Life Science Conference; Portland, OR; July 2004. He gave talks at the GSAC colloquium and Gordon Research Conference.

Bob is currently a postdoc here working with Aaron Fogelson and Jim Keener on the FRG project, "Dynamics of Growing Biogels."

Bob's forthcoming publications:

- R.D. Guy, "Asymptotic analysis of PTT type closures for transient network models", *J. Non-Newton. Fluid Mech.*, To Appear.
- A.L. Fogelson and R.D. Guy, "Platelet-wall interactions in continuum models of platelet thrombosis: Formulation and numerical solution", *Mathematical Medicine and Biology*, To Appear.

R.D. Guy and A.L. Fogelson, "Stability of \square \square
 \square approximate projection methods on cell- \square
 \square centered grids", J. Comp. Phys., To Appear. \square \square
 \square pulses in an excitatory neural network \square \square
 \square SIAM J. Dyn. Syst. 3: 378-407 (2004). \square \square

Brynja Kohler:

Brynja's thesis was entitled "T Lymphocyte Population Dynamics in Health and Autoimmunity." She presented a poster, "Activation and Differentiation of T cell by T cell receptor engagement," at the Society of Mathematical Biology Annual Meeting in Ann Arbor, MI. She is currently an assistant professor in the department of Mathematics at Utah State University. Brynja was honored with a Project NExT fellowship from the MAA and AMS for the 2004-2005 academic year.

Graduate Student Activities

Courtney Davis:

Courtney worked this past summer in Dr. Dearing's lab studying the effect of disturbance on hantavirus prevalence in deer mice. She attended the INFORMS Annual Meeting, in Atlanta, October 2003. At the meeting she presented "Haplotype Inferencing and Minimum Diversity Graphs" which was based on undergraduate research and a paper currently in review.

Katherine Fitzgerald:

Katherine did an internship/lab rotation this summer with Don Feener's lab in Biology. She spent June in Austin and Smithville, Texas, doing field work to investigate the foraging behavior and community dynamics of local ants, including the invader *Solenopsis invicta*, better known as the fire ant.

Stefanos Foliass:

Stefanos presented a poster at the Society for Neuroscience Conference. He coauthored two papers this year:

P. C. Bressloff and S. E. Foliass. Front \square \square
 \square bifurcations in an excitatory neural \square \square
 \square network SIAM J. Appl. Math 65:31-151 \square \square
 \square (2004).
S. Foliass and P. C. Bressloff. Breathing \square \square

Bill Koppelman:

Bill and Fred Adler are finishing up a chapter titled "Do rhinoviruses follow the neutral theory? The role of cross-immunity in maintaining the diversity of the common cold" to be published in the book "Disease evolution: Models, concepts, and data analyses."

Frank Lynch:

Frank attended the SIAM Meeting of Life Sciences Group, and SIAM General Meeting. He gave a talk and presented a poster at the Utah-Arizona Biomathematics Summit.

Aaron McDonald:

Aaron worked on a project involving the evolution of virulences for spatially non-homogeneous populations. He presented this work to other math biology students and gave talks at Fred Adler's lab meeting and GSAC.

William Nesse:

Will attended the 2003 neuroscience conference and a conference in dynamical neuroscience. He gave a talk on phase equations applied to neural oscillators in the neuroscience group meeting.

Andrew Oster:

Andrew presented a poster, "A Theory for the Alignment of Ocular Dominance Columns with CO Blobs During Development," at the Society for Neuroscience conference in New Orleans. Also, he participated in a special topics course at the Marine Biological Laboratory in Woods Hole, MA on "Methods in Computational Neuroscience." There, he gave a talk on rhythmic bursting patterns of averaged activity during development.

Amber Smith:

Amber worked this past summer with Dr. Andrew Pavia (Chief, Division of Pediatrics and Infectious Diseases), Dr. Carrie Byington (Associate Professor of Pediatrics and Infectious Diseases), and Dr. Matthew Samore (Chief, Division of Clinical

Epidemiology) on projects involving the *Streptococcus pneumoniae*. With Dr. Pavia and Dr. Byington, she investigated mathematical models involving vaccinations and serotype replacement. Then, Dr. Samore and Amber looked at models of carriage and the involvement of antibiotic resistance of *Streptococcus pneumoniae*. She attended the Utah-Arizona IGERT Summit in Tucson, AZ.

Nessy Tania:

Nessy did a lab rotation at the Sanguinetti Lab, CVRTI, University of Utah. She studied electrophysiology of HERG potassium channels. She attended the Red Raider Mini-Symposium on Mathematical and Computational Modeling of Biological Systems at Texas Tech University in Lubbock, TX.

John Zobitz:

In December 2003, John presented a poster entitled "Process Based Belowground Carbon Dioxide Modeling in a Desert Ecosystem" at the Annual National Meeting of the American Geophysical Union in San Francisco. This poster was based on his summer 2003 lab rotation with Dr. David Bowling, University of Utah Department of Biology. His task was to develop a model explaining vertical movement of CO₂ in the soil at a desert grassland site outside of Canyonlands National Park.

For 6 weeks during the summer, John visited the Institut National de la Recherche Agronomique (INRA) in Bordeaux, France working with Dr. Jerome Ogee. This visit was funded through IGERT. Dr. Ogee works on ecosystem carbon cycling of CO₂, among other things. This was a great opportunity to begin collaboration with his lab and the Bowling lab at the University of Utah as there are convergent research interests.

Postdoctoral Activities

Thomas Robbins:

Tom has given talks at USAC, GSAC and the Utah-Arizona IGERT Summit in Tucson, AZ.

Faculty Activities

Fred Adler:

Fred attended the Ecological Society of America conference in Portland Oregon in August, and presented a talk with Donald Feener and Edward G. LeBrun: "Maintenance of diversity in ant communities: Modeling the dominance-discovery tradeoff."

The second edition of Fred's textbook, "Modeling the Dynamics of Life - Calculus and Probability for Life Scientists," was published.

Fred's publications:

E.E. McClelland, Adler F.R., Granger D.L., \square
 \square and Potts W.K. Major histocompatibility \square \square
 \square complex controls the trajectory but not host- \square
 \square specific adaptation during virulence \square \square
 \square evolution of the pathogenic fungus \square \square
 \square cryptococcus neoformans. Proc. Roy. Soc. \square
 \square of London B, 271:1557--1564, 2004.
K.Chase, D.F. Lawler, F.R. Adler, E.A. \square \square
 \square Ostrander, and K.G. Lark. Bilaterally \square \square
 \square asymmetric effect of quantitative trait loci \square
 \square (QTLs):QTLs that affect laxity in the right \square
 \square versus left coxofemoral (hip) joints of the \square
 \square dog (*Canis familiaris*). American Journal of \square
 \square Medical Genetics, 124A:239--247, 2004.
A.D. Kay and F.R. Adler. Optimal tempo and \square
 \square defense for consumers of multiple \square \square
 \square resources. Evolutionary Ecology Research, \square
 \square 5:701--716, 2003.
F.R. Adler and D.M. Gordon. Optimization, \square
 \square conflict, and non-overlapping foraging \square \square
 \square ranges in ants. American Naturalist, 162: \square
 \square 529-543, 2003.
S.L. Elliot, F.R. Adler, and M.W. Sabelis. How \square
 \square virulent should a parasite be to its vector? \square
 \square Ecology, 84:2568-2574, 2003.

Paul Bressloff:

Paul gave talks at:

Les Houches Summer School in Neurophysics (Aug 2003)
Workshop on Neural Pattern Formation, Institute for Physics, UCSB (Oct 2003)