THE BIOLOGICAL PHYSICIST

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In this Issue

This issue of THE BIOLOGICAL PHYSICIST takes you on a visit to the campus of Cal Poly Pomona, to meet a dynamic group of scientists at the forefront of research and teaching in biological physics. We also bring you all the usual suspects – PRE and PRL Highlights, job ads, election results, and an announcement about a new "Viewpoint" feature in the *Physical Review* Journals. Plus, your editor contemplates the passage of time on page 20.

– SB

FEATURE

Biological Physics at Cal Poly Pomona

Many DBP members probably envision the most advanced biological physics as being done at the "biggest" universities. But much important and groundbreaking research – and teaching – in our field is carried out at smaller schools. In this issue, we visit with Alex Small and his colleagues at California State Polytechnic University at Pomona (Cal Poly Pomona).

THE BIOLOGICAL PHYSICIST: **Describe the Physics Department at Cal Poly Pomona. What different branches of physics are emphasized?**

Alex Small: We are an undergraduate department, graduating about 10 majors per year and also teaching introductory courses for engineering and life sciences majors. We have about 16 tenure-track faculty. Most of our junior and mid-career faculty are working in optics, solid-state physics, and biophysics. Many of the optics and solid state people have biophysics-related projects. Astronomy and astrophysics are also important, and are popular with majors and non-majors alike. Many of our senior faculty have been heavily involved with AAPT (American Association of Physics Teachers), including recent AAPT President Harvey Leff and AAPT executive board member Mary Mogge. Pedagogical innovation and teacher prep are thus important areas for us. One of our recent hires was in Physics Education Research.

Describe the interdisciplinary research going on in the Physics Department. What is the history of interdisciplinary science & biological physics in the department?

Alex Small: Biophysics isn't new for us. Our department chair did his Ph.D. and postdoc work on the photophysics of photosynthesis, and he did multiple sabbaticals in that field. He still supervises senior projects, and for many years he taught our biophysics course. Somewhere along the line, Peter Siegel, who trained in nuclear theory, became interested in stochastic phenomena in heart rate variability, and started working on it during a sabbatical. He continued that work at Cal Poly, and even did measurements on our Arabian horses. (Aside: Mr. Kellogg—of cereal fame – donated his ranch to Cal Poly, on the condition that we raise a herd of Arabian horses. The horses remain a prominent fixture of our agriculture school as well as campus tours.) Related to Arabian horses and biophysics, Don Hoyt in the Biology Department (now our Associate Vice President for Research) works on horse biomechanics and has been the subject of documentaries and a Nature cover. He has given guest lectures in our biophysics course.

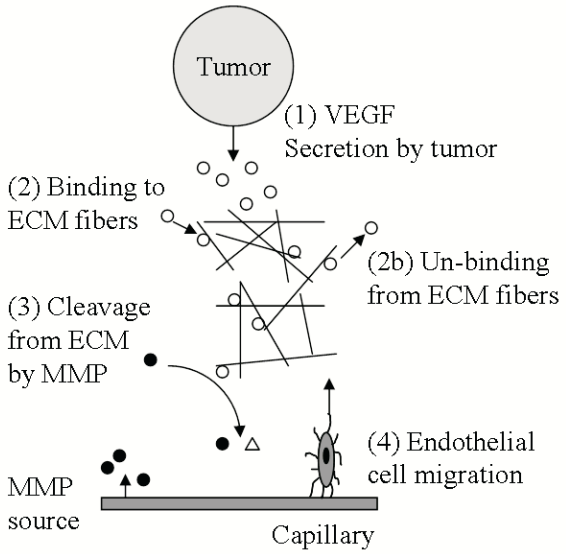
Pomona's campus isn't only known for its biological physics. Arabian horses are raised on campus at the Kellogg Arabian Horse Center.

Biophysics got a new boost several years ago, when Nina Abramzon was hired. She studies plasma as a tool for destroying bacterial films, and she started collaborating with Graciela Brelles-Mariño in biology, as well as Kurt Vandervoort. Kurt is a solid state physicist who does AFM work, and he uses AFM to

characterize bacterial membranes before and after plasma treatment. Nina also completely redesigned our biophysics course and made it into a research seminar. A few years after Nina arrived, Ertan Salik, a fiber optics specialist, was hired, and he has started working on biosensors, in collaboration with Wei-Jen Lin in biology. Around the same time, our Center for Macromolecular Modeling and Materials Design (CM3D) received a large Keck grant to expand their facilities, which helped to recruit Shantanu Sharma as Assistant Professor of Physical Chemistry and Director of Computational Science at CM3D. Then I was hired in 2007 along with Barbara Hoeling, an experimentalist who has done a lot of work on Optical Coherence Microscopy.

Could you and you colleagues tell us about your current research?

Alex Small: I work in two fields: Mathematical models of angiogenesis (blood vessel growth) around tumors, and subwavelength optics. In angiogenesis, I'm interested in reaction-diffusion models of growth factor transport, and pattern formation by blood vessel sprouts that grow in response to growth factor gradients. A tumor gets existing capillaries to grow new sprouts, which deliver food and oxygen and also provide a pathway for tumor cells to spread to the rest of the body. This process is controlled by a growth factor called



Schematic of angiogenesis process from Small et. al., J. Theoretical Biology, 2008.

VEGF (vascular endothelial growth factor) which comes in several different isoforms. Each isoform interacts with the extracellular matrix in a different way, and can give rise to a different vascular morphology. This growth factor is a major target of cancer therapies, so I'm trying to understand how it interacts with the extracellular matrix before reaching the blood vessel and how the blood vessel responds to gradients of the growth factor.

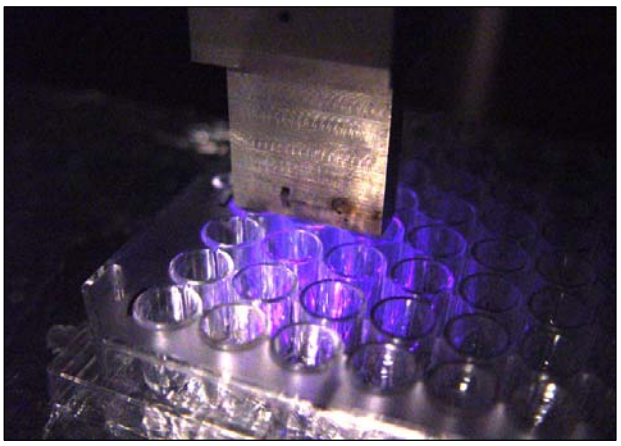
In subwavelength optics, I'm interested in beating the diffraction limit in fluorescence microscopy through the use of molecules that switch on and off. This approach to imaging has been implemented in experimental techniques like STOchastic Reconstruction Microscopy (STORM) and PhotoActivation Localization Microscopy (PALM). As a theorist, what interests me is the issue of fundamental limits to speed and resolution. Since these techniques involve significant amounts of computational work for image reconstruction, it turns out that the achievable speed and resolution depend not just on your hardware, but also on the techniques you're using to analyze the images and piece them together. I've derived limits in the case of "perfect" algorithms that never make errors, and I've analyzed the role of errors in certain cases. I continue to work on extending the theory to more cases, and some of my students are trying to translate these insights into useful algorithms. I've also done some work on simulating photochemistry controlled with subwavelength resolution.

Graciela Brelles-Mariño: I am an Associate Professor of Microbiology at the Biology Department, although I am a Biochemist by training. One of my research lines at Cal Poly Pomona is about the use of gas discharge plasma to inactivate bacterial biofilms. Biofilms are microbial communities that grow attached to a surface and encased in a gummy-like matrix that protects the microorganism. As a consequence, biofilms are very difficult to get rid of and they pose many health and environmental problems. This project started as a collaborative effort between Drs. Nina Abramzon and Kurt Vandervoort, from the Physics Department at Cal Poly Pomona. To summarize, we treat bacterial biofilms with plasma and we study the physiological and structural changes that bacteria go through, by means of viability and metabolic tests and microscopy. I particularly like interdisciplinary approaches since I believe that most of the actual problems that we

← *Prof. Graciela Brelles-Mariño's work was featured on the cover of last month's issue of Microbiology.*

encounter cannot be solved just by looking at 'one side of the mirror' or by using the tools provided by one discipline. I find that it is particularly difficult for undergraduate students to grasp this concept since they believe that one thing is Physics, another thing is Chemistry, another thing is Biology and they have a hard time integrating concepts from different disciplines. Having been trained as a biochemist, and with a strong background on "hard' sciences, I am in a good position to cross boundaries and integrate approaches from several disciplines. My colleagues Drs. Abramzon and Vandervoort share the same vision so it was challenging and interesting to work on this project.

Nina Abramzon: We study the effect of atmospheric pressure plasmas on biofilm, and spores. Bacterial spores are the most resistant form of life and have been a major threat to public health and food safety. Spore-forming bacteria cause serious diseases including botulism, anthrax, and enterocolitis. Bacterial biofilms on surfaces cost the nation billions of dollars yearly in equipment damage, product contamination, energy losses and medical infections. Biofilms are responsible for diseases such as otitis media and play a role in cystic fibrosis and Legionnarie's disease among others. Biofilms commonly colonize many household surfaces, including toilets, sinks, countertops and cutting boards, they cause pipe plugging, corrosion and water contamination in industries. Conventional methods of killing bacteria (such as antibiotics, sterilization by heat, sterilization by chemical processes and UV radiation) are often limited and ineffective with bacterial biofilms and spores.



Plasma applicator delivering nitrogen plasma to a microplate containing a bacterial biofilm (Credit: Jonathan C. Joaquin, Master's Thesis, 2008, Biological Sciences Department).

The use of the plasmas offers a very effective alternative to conventional sterilization methods as plasmas contain a mixture of charged particles (ions, electron), chemically reactive species, and UV radiation. We use physiological and metabolic determinations together with atomic force microscopy and fluorescence microscopy to evaluate the effect of the plasma on the microorganisms. We use optical emission spectroscopy to study plasma composition and correlated it with the effectiveness of killing.

Ertan Salik: Our research focuses on developing optical biosensors that are simple and cost-effective, and at the same time deliver sensitivity, specificity, and speed. Simplicity and cost-effectiveness are crucial with any biomedical technology, if we want to put them in the hands of medical practitioners. One of the approaches we pursue is tapered fiber-optic sensors. Standard optical fiber is cheap, tapering with a flame is simple and inexpensive. The result is, however, an interferometric sensor that is very sensitive to any refractive index changes on the surface. Our goals are 1) to enhance sensitivity of the sensor with simple tweaks and tunes, 2) to obtain temperature-insensitive operation, and 3) to optimize the sensor for various target biological agents.

Peter Siegel: We have continued to do studies on heart rate variability by measuring the times between successive heartbeats, the RR interval. Our undergraduate students are able to analyze the RR interval data by writing computer programs. In addition to stochastic aspects of the time series, we have studied the beat-to-beat variability as a function of heart rate. In particular, by examining the respiratory sinus arrhythmia amplitude as a function of heart rate we can obtain a measure of the subject's parasympathetic influence. These projects give the students experience in both experiment and theory: They build the electronic circuitry to obtain and store the data, and apply the methods of time series analysis to analyze the data.

Barbara Hoeling: I have been part of the Optical Coherence Microscopy (OCM) research group at Harvey Mudd College for several years before joining Cal Poly in September 2007. Harvey Mudd is one of the Claremont Colleges just 15 minutes down the freeway from Cal Poly, so it's easy for me to keep up the collaboration. OCM is a new biomedical imaging technique capable of imaging deep into highly scattering biological tissue in vivo and non-destructively. It is currently used in clinical applications, e.g. in ophthalmology for non-invasive imaging of the retina, and its potential for delivering optical biopsies is being explored in many other fields of medicine. Our group has been imaging in vivo developing frog embryos during gastrulation, a process that is of great interest to developmental biologists. We are also collaborating with bioengineers at Harvey Mudd College by imaging the

artificial cornea tissues they are developing. Here at Cal Poly, I am expanding my research interests by setting up a quantum optics experiment designed to explore non-classical properties of light for potential applications, e.g. in quantum imaging. On the teaching side, I am planning to develop a course in biomedical imaging, which should be interesting to physics majors as well as to undergraduate and graduate biology students, and to pre-meds.

Shantanu Sharma: My research group is interested in understanding how antimicrobial peptides (AMPs) interact with micelles, ion channels, and viral proteins. Since viral proteins may be rendered ineffective upon AMP binding, obtaining residue-specific insight into this mode of interaction is a critical first step toward advancing the field of peptidomimetic therapy. In an effort to fill this knowledge gap, we integrate seemingly

Prof. Shanatu Sharma's work was featured on the cover of the Dec. 2007 issue of the FEBS Journal.

distinct computational and experimental biophysical techniques: deterministic molecular dynamics and stochastic Monte Carlo simulations coupled with surface plasmon resonance and isotope-enhanced FTIR measurements. Presently, our primary focus is on the binding of a class of theta defensin AMPs to viral heptad repeat regions of HIV-1 (supported by the Cottrell College Science Award from the Research Corporation for Science Advancement). Due to the highly interdisciplinary nature of our work, I have been successful in recruiting undergraduate researchers from the departments of biology, chemistry, computer science, mathematics, and physics. In addition, we maintain active collaborations with colleagues at Caltech and the UCLA School of Medicine. Data from a recent collaborative publication (with a Cal Poly Pomona undergraduate and colleagues from UCLA and UCF) was featured on the cover of the December 2007 issue of the FEBS Journal.

Alex, you have had an unusual research trajectory yourself, working at NIH for a while before coming to Cal Poly Pomona. Can you tell me something about the path your career has followed so far? Are there ways that your experience at NIH has helped you bring something unique to your interactions with undergraduate students (both in the classroom and in the lab)?

Alex Small: My path has definitely been unusual. In grad school at UCSB I did a mix of theory and experiment on light scattering in photonic crystals and disordered materials, especially "soft" materials like polymers and colloidal crystals. As a postdoc, I joined a biomedical optics group at NIH because I wanted to study optics in a more useful context. I wound up doing mostly theoretical projects related to superresolution microscopy and also tumor-induced angiogenesis. I came to Cal Poly because I like teaching, and because there is a growing cohort of biophysicists.

I think that being at NIH helped me in two ways. First, although like everyone else here I started off doing something other than biophysics, being at NIH required me to really learn the bio side of biophysics. Having that grounding has helped me to pick useful directions for my projects. Also, it helps me in teaching physics for pre-meds, because I can take a break from some highly idealized freshman textbook model of fluid transport and say something about the details of blood vessel architecture, and let them know that I am grounded in this stuff, that I know something about what biology majors study. Interestingly, although professor ratings websites mostly attract the disgruntled, the most enthusiastic review really appreciated that I made physics relevant to biologists.

Since you've been at many larger institutions, such as UCSB and NIH, what surprised you most about the research atmosphere at Cal Poly Pomona?

Alex Small: I thought that being in a place with a heavy teaching load would necessitate focusing on just a few very familiar research directions rather than branching out, but that's not at all the case. The teaching load does pose certain challenges in terms of quantity of research, but people here are still just as flexible as anywhere else in terms of exploring new fields. Half of the biophysics researchers in this department didn't start doing biophysics until they arrived here. And the directions I've taken in some of my projects are very different (in a good way!) from anything I envisioned as a postdoc.

Have you needed to (or chosen to) adjust your research approaches in order to work in an undergraduate-driven atmosphere rather than at a university with a large grad student population?

Alex Small: Fortunately, I haven't had to adjust as much as I expected. My research often emphasizes finding insights with simple models. The actual calculations are often easy for undergrads to set up on a computer and work on. The hard part is finding the physical insights to formulate the model, and I do that while the students write code. Also, it helps that a lot of my work involves computation rather than] abstract mathematics. It's easy for an undergrad with a course on differential equations and some computer programming knowledge to get going on numerical work. The only thing I've really had to dial back in my approach is my expectations for quantity (but not quality!) in the school year.

Graciela Brelles-Mariño: Being in a primarily undergraduate institution with a heavy teaching load, we face two main problems:1) having to work with undergraduates that are not trained in research 2) having a very limited amount of time to do research. Working with undergraduates if is very time-consuming and difficult at times because we have to invest a lot of time training them and they typically stay with us for a couple of quarters. Time is our more precious and expensive resource since we have to buy out our research time with grants monies. And, being in a primarily undergraduate institution without a long tradition in research makes it more difficult to get grants.

Shantanu Sharma: As a graduate student at Caltech, I was expected to work independently and be productive from the very day I joined a research lab. In my current environment, I came to realize that having the same expectations of every one of my new students was unrealistic. Thankfully, I quickly learned it was necessary for me to interface early and often (a few times a day!) with my undergraduate researchers, and then grow them into independence over time. Things work really well now since the more senior students assist me in mentoring the junior students and I require all the "new recruits" to work together while learning the basic theories and protocols for our research projects (MD simulations, in silico docking, CD/FTIR/SPR spectroscopy). Once an individual student and I feel confident that (s)he has a good grasp of background material, we co-develop a team project (one senior student, one junior student, and myself) and get to work. So I am a lot more hands on in the beginning than I had ever expected to be, but it continually encourages me to think about our hypotheses on a very basic level, which is quite fun!

What has surprised/impressed you most about doing research with undergraduates?

Alex Small: On a per hour basis, a smart undergrad can be about as good as a new grad student. (Although the smart undergrad obviously has very few hours to put into the project.) There's really no reason to assume that a person must take a bunch of courses before starting research. Even in theoretical work, courses and research are very different, especially if the work is mostly computational as opposed to paper and pencil mathematics. It helps that we have an honors college with some amazing students eager to get into research, and that the director of our honors college was trained as a theoretical physicist. I've worked with two honors students so far, I'm writing a paper on results that one of them obtained, and the other is very close to having publishable results.

Do you use your research to fit with Cal Poly Pomona's undergraduate teaching mission? How?

Alex Small: Our school motto is "learn by doing", since we started off as an agriculture and engineering school. Any research program that undergraduates can contribute to is consistent with that pedagogical theme.

What sorts of future plans do the Cal Poly Pomona physics majors have? Do you have many people coming to you asking for advice about applying to graduate school? And a related question, what advice would you (or do you) give to undergraduate students who want to make a career in interdisciplinary science?

Alex Small: Industry is the most popular destination for our students. Some of our students get technical jobs while in school and finish their degrees on a part-time basis. We do send a fair number of people to graduate school.

I would tell somebody thinking of interdisciplinary research to start reading publications like Science and

Nature as early as possible. You'll see the full sweep of science there, and the ways that people in those fields talk about science and what they're interested in. *Physics Today* is pretty inclusive of interdisciplinary work, but the commentary is still largely from a physics point of view. So read what people in other fields read, and try to get into a research group doing something interdisciplinary. You'll get familiar with things that you wouldn't see in your major courses.

What effects have you seen of the economic downturn on Cal Poly Pomona's campus?

Alex Small: The downsides are discussed ad nauseum nauseam in faculty meetings, so I'll talk about the silver lining: Being in the state university system, it's often hard for us to recruit students accepted at more brand-name institutions. But those schools are expensive, and now that students are more budget-conscious we'll be able to get some high achievers who might have gone elsewhere in a different year. I should add that some of our best students (including one doing research with me!) do turn down brand-name schools, because as an undergraduate institution we can focus more on undergraduates, and we do have a strong reputation in technical fields.

What courses are available at Pomona to introduce students to interdisciplinary science? Or do they get that background mostly from doing research with faculty members?

Alex Small: The research groups are always the most important place to learn interdisciplinary science, but we do have a very popular elective in biophysics that Nina Abramzon has designed as a research seminar. Faculty from physics, chemistry, biology, math, and even engineering give seminars on their research, and students read our papers. This is probably our most successful interdisciplinary course. Many of our other electives have traditional titles (e.g. plasma physics, computational physics, applied optics) but those of us with interdisciplinary backgrounds like to focus on examples from our work.

PRE/PRL UPDATE

Viewpoints on Biological Physics in Physical Review

Margaret Foster

The *Physical Review* journals have recently begun highlighting important work with Viewpoints in the online publication Physics. Viewpoints have already appeared on several manuscripts published in Physical Review on biological physics topics. A Viewpoint and the "viewpointed" article or letter are published simultaneously, and both are freely available for download. The following three Viewpoints have already appeared:

1. "Statistics and the single molecule" by Igor M. Sokolov is a Viewpoint on "Random Time-Scale Invariant Diffusion and Transport Coefficients"by Y. He, S. Burov, R. Metzler, and E. Barkai, Phys. Rev. Lett. 101, 058101 (2008)

2. "The inner life of mesoorganisms," by Todd Squires is a Viewpoint on "Nature's Microfluidic Transporter: Rotational Cytoplasmic Streaming at High Péclet Numbers by Jan-Willem van de Meent, Idan Tuval, and Raymond E. Goldstein, Phys. Rev. Lett. 101, 178102 (2008)

3. "Just-in-time DNA replication" by Suckjoon Jun and Nick Rhind is a Viewpoint on "How Xenopus laevis embryos replicate reliably: Investigating the random-completion problem" by Scott Cheng-Hsin Yang and John Bechhoefer, Phys. Rev. E 78, 041917 (2008).

See http://physics.aps.org/ for additional Viewpoints and other highlighted research. This is an effort to bring important research to the attention of a wider community. As you know, biological physics published in Physical Review is also indexed in MEDLINE.

PRL HIGHLIGHTS

Soft Matter, Biological, &
Inter-disciplinary Physics Articles from

Physical Review Letters

6 February 2009

Vol 102, Number 5, Articles (05xxxx)
Articles published 31 Jan - 6 Feb 2009
http://scitation.aip.org/dbt/dbt.jsp?KEY=PRLTAO&Volume=102&Issue=5

Icosahedral Order, Frustration, and the Glass Transition: Evidence from Time-Dependent Nucleation and Supercooled Liquid Structure Studies
Y. T. Shen, T. H. Kim, A. K. Gangopadhyay, and K. F. Kelton
Published 6 February 2009 // 057801

Dynamic Effective Mass of Granular Media
Chaur-Jian Hsu, David L. Johnson, Rohit A. Ingale, John J. Valenza, Nicolas Gland, and Hernán A. Makse
Published 5 February 2009 // 058001

Viscoelasticity in Homogeneous Protein Solutions
Weichun Pan, Luis Filobelo, Ngoc D. Q. Pham, Oleg Galkin, Veselina V. Uzunova, and Peter G. Vekilov
Published 2 February 2009 // 058101

Replicators in a Fine-Grained Environment: Adaptation and Polymorphism
Armen E. Allahverdyan and Chin-Kun Hu
Published 2 February 2009 // 058102

Pushing off the Walls: A Mechanism of Cell Motility in Confinement
R. J. Hawkins, M. Piel, G. Faure-Andre, A. M. Lennon-Dumenil, J. F. Joanny, J. Prost, and R. Voituriez
Published 5 February 2009 // 058103

Hydrodynamic Object Recognition: When Multipoles Count
Andreas B. Sichert, Robert Bamler, and J. Leo van Hemmen
Published 6 February 2009 // 058104

Reacting Differently to Adverse Ties Promotes Cooperation in Social Networks
S. Van Segbroeck, F. C. Santos, T. Lenaerts, and J. M. Pacheco
Published 6 February 2009 // 058105

Equilibrium Route to Colloidal Gelation: Mixtures of Hard-Sphere-Like Colloids
Ph. Germain and S. Amokrane
Published 4 February 2009 // 058301

Velocity Oscillations in Microfluidic Flows of Concentrated Colloidal Suspensions
Lucio Isa, Rut Besseling, Alexander N. Morozov, and Wilson C. K. Poon
Published 4 February 2009 // 058302

Assembly of Gold Nanoparticles into Microwire Networks Induced by Drying Liquid Bridges
Ivan U. Vakarelski, Derek Y. C. Chan, Takashi Nonoguchi, Hiroyuki Shinto, and Ko Higashitani
Published 4 February 2009 // 058303

Navigating Ultrasmall Worlds in Ultrashort Time
Marián Boguñá and Dmitri Krioukov
Published 3 February 2009 // 058701

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Articles published 7 Feb - 13 Feb 2009
http://scitation.aip.org/dbt/dbt.jsp?KEY=PRLTAO&Volume=102&Issue=6

Nonmonotonic Models are Not Necessary to Obtain Shear Banding

Phenomena in Entangled Polymer Solutions
J. M. Adams and P. D. Olmsted
Published 12 February 2009 // 067801

Sequential Desynchronization in Networks of Spiking Neurons with Partial Reset
Christoph Kirst, Theo Geisel, and Marc Timme
Published 9 February 2009 // 068101

Asynchronous Response of Coupled Pacemaker Neurons
Ramana Dodla and Charles J. Wilson
Published 10 February 2009 // 068102

Probing the Electronic Structure of the Hemoglobin Active Center in Physiological Solutions
Emad F. Aziz, Niklas Ottosson, Sébastien Bonhommeau, Nora Bergmann, Wolfgang Eberhardt, and Majed Chergui
Published 13 February 2009 // 068103

Oscillations in the Expression of a Self-Repressed Gene Induced by a Slow Transcriptional Dynamics
Pierre-Emmanuel Morant, Quentin Thommen, François Lemaire, Constant Vandermoëre, Benjamin Parent, and Marc Lefranc
Published 13 February 2009 // 068104

Delay-Induced Degrade-and-Fire Oscillations in Small Genetic Circuits
William Mather, Matthew R. Bennett, Jeff Hasty, and Lev S. Tsimring
Published 13 February 2009 // 068105

Nonlinear Low-Force Elasticity of Single-Stranded DNA Molecules
O. A. Saleh, D. B. McIntosh, P. Pincus, and N. Ribeck
Published 11 February 2009 // 068301

Dynamics of Concentrated Hard-Sphere Colloids Near a Wall
V. N. Michailidou, G. Petekidis, J. W. Swan, and J. F. Brady
Published 12 February 2009 // 068302

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Articles published 14 Feb - 20 Feb 2009
http://scitation.aip.org/dbt/dbt.jsp?KEY=PRLTAO&Volume=102&Issue=7

3D Pressure Field in Lipid Membranes and Membrane-Protein Complexes
O. H. Samuli Ollila, H. Jelger Risselada, Martti Louhivuori, Erik Lindahl, Ilpo Vattulainen, and Siewert J. Marrink
Published 19 February 2009 // 078101

Measurement of the Torque on a Single Stretched and Twisted DNA Using Magnetic Tweezers
Francesco Mosconi, Jean François Allemand, David Bensimon, and Vincent Croquette
Published 17 February 2009 // 078301

Molecular-Weight Dependent Thermal Diffusion in Dilute Polymer Solutions
Alois Würger
Published 17 February 2009 // 078302
See Also: Phys. Rev. Focus

Positioning Janus Nanoparticles in Block Copolymer Scaffolds
Jaeup U. Kim and Mark W. Matsen
Published 20 February 2009 // 078303

Avalanche Prediction in a Self-Organized Pile of Beads
O. Ramos, E. Altshuler, and K. J. Måløy
Published 19 February 2009 // 078701

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Articles published 21 Feb - 27 Feb 2009
http://scitation.aip.org/dbt/dbt.jsp?KEY=PRLTAO&Volume=102&Issue=8

Beyond the Poisson-Boltzmann Model: Modeling Biomolecule-Water and Water-Water Interactions
Patrice Koehl, Henri Orland, and Marc Delarue
Published 24 February 2009 // 087801

Building Blocks of Dynamical Heterogeneities in Dense Granular Media
R. Candelier, O. Dauchot, and G. Biroli
Published 27 February 2009 // 088001

Knot-Controlled Ejection of a Polymer from a Virus Capsid
Richard Matthews, A. A. Louis, and J. M. Yeomans
Published 23 February 2009 // 088101

Cross-Linked Networks of Stiff Filaments Exhibit Negative Normal Stress
Enrico Conti and Fred C. MacKintosh
Published 26 February 2009 // 088102

Analysis of Correlations between Energy and Residue Fluctuations in Native Proteins and Determination of Specific Sites for Binding
Turkan Haliloglu and Burak Erman
Published 27 February 2009 // 088103

Tracing, Amplifying, and Steering Chromophore-Bath Coherences by Ultrashort Pulse Trains
Heide Ibrahim, Mónika Héjjas, and Nikolaus Schwentner
Published 24 February 2009 // 088301

Symbolic Dynamics of Biological Feedback Networks
Simone Pigolotti, Sandeep Krishna, and Mogens H. Jensen
Published 26 February 2009 // 088701

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Articles published 28 Feb - 6 Mar 2009
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Long-Time Tails and Cage Effect in Driven Granular Fluids
Andrea Fiege, Timo Aspelmeier, and Annette Zippelius
Published 3 March 2009 // 098001

Charge Transport in Proteins Probed by Resonant Photoemission
D. V. Vyalikh, V. V. Maslyuk, A. Blüher, A. Kade, K. Kummer, Yu. S. Dedkov, T. Bredow, I. Mertig, M. Mertig, and S. L. Molodtsov
Published 5 March 2009 // 098101

Cross-Modulated Amplitudes and Frequencies Characterize Interacting Components in Complex Systems
Fabian Gans, Aicko Y. Schumann, Jan W. Kantelhardt, Thomas Penzel, and Ingo Fietze
Published 4 March 2009 // 098701

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Vol 102, Number 10, Articles (10xxxx)
Articles published 6 Mar - 13 Mar 2009
http://scitation.aip.org/dbt/dbt.jsp?KEY=PRLTAO&Volume=102&Issue=10

Trafficlike Collective Movement of Ants on Trails: Absence of a Jammed Phase
Alexander John, Andreas Schadschneider, Debashish Chowdhury, and Katsuhiro Nishinari
Published 13 March 2009 // 108001

Equilibrium and Nonequilibrium Effects in the Collapse of a Model Polypeptide
Natalia A. Denesyuk and John D. Weeks
Published 10 March 2009 // 108101

Particle Pressure in a Sheared Suspension: A Bridge from Osmosis to Granular Dilatancy
Angélique Deboeuf, Georges Gauthier, Jérôme Martin, Yevgeny Yurkovetsky, and Jeffrey F. Morris
Published 9 March 2009 // 108301

Pair Potential of Charged Colloidal Stars
F. Huang, K. Addas, A. Ward, N. T. Flynn, E. Velasco, M. F. Hagan, Z. Dogic, and S. Fraden
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Kumiko Kamata, Takeaki Araki, and Hajime Tanaka
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Molecular Dynamics Simulations of Optimal Dynamic Uncharged Polymer Coatings for Quenching Electro-osmotic Flow
Owen A. Hickey, James L. Harden, and Gary W. Slater
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Laurent Lacaze and Rich R. Kerswell

Published 13 March 2009 // 108305

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A. Knoll, D. Wiesmann, B. Gotsmann, and U. Duerig
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Crowding Effects on the Structural Transitions in a Flexible Helical Homopolymer
Alexander Kudlay, Margaret S. Cheung, and D. Thirumalai
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Sirish Kaushik Lakkaraju and Wonmuk Hwang
Published 16 March 2009 // 118102

Self-Assembled Magnetic Surface Swimmers
A. Snezhko, M. Belkin, I. S. Aranson, and W.-K. Kwok
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Jan Brugués and Jaume Casademunt
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Self-Assembly and Evolution of Homomeric Protein Complexes
Gabriel Villar, Alex W. Wilber, Alex J. Williamson, Parvinder Thiara, Jonathan P. K. Doye, Ard A. Louis, Mara N. Jochum, Anna C. F. Lewis, and Emmanuel D. Levy
Published 18 March 2009 // 118106

Instabilities and Waves in Thin Films of Living Fluids
Sumithra Sankararaman and Sriram Ramaswamy
Published 19 March 2009 // 118107

In silico Relationship between Configurational Entropy and Soft Degrees of Freedom in Proteins and Peptides
Da-Wei Li and Rafael Brüschweiler
Published 20 March 2009 // 118108

Nonequilibrium Phase Transitions in the Extraction of Membrane Tubes by Molecular Motors
J. Tailleur, M. R. Evans, and Y. Kafri
Published 20 March 2009 // 118109

Phase Transitions towards Criticality in a Neural System with Adaptive Interactions
Anna Levina, J. Michael Herrmann, and Theo Geisel
Published 20 March 2009 // 118110

Classical Simulation of Quantum Energy Flow in Biomolecules
Gerhard Stock
Published 19 March 2009 // 118301

Direct Measurements of Hydrophobic Slippage Using Double-Focus Fluorescence Cross-Correlation
Olga I. Vinogradova, Kaloian Koynov, Andreas Best, and François Feuillebois
Published 20 March 2009 // 118302

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Q.-B. Lu
Published 19 March 2009 // 118501

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Bimodal Spectrum for the Curvature Fluctuations of Bilayer Vesicles: Pure Bending plus Hybrid Curvature-Dilation Modes

R. Rodríguez-García, L. R. Arriaga, M. Mell, L. H. Moleiro, I. López-Montero, and F. Monroy
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Laser-Driven Nanoplasmas in Doped Helium Droplets: Local Ignition and Anisotropic Growth
Alexey Mikaberidze, Ulf Saalmann, and Jan M. Rost
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Alessandro Patti and Marjolein Dijkstra
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Douglas B. Staple, Marko Loparic, Hans Jürgen Kreuzer, and Laurent Kreplak
Published 27 March 2009 // 128302

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Entropic trap, surface-mediated combing, and assembly of DNA molecules within submicrometer interfacial confinement
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Noise-driven attractor switching device
Naoki Asakawa, Yasushi Hotta, Teruo Kanki, Tomoji Kawai, and Hitoshi Tabata
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Three-dimensional quantification of structures in trabecular bone using measures of complexity
Norbert Marwan, Jürgen Kurths, Jesper Skovhus Thomsen, Dieter Felsenberg, and Peter Saparin
Published 3 February 2009 // 021903

Dynamical phase transitions in periodically driven model neurons
Jan R. Engelbrecht and Renato Mirollo
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Serial correlation in neural spike trains: Experimental evidence, stochastic modeling, and single neuron variability
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H. Berthoumieux, C. Antoine, L. Jullien, and A. Lemarchand
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Péter Szabó, Máté Nagy, and Tamás Vicsek
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David Dominguez, Mario González, Eduardo Serrano, and Francisco B. Rodríguez
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Pavel V. Zinin and John S. Allen, III
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Derivation and analysis of an ordinary differential equation mean-field model for studying clinically recorded epilepsy dynamics
Frank Marten, Serafim Rodrigues, Piotr Suffczynski, Mark P. Richardson, and John R. Terry
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S. Chodankar, V. K. Aswal, J. Kohlbrecher, R. Vavrin, and A. G. Wagh
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A. J. K. Phillips and P. A. Robinson
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Hideaki Fujitani, Yoshiaki Tanida, and Azuma Matsuura
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Janusz Szwabiński and Andrzej Pkalski
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Yuan Lin
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Quantized biopolymer translocation through nanopores: Departure from simple scaling
Simone Melchionna, Massimo Bernaschi, Maria Fyta, Efthimios Kaxiras, and Sauro Succi
Published 3 March 2009 // 030901(R)

Relationship between protein folding thermodynamics and the energy landscape
Jaegil Kim, Thomas Keyes, and John E. Straub
Published 4 March 2009 // 030902(R)

Probabilistic model of ligaments and tendons: Quasistatic linear stretching
M. Bontempi
Published 12 March 2009 // 030903(R)

Diffusion in narrow domains and application to phototransduction
Jürgen Reingruber and David Holcman
Published 17 March 2009 // 030904(R)

Hydrophobicity at low temperatures and cold denaturation of a protein
Takashi Yoshidome and Masahiro Kinoshita
Published 26 March 2009 // 030905(R)

Line-defect patterns of unstable spiral waves in cardiac tissue

ARTICLES

DBP COMMITTEE ANNOUNCEMENT

NOMINATIONS FOR
2010 MAX DELBRÜCK PRIZE
IN BIOLOGICAL PHYSICS

The Max Delbrück Prize recognizes outstanding achievements in biological physics research. The prize consists of $10,000, an allowance for travel to attend the meeting at which the prize is awarded, and a certificate citing the contributions made by the recipient or recipients. It is presented biennially in even-numbered years.

Prior to 2008, this prize was awarded as the Biological Physics Prize.

The prize was established in 1981 by friends of the Division of Biological Physics and renamed the Max Delbruck Prize in 2006 in conjunction with a campaign that endowed the prize. The successful fundraising efforts enabled the increase of the prize amount from $5,000 to $10,000. Key contributors include an anonymous donor, a former student of John Hopfield, and all DBP members as a group through a lump-sum transfer from DBP operating funds.

Nomination Deadline: The deadline for submission of nominations for the prize to be awarded in 2010 is: July 1, 2009.

Nominations and supporting documentation for the 2010 Prize should be sent to the Chair of the 2010 Selection Committee:

Prof. Peter Wolynes
pwolynes@ucsd.edu

Nomination Guidelines are listed at:
http://www.aps.org/programs/honors/prizes/delbruck.cfm

Rules & Eligibility:

Nominations are open to scientists of all nationalities regardless of the geographical site at which the work was done. The prize may be awarded to more than one investigator on a shared basis. Nominations are active for three cycles.

Award for Outstanding Doctoral Thesis Research in Biological Physics

Background

Biological Physics is one of the most rapidly growing, exciting and interdisciplinary branches of contemporary physics. To encourage the healthy development of this field, the Division of Biological Physics has established an annual award for Outstanding Doctoral Thesis Research in Biological Physics.

Description

To recognize doctoral thesis research of outstanding quality and achievement in any area of experimental, computational, engineering, or theoretical Biological Physics, broadly construed, and to encourage effective written and oral presentation of research results, the Division of Biological Physics will present an award, to be given annually, consisting of $1,500, a certificate citing the contribution made by the Awardee, and a $500 travel allowance ($1000 international) and fee waiver to attend the subsequent March meeting and to present an invited talk based on the thesis work or an extension of that work. Award and travel monies will be presented following the talk. The two runners-up will receive certificates of merit citing their contributions.

Establishment & Support

The award was established in 2009 by the Division of Biological Physics and is sponsored by members and friends of the Division of Biological Physics.

Rules & Eligibility

Doctoral students at any university in the United States or abroad who have passed their thesis defense for the Ph.D. in any areas of experimental, computational, engineering, or theoretical Biological Physics, broadly construed, any time from October 1st two years before the year in which the award is to be presented until September 30th in the year before the award is to be presented, are eligible for the award, except for those whose thesis advisors serve on the current Selection Committee. To recognize the fundamentally interdisciplinary nature of biological physics, the applicant, advisor and degree awarded need not be in Physics, but may also be in any appropriate related area, including, but not limited to, Biomedical Engineering, Applied Mathematics, Applied Physics or Biological Physics, Biophysics, Biology, Mathematics, Biochemistry, Chemistry or Chemical Engineering. In the event that the Committee judges no submitted theses to be of sufficient quality, the Committee may elect not to present the award.

Nomination & Selection Process

Nominations must be received by the Chair of the 2009 Biological Physics Thesis Award Selection Committee prior to the deadline for nominations: **the first Monday in October each year (October 5th, 2009)**. Nominations **must** be submitted as a single PDF file to the Chair of the Selection Committee in an email attachment.

The nomination process is initiated by the thesis advisor. The nomination package consists of the following materials:

1. A letter from the thesis advisor citing the specific contributions of the nominee and the significance of those contributions.

2. A letter from the department chair and/or relevant program director certifying the date of the thesis defense.

3. Two letters seconding the nomination.

4. A manuscript prepared by the nominee describing the thesis research; the manuscript may not exceed 1,500 words (excluding figures and references).

5. An abstract prepared by the nominee suitable for publication in the Bulletin of the American Physical Society; the abstract may not exceed 1,300 characters. The name of the thesis supervisor and the institution should be indicated in a footnote.

6. A full curriculum vitae of the nominee including a publication list.

Nominations are limited to one per year per nominator. Writers of seconding letters may only submit one seconding letter per year.

Timeline

September 30th—Deadline for thesis defenses for consideration by the Selection Committee.
First Monday in October (October 5th, 2009)—Deadline for nominations.
November 10th—Selection of Awardee and runners up.
November 17th—Notification of Awardee and invitation to March Meeting.
December 2nd—Deadline for acceptance of invitation by Awardee.
March Meeting—Awarding of Prize.

For the 2009/2010 Award, Nominations must be sent to:
Chair: Prof. James A. Glazier
Indiana University
Biocomplexity Institute and Department of Physics
Simon Hall MSB1, 047G
212 S. Hawthorne Drive
Bloomington, IN 47405-7003
USA
Email: glazier@indiana.edu

DBP ANNOUNCEMENT

FOCUS SESSIONS FOR MARCH MEETING 2010

Begin planning now for DBP Invited Symposia and Focus Topic Sessions. In the next week or two you will receive emailed instructions on proposing such sessions.

DBP ANNOUNCEMENT

ELECTION RESULTS!

The long-awaited Division election results for new 2009 officers are now in hand.
The new DBP officers are

Division Councillor - **Mark Reeves**
Vice-Chair - **Aihua Xie**
Members-at-Large - **Tom Chou and Phil Wyatt**.

11.9% of the Division membership voted, 0.3% via paper ballot.

The vote totals were as follows:
Councillor:
Reeves 117,
Schlichting 113

Vice-Chair:
Xie 133,
Gilbert 97

Members-at-Large:
Chou 130,
Wyatt 116,
Bakajin 95,
Ma 86

You can see that if you voted, your vote indeed counted!

NOT REALLY A JOB AD
JUST A GREAT OPPORTUNITY TO SERVE
THE BIOLOGICAL PHYSICS COMMUNITY!

Assistant Editor Needed

THE BIOLOGICAL PHYSICIST

Well, we're in Volume 9 now. Yes, that's VOLUME 9 of THE BIOLOGICAL PHYSICIST. The realization that I've been doing this for **NINE** years, coupled with ever-increasing research commitments and other editorial duties (*Journal of Biological Physics*), have led your editor to set a self-imposed term limit. I'll go up through Volume 10 (February issue of 2011), but then I think it's time for me to step down as editor of THE BIOLOGICAL PHYSICIST. As they say on NPR, "let someone else have a chance for a change."

What does that mean? It means I am looking for someone to serve as Assistant Editor with an eye to possibly taking over the editorship in 2011. This is an ideal position for someone who (1) **can write**, (2) **likes to write**, (3) **wants to serve the biological physics community**. It is also an ideal opportunity for someone early in their scientific career who would like to make connections within the field.

Over the past 9 years, we have run essays and feature articles, as well as bringing the DBP community important announcements and PRE and PRL highlights. How do YOU want to see this "voice of the DBP" grow over the next decade?

Do you have to be a DBP member? No, but if you're not, I'll twist your arm to join.

Do you have to be an active researcher? Not necessarily. I've been editing the newsletter through my Postdoc and Assistant Professor years, but this could also be an opportunity for someone in science journalism rather than a bench scientist, as long as you care deeply about interdisciplinary science and are committed to working closely with the DBP community.

Send CV and a writing sample to Sonya Bahar at bahars@umsl.edu.

JOB AD

Graduate student position at Texas A&M
University Health Science Center / Biomedical Engineering Health Science Center / Biomedical Engineering

Experimental Biophysics

A PhD student/graduate research assistant position is available immediately in the laboratory of Prof. Andreea Trache at Texas A&M Health Science Center, College Station, TX. The student will be enrolled in the Biomedical Engineering PhD program at Texas A&M University and will do their PhD thesis work at Texas A&M Health Science Center. The position will involve the study of molecular dynamics at the cellular level, focusing on mechanotransduction at cell adhesions and its connection with the cytoskeleton. These interdisciplinary studies will involve instrumentation development and calibration, and will use an atomic force microscope combined with total internal reflection fluorescence and fast confocal microscopy.

The successful candidate should have a BS/MS in Physics, Biophysics or Engineering with basic training in optics or microscopy. No cell biology knowledge is necessary at this time; however acquiring general cell biology skills and knowledge will be required to carry on live-cell experiments. Experience with MatLab is a plus.

Interested applicants please send your CV to trache@tamu.edu.
Lab website: http://medicine.tamhsc.edu/basic-sciences/sbtm/homepages/trache/

JOB AD

Postdoc in Physical Biology of Bacteria

Postdoctoral position to study the physical biology of bacterial mechanisms such as self-organization of division proteins (subcellular Min oscillations), export and motility apparatus (pili), and growth and division (peptidoglycan). My general interest is in developing computational models of spatial and temporal structure formation within bacteria, see http://www.physics.dal.ca/~adr

You should have a physics PhD and experience in computational modeling. The start date is Sept 1 2009. Please email your CV as a pdf file, and provide the contact details for three references, to andrew.rutenberg@dal.ca The position is for one year, though additional funding should become available.

IWTF3

3rd International Workshop on
Physics and Technology of Thin Films
August 26th - 28th, 2009
including
Materials Master Class, August 24th - 25th, 2009
at Fontana Hotel Lepolampi, Espoo, Finland

http://www.fyslab.hut.fi/~ptk/iwtf3

IWTF2009@gmail.com

The 3rd International Workshop on Physics and Technology of Thin Films focuses on recent developments and advances related to thin films, in particular on the nanoscopic scale. The sessions cover theoretical, computational and experimental studies of thin films. IWTF3 is organized as a Satellite Conference of ECOSS26, and it is preceded by a two-day introductory Materials Master Class intended for advanced undergraduate and graduate students.

Topics of the Sessions:

- Biological and soft-matter thin films
- Electronic and transport properties of thin films
- Graphene
- Growth, self-organization and stability of nanostructures
- Nanochemistry and catalysis
- Theory and modeling of thin film growth
- Ultrathin overlayers and quantum wires
- Quantum size effects in metallic nanostructures

Invited Speakers Include:

Jorge Bernardino de la Serna	University of Southern Denmark, Denmark
Zdenek Chvoj	The Academy of Sciences of the Czech Republic
Roland Faller	University of California, Davis, USA
Antti-Pekka Jauho	Technical University of Denmark, Denmark
Markku Leskelä	University of Helsinki, Finland
John Lowengrub	University of California, Irvine, USA
Alireza Z. Moshfegh	Sharif University of Technology, Iran
Herbert Over	Justus Liebig University Giessen, Germany
Martti Puska	Helsinki University of Technology, Finland
Patrick Soukiassian	Universite de Paris-Sud/Orsay, France
Ulrich Starke	Max Planck Institute for Solid State Research, Germany
Michael C. Tringides	Iowa State University, Ames Lab, USA
Oleg Trushin	Russian Academy of Sciences, Russia
Axel Voigt	Technische Universität Dresden, Germany

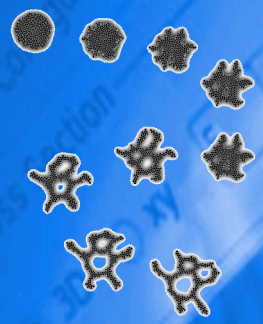
Important dates:

Registration 15.3.2009 – 30.6.2009
Abstract submission deadline 15.5.2009

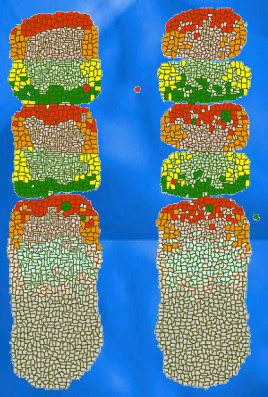
For further information contact:

Prof. Tapio Ala-Nissilä
(Chairman of the Organizing Committee)
Department of Applied Physics, P.O. Box 1100,
Helsinki University of Technology,
FI-02015 TKK, Finland.
Email: Tapio.Ala-Nissila@tkk.fi.
Tel: +358-40-541-2983

Training Workshop
Developing Multi-Cell Developmental and Biomedical Simulations with CompuCell3D
August 17th-21st 2009
Indiana University, Biocomplexity Institute, Bloomington, IN, USA



Background: Modeling is becoming an integral part of contemporary bioscience. The Glazier-Graner-Hogeweg (*GGH*) model as implemented in the modeling environment, CompuCell3D allows researchers to rapidly build complex models of multi-cell processes in development and disease with user-selectable resolution, from sub-cellular compartmental models to continuum models of tissues. CompuCell3D's use of CC3D-ML, BioLogo and Python model-specification allows compact description of models for publication, validation and sharing. CompuCell3D is open source, allowing users to extend, improve, validate, modify and share the core software. For more information on the GGH and CompuCell3D, please visit: http://www.compucell3d.org/

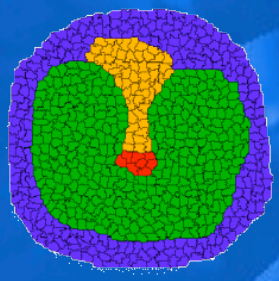


Goal: By the end of the week, participants will have implemented a basic simulation of the particular biological problem they work on. Post-course support and collaboration will be available to continue simulation development.

Topics: Introduction to GGH modeling. Applications of GGH modeling and overview of published work. Introduction to CompuCell3D. Python and BioLogo scripting. Basics of model building. Extending CompuCell3D. Building a basic simulation of your system.

Format: The workshop will consist of a limited number of lectures and extended hands-on computer tutorials.

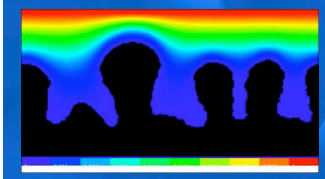
Instructors: James A. Glazier, Maciej Swat, Benjamin Zaitlen, Abbas Shirinifard, Nikodem Poplawski, Randy Heiland (Biocomplexity Institute, Indiana University)



Target Audience: Experimental Biologists, Medical Scientists, Biophysicists, Mathematical Biologists and Computational Biologists from advanced undergraduates to senior faculty, who have an interest in developing multi-cell computational models, or learning how such models might help their research. No specific programming or mathematical experience is required, though familiarity with some modeling environment (e.g. Mathematica®, Maple®, Matlab®) and how to represent basic concepts like diffusion and chemical reactions mathematically, would be helpful.

Fees and Support: The basic registration fee of $500 will cover workshop participation, workshop materials and lunches. Partial support for registration, travel and hotel costs may be available.

Application and Registration: Enrollment is limited and by application only. To apply, please send a c.v., a brief statement of your current research interests and of the specific problem you would like to model. Students and postdocs should also include a letter of support from their current advisor. If travel support is being requested, please include a statement documenting need and amounts requested. Please submit all application materials electronically to Maciej Swat (mswat@indiana.edu) by June 30th, 2008. Funding will be awarded on a first come first serve basis.



Facilities: Participants will have access to an OSX cluster and will be able to connect to the Internet using their own laptops.

For More Information, Please Contact: Maciej Swat (mswat@indiana.edu).

Or visit: www.compucell3d.org

the biocomplexity institute

The Third Annual q-bio Conference on Cellular Information Processing

August 5-9, 2009 | Santa Fe, New Mexico, USA

http://q-bio.org
q-bio-09@cnls.lanl.gov

The q-bio Conference is intended to advance predictive modeling of cellular regulation. The emphasis is on modeling and quantitative experimentation for understanding and predicting the behaviors of particular regulatory systems, phenomena that manifest themselves in many biological systems, and/or general principles of cellular information processing.

The single-track program will include invited talks from leading experimental and theoretical researchers as well as contributed talks, poster presentations, and tutorials. The conference has been extended to five days to provide increased opportunities for contributed talks.

Opening Banquet Talk: Bruce M. Alberts *(U. California, San Francisco)*
Closing Banquet Talk: Michael Levine *(U. California, Berkeley)*

Abstract Submission Deadline - May 20, 2009

Travel awards are available for junior researchers.

Postdoc positions are available at Los Alamos National Laboratory for those interested in a career in quantitative biology.

IAS Institute for Advanced Studies at Los Alamos National Laboratory

Los Alamos NATIONAL LABORATORY EST. 1943

Center for Nonlinear Studies