

THE BIOLOGICAL PHYSICIST

The Newsletter of the Division of Biological Physics of the American Physical Society

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DIVISION OF BIOLOGICAL PHYSICS EXECUTIVE COMMITTEE

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glazier@indiana.edu

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quake@stanford.edu

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hlevine@ucsd.edu

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bmsalzbe@mail.med.upenn.edu

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jmilton@jsd.claremont.edu

Jin Wang
Jin.Wang.1@stonybrook.edu

Daniel Cox
cox@physics.ucdavis.edu

Tim Newman
timothy.newman@asu.edu

Newsletter Editor

Sonya Bahar
bahars@umsl.edu

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This issue of **THE BIOLOGICAL PHYSICIST** brings you a special visit to the Center for Biological Physics at Arizona State University, and an interview with Center Director Timothy Newman. We also bring you some important announcements of conferences and workshops, the announcement of the 2009 Shirley Chan Student Travel Grants, calls for papers, PRE and PRL highlights, and job ads. Happy New Year!

– SB

FEATURE

Arizona State University's Center for Biological Physics

The Arizona State University Center for Biological Physics is a major research center in our field. Currently directed by Timothy Newman, with the assistance of Program Coordinator Jill Kolp and Program IT Support Analyst Kirill Speranskiy, the CBP is home to a large number of scientists at the forefront of many different aspects of biological physics. We talked with Center Director Timothy Newman about the history of the Center, the current research there, and its directions for the future.

What is the history of the CBP? Can you describe the Center's original "vision", and how that has evolved and changed over the years?

The CBP was officially accredited by ASU in early 2006, but we had existed as a “center with a small c” since 2004. The ASU Physics Department had a small but vibrant biophysics group for many years, under the leadership of Stuart Lindsay. I was hired in 2002 as the first recruit in an intense expansion process which has boosted the number of full-time biological physics faculty in the department to nine, making us one of the largest such groups in the US. A key senior hire was that of Michael Thorpe in 2003. Mike brought a vision of creating a physical center, and had the resources to really get the ball rolling. Mike was the founding director of the CBP from its inception until summer 2008. Our vision was and is to be the intellectual focus of biological physics on campus, to be a center of excellence at the national level, with the wider purview of integrating disparate areas of the biosciences through the common desire of biologists in these areas to work more closely with quantitative scientists such as physicists.

What are the faculty interactions like within the CBP? Do many of the faculty members collaborate with each other, and/or do they have

outside interdisciplinary collaborations? How many departments are involved in CBP?

We have 16 core faculty (whose research interests are listed below), all of whom have either home or affiliated appointments with the Department of Physics. The main disciplines represented are Biological Physics and Biochemistry. The faculty interactions within the CBP are close-knit and collegial. We have one formal faculty meeting each year, mainly for long-term planning purposes. However, we meet informally twice a week at our organized events – the biological physics seminar and the weekly “chalk talk.” All of our events are heavily attended by faculty members and students, which is a sign of true intellectual engagement in biological physics. All of our faculty members have at least one “outside collaboration” – typically with life scientists. We do have a number of internal collaborations also, for example Kong-Thon Tsen and Otto Sankey are collaborating on a fascinating project involving the destruction of viruses using ultrashort laser pulses, and John Spence and Petra Fromme (and others) are collaborating on a highly ambitious project to determine the structure of single protein molecules suspended in water droplets, using femtosecond X-ray pulses. This latter project is known locally as “diffract and destroy” and raises new questions in fundamental physics, thus folding in the interests of other physics faculty, such as theorist Kevin Schmidt and experimentalist Bruce Doak.

How many graduate students are conducting their PhD studies within the CBP? Do they receive mainly degrees in Physics, or in other disciplines?

Our website lists about 50 graduate students who have varying degrees of affiliation with the CBP. About half of these students see the CBP as their academic home. The CBP has dedicated open-plan

office space for students, which really encourages interactions across research groups via student discussions. Students receive degrees in Physics and Biochemistry in about equal numbers. We are currently debating whether to establish a PhD in Biological Physics. A number of such programs are springing up across the US. The advantage of such programs is that one can attract students from a more diverse set of backgrounds, and provide a more open-ended and interdisciplinary curriculum compared to a Physics PhD program. That said, the ASU Physics PhD has itself been recently modernized (by me, in my previous administrative role as Director of Graduate Studies) with first-year research rotation projects and a more flexible curriculum, so we have mixed feelings as to whether to establish an additional program. ASU has a strong graduate physics program, and the quality of students we have attracted in recent years is very high. We aim to graduate our students within five years, and many have gone on to professional careers in the wider bioscience arena.

What interdisciplinary courses are offered by CBP, or by members of CBP? Have you seen demand for these courses grow over the years?

We offer two specialized courses in biological physics and are planning on offering a third in 2009, thus providing graduate students (and advanced undergraduate students) with a significant three-course sequence covering broad areas of biological physics. The curricula for these courses are fluid, and are determined mainly by the interests of the person teaching the course. I have taught the first course in the sequence for the past four years, and essentially made it a “biology for physicists” course, as many of our students get excited by biological physics without having a strong background in biology. I am passionate that biological physicists should be well-educated in biology, especially with regard the “big picture,” so they can explain the biological (as well as the biophysical) rationale for why, for example, a particular bio-molecule is under study. Our biological physics courses have been popular since their inception, routinely attracting class sizes of twenty or more students.

What is the Center's "philosophy" of biological physics? Do you see "biophysics" as a separate discipline?

In 2003, the biophysics faculty (five of us at that time) sat in my office and discussed teaching a course in biophysics. What emerged from that discussion has essentially set the tone for how we regard “biophysics”, or rather its modern incarnation as “biological physics.” In a nutshell, we didn’t think it compelling to teach a set of lectures on traditional topics of biophysics per se – we wanted to be more broad and interdisciplinary. In our philosophy of biological physics, we place a very strong emphasis on connecting physics to biology, rather than abstracting pieces of biology and “doing physics on them.” We also place strong emphasis on biological physics not just being performed at the molecular level. Evolution as a process connects all scales in biology, and it makes sense to bring physics to biology with this rationale firmly at the front of one’s thinking. To be sure, many of our faculty members perform research on molecular biology topics, but we also have strong emphases at the scale of viruses, cells, and, in my own research, on embryonic systems and population biology. We have a strong interest in our future hires being specialists at the level of cells or higher scales. Regarding the second part of your question, I do not see “biophysics” as a distinct discipline from “biological physics” – in some sense the new term is a rebranding, which plays a useful role in generating excitement, re-evaluating priorities, and bringing new people into the field. Within our community, both in the past and nowadays, there is a spectrum of activities ranging from hard-core physics research on systems that have their origins in biology to research on distinctly biological questions. My tastes are most definitely at the biological end of the spectrum, because I am enamored with biological phenomena and want to understand them. Many others share this perspective, and this is reflected, for example, in the recent renaming of the NSF Division of Biological Physics to the NSF Division of the Physics of Living Systems.

How is the Center organized? Is there a physical building or set of laboratories that make up the Center, or is it a "virtual" Center? Does the Center have its own personnel?

We were fortunate to attract significant infrastructural investment from our College in 2005 which led to a major renovation of several thousand square feet of space in the Department of Physics, which now houses the CBP. We have an annual budget which covers personnel, day-to-day expenses, and our various activities. This budget is a patchwork of highly valued contributions from the College of Liberal Arts and Sciences, the Departments of Physics and Chemistry, the Office of the Vice-Provost for Research, and the ASU Biodesign Institute. We also have valued support from Agilent Technologies, a local biotech company in the Phoenix metropolitan area. In terms of both funding and intellectual commitment, we truly appreciate the strong support from the Physics Chair (previously Barry Ritchie, and currently Robert Nemanich) and from the wider physics faculty. Mike Thorpe, and the program coordinator at that time, Peg Stuart, invested hundreds of hours of time with architects to design an excellent space – we have very pleasant faculty, postdoc, and graduate offices, and one small and one medium-sized discussion area, the latter large enough to host small seminars. Our two most recent hires, Robert Ros and Sara Vaiana, are experimentalists and have newly renovated labs adjacent to the CBP. Several faculty members have labs elsewhere, primarily in the Department of Chemistry, which is physically connected to the Department of Physics, and in the ASU Biodesign Institute, a most impressive interdisciplinary research structure built in 2003. So, I am happy to say, we are most definitely not a “virtual center” – the physical proximity of our faculty, and the large number of organized events promote a steady-state of intellectual excitement and collegiality. Regarding CBP personnel, we have been extremely fortunate to have energetic, talented, and committed people running the CBP behind the scenes. Our first program coordinator, Peg Stuart, was passionate about the success of the CBP and worked tirelessly with Mike Thorpe on planning and creating an atmosphere of excellence – I think this has been appreciated by all the visitors to the CBP over the years. Our current coordinator, Jill Kolp, has maintained the standard of excellence and brings terrific energy to her role. We have also had first-rate IT support over the years, thanks to Brandon Hesperheide and Kirill Speranskiy, allowing us to maintain high quality interactive

websites for the Center, and for its various programs.

What are some of the major scientific achievements that have come from CBP so far?

I should preface my answer to this question by saying that several of the CBP faculty members are highly distinguished scientists who have produced significant scientific impact within their own groups over the years. For example, Petra Fromme is very well known for her work in 2001 resulting in the atomic-scale protein structure determination of photosystem I. Her extensions of this extraordinary work involve CBP faculty and students to a significant extent. The CBP adds to the excellence of individual groups by providing the intellectual home for biological physics on campus, and thus seeding new interactions and projects. As mentioned in one of the earlier answers, we do have some very ambitious research collaborations within the center, concerning virus destruction using lasers, and single molecule protein structure determination. These are obviously high-risk, high-pay-off projects. Another such project is a collaboration between CBP faculty Stuart Lindsay and Otto Sankey on high-speed DNA sequencing – using the differential conductivity of base pairs as a signal while pulling DNA through an electronic junction. Two recent examples of achievements from the theoretical side are i) Mike Thorpe’s work, which has made waves in the protein community, with a new coarse-grained algorithm (FRODA), based on rigidity theory, for studying dynamics of very large protein complexes, and ii) the work from my own group, developing biologically plausible computational models of large cell aggregates, relevant to developmental processes and tissue pathologies such as cancer. All of the CBP faculty members perform research that is cutting-edge, and I have provided a short summary of each person’s work.

Talk about the seminar series and workshops that CBP has organized and sponsored.

Our seminars and workshops really define the “value-added” of the CBP, beyond being a group of faculty and students with common interests. We often hear from colleagues that the biological physics seminar series is the best series on campus.

We focus on bringing in excellent speakers, with diverse interests, and this has allowed us to build up a committed audience of 30 to 40 people who regularly attend the talks. We already have a full schedule of great speakers for spring 2009, and our program coordinator Jill Kolp is now booking fall 2009 well in advance. In addition to the seminar series, Mike Thorpe has recently organized the CBP “chalk talks”. Each week for one hour we meet to hear about the research of an ASU faculty member, usually from the biosciences. The person is not allowed to bring any props, or a computer, but must describe their work using only words and a chalkboard. This leads to a very nice dynamic, with lots of questions and good discussion. The graduate students also run their own biweekly seminar series (no faculty allowed) in which a given student will present their research to their peers. This is popular, as students feel more able to ask “stupid questions” of one another, although I insist to them that ostensibly simple questions often lead to the most interesting discussions, and they should be proactive in asking such of our invited guests. Each summer we organize at least one workshop – usually with between 15 and 30 invited guests – on a fairly focused research area. Detailed websites for all of these workshops from previous years are available on the main CBP website. Workshops have covered diverse topics such as rigidity in biomolecules, and quantitative approaches to embryo development. In summer 2009 Dmitry Matyushov and Arjan van der Vaart are organizing a workshop titled “Proteins and Water.” As with our seminar series, we aim for true excellence with the workshops, inviting the leaders in the field, and providing for them a great environment to discuss and share topics at the cutting-edge. We also collaborate with the University of Arizona in Tucson on a one-day local meeting held in May each year on biological physics, aptly named AZ Biophest. This is a high energy meeting, with around a hundred participants presenting 10 minute talks and/or posters.

Describe some of the Center's outreach activities (high school teachers program)?

Each year during the summer, several CBP faculty run a program for local high school teachers, using biological physics as a vehicle for bringing contemporary science into the classroom. A great

spin-off of this has been the “popsicle stick” project, spearheaded by Mike Thorpe. Mike’s long-term interest in rigidity theory led to creating hands-on models of rigid and floppy networks using popsicle sticks connected together at their ends by metal pins to create joints. Mike and several teachers have taken this to the level of a professional resource that teachers can use to instruct students in algebra and geometry via hands-on experience.

How do you see CBP growing and evolving over the coming decade?

When I took over as Director this summer I saw my role focused on two aspects for the future of the CBP. First, I wanted to maintain the excellence of the CBP activities, which to a large extent are the result of the vision and energy of the previous director, Mike Thorpe. Second, I wanted to extend the influence of our relatively large group and the quality of our programs, specifically with an aim to achieve the status of a national center for biological physics within the next few years. There are currently two NSF funded centers in biological physics (UCSD and more recently UIUC), which are truly excellent. I have had the pleasure of visiting each in the past year and have been really impressed by their vision and energy. We have strong professional and collegial connections with scientists in these centers, and look forward to working with them over the next few years to create a stronger network of biological physics within US physics departments. I envision that the CBP will continue to grow, with several new faculty hires in the next decade. As I mentioned earlier, we are keen to diversify our expertise, and to hire young biological physicists working in areas such as cell biology and neuroscience.

Do you have any advice for young scientists starting out in interdisciplinary work?

Well, I think in my early career I made every mistake in the book, so I am certainly able to help our young faculty in the CBP avoid common pitfalls! A primary difficulty in performing interdisciplinary work as a young scientist is that there is often no natural community to which to belong, and hence it is difficult to quickly define a niche for oneself. Without a niche, it is difficult to

gain credibility rapidly in order to attain tenure. In this sense, starting out in interdisciplinary science is somewhat of a high-risk venture. Young people do it because they are fascinated by the science and that is what really counts, and I certainly encourage young scientists, no matter what, to pursue that which fascinates them. Life in science is too short to waste valuable years “treading water.” My own students, having graduated, have all proceeded to postdoctoral careers in the wider community of bioscience. Biologists have a sincere appreciation for the skills of physicists, and a young biological physicist with a PhD in Physics and a broad interest in biology can find all sorts of great opportunities in bioscience departments. On a related note, I highly recommend young faculty to be proactive in creating collaborative ventures. In these times of abysmal levels of federal funding, one’s best bet for successful funding may well be as a co-PI on a larger collaborative grant. Do not wait passively for the email asking you to take part in such ventures – be highly visible on campus and create opportunities.

A related but more depressing question -- do you think the current economic situation in the US will have a direct impact on job prospects in interdisciplinary science?

I think, pragmatically, there is a clear danger that a shrinking pot of money will lead to starvation of interdisciplinary programs, both at the level of federal funding agencies, and at the level of campus priorities. This would have severe negative impact on US science. There are a number of very large, highly interdisciplinary bioscience initiatives funded by the European Community, and the US could easily find itself left in the dust over the next decade. That said, from my experience serving on panels at NSF and NIH, I know there are serious and significant efforts within the agencies to nurture the new interdisciplinary programs connecting biological physics and various bioscience areas. University administrators, chairs, and faculties have to seriously consider the intellectual momentum of science at the global scale and continue to invest in interdisciplinary programs. In parallel, we must work hard to redefine metrics and expectations so that these new programs can be successful, both in training new scientists and with regard the prospects for young

tenure-track scientists who work in these areas. To end the interview on a more positive note, I think the intellectual richness of biological physics, along with the talents and excitement of the new generation of young scientists in the area, bode extremely well for the future, both in terms of scientific discovery and the strength of the field as measured by job prospects and funding.

CBP Faculty

The CBP has 16 core faculty members listed below. Eleven have their home appointment in the Department of Physics, four in Chemistry, and one in Electrical Engineering.

Petra Fromme (Chemistry/Physics)

The research in the group of Petra Fromme focuses on the structural biochemistry and biophysics of membrane proteins. The understanding of the structure, dynamics and function of the large membrane protein complexes involved in the primary processes of photosynthesis is the main field of interest. Photosynthesis is the unique energy source for all higher life on earth and produces all the oxygen in the atmosphere; the Fromme lab also works on the design of new concepts for bioenergy based on the structure and function of the natural photosynthetic systems.

Ying-Cheng Lai (Electrical Engineering/Physics)

Y.-C. Lai applies ideas from non-linear dynamics to a range of problems in computational biology. His other research areas include complex networks, signal processing, MEMS, and quantum transport in nanostructures.

Marcia Levitus (Chemistry/Physics)

The Levitus group applies state-of-the-art techniques of single molecule spectroscopy to study complex biological systems, such as nucleosome dynamics, and transitions between DNA conformations.

Stuart Lindsay (Physics/Chemistry)

The Lindsay lab uses scanning probe and nanofabrication to probe the properties of single molecules, particularly to follow biochemical and electronic processes in-situ. One of the current lab projects aims to use hydrogen-bond mediated electron tunneling to identify bases in DNA as a

route to a new rapid, single molecule sequencing technique.

Dmitry Matyushov (Physics/Chemistry)

The Matyushov group studies thermodynamics and dynamics of biological electron transport and photosynthesis, and hydration and electrostatics of proteins.

Timothy Newman (Physics/Life Sciences)

The Newman group is interested in emergent phenomena in biology. Systems at all biological scales are studied, but particular emphasis is placed on emergent large-scale cell movement in embryonic development. The group has created the Subcellular Element Model algorithm to compute three-dimensional dynamics of embryonic processes composed of many thousands of cells.

Banu Ozkan (Physics)

S. Banu Ozkan's research is focused on theoretical models and computational simulation in biological systems. She has several research interests : (i) to understand the sequence-structure function relationship in proteins using evolutionary information (i.e. how amino acid sequence encodes a protein's specific structure and function and how new functions evolve), (ii) how dynamics governs protein mechanisms, (iii) how proteins assemble into molecular machines, and (iv) prediction of protein-protein interactions taking into account chain flexibility.

Peter Rez (Physics)

Research in Peter Rez's group is in two areas: i) calculating electromagnetic response of large biomolecules, to see if there is a way to distinguish biothreats from innocuous molecules using a part of the electromagnetic spectrum - this project involves examining frequency response from all the various terms contributing to the total energy of the molecule as represented by a force field and could lead to insights into the mechanisms of protein folding; ii) biomineralization, both normal and pathological - this involves experimental imaging studies using SEM, AFM, PEEM to understand the interface between biomolecules such as proteins or phospholipids and the mineral surface as well as theoretical modeling of amorphous biomineral phases.

Robert Ros (Physics)

The lab of Robert Ros develops and improves nanobiophysical techniques to elucidate fundamental biological processes, properties, and structures. Examples are single molecule studies on protein-DNA and protein-RNA interactions related to transcriptional and post-transcriptional regulation, bacterial surface structures and charge transfer in bacterial nanowires, as well as cell mechanics and adhesion.

Otto Sankey (Physics)

Otto Sankey is performing simulations of rapid electronic sequencing of ssDNA translocating through a nanopore. This work is in collaboration with Prof. Lindsay. In a second project, Sankey is studying vibrational modes of viral capsids and their coupling to ultra-short laser pulses. Experiments by F. Tsen have shown that light scattering is a means by which viral pathogens can be inactivated; an initial application is the cleansing of blood through laser treatment.

John Spence (Physics)

John Spence leads work on the use of femtosecond X-ray pulses to get diffraction patterns from individual hydrated proteins in a stream. This will run across the DOE's new LCLS free electron laser, nearing completion at Stanford. The aim is to solve proteins which cannot be crystallized.

Michael Thorpe (Physics/Chemistry)

Michael Thorpe's research interests are in the theory of disordered systems, with a special emphasis on properties that are determined by geometry and topology. In recent years he has developed the mathematical theory of flexibility and mobility for proteins. Areas of current interest involve fitting cryo-EM data, viral capsid formation and amyloid formation.

Kong-Thon Tsen (Physics)

K.T. Tsen is interested in the interaction of photons with biological materials, in particular in the microscopic mechanisms of the laser-virus, laser-bacterium and laser-cell interactions with ultrashort pulsed lasers.

Sara Vaiana (Physics)

The Vaiana group is establishing a new laser spectroscopy lab where fast laser pump techniques

and advanced light scattering are used in combination, to investigate the structural and dynamical properties of intrinsically disordered proteins and their relation to pathological aggregation. As an example, they are currently investigating intra- and inter-protein interactions in Islet Amyloid Polypeptide (or "amylin"). This is a hormone peptide, product of the pancreatic islet, which has a range of metabolic effects that relate to nutritional status and is the main component in amyloid deposits formed in type II diabetes.

Arjan van der Vaart (Chemistry/Physics)

Research in the van der Vaart group is focused on conformational changes, the changes in shape of a protein upon binding other molecules. It is well-known that conformational changes are crucial for the functioning of many proteins (for example for

motor proteins, enzymes, allosteric proteins, and transcription factors), but the causes of this behavior are often unclear. His group is particularly interested in proteins that fold, unfold, or refold upon binding, and use computer simulations to elucidate the key interactions responsible.

Neal Woodbury (Chemistry/Physics)

The Woodbury group is investigating the role of protein dynamics in the electron transfer reactions of photosynthesis. This involves performing ultrafast spectroscopy on photosynthetic reaction centers from purple nonsulfur bacteria. They monitor both the protein movement and the electron transfer kinetics and try to understand the correlation.

CONFERENCE ANNOUNCEMENT

2009 GORDON RESEARCH CONFERENCE ON NONLINEAR SCIENCE

The 2009 Gordon Research Conference on Nonlinear Science,
will be held in at
Mount Holyoke College, South Hadley Massachusetts, USA
from June 28 - July 3, 2009.

We expect to bring together an outstanding and diverse group of
scientists at the forefront of research. Topics will span fluids,
biology, condensed matter, and dynamical systems.

More information is available
at the Gordon Research Conferences website:

<http://grcmail.grc.uri.edu/meetings.aspx?year=2009>

For additional information, please contact
Bob Behringer (chair: bob@phy.duke.edu)
or Stephen Morris (vice-chair: smorris@physics.utoronto.ca).

PROGRAM / WORKSHOP ANNOUNCEMENT

Program on Morphodynamics of Plants, Animals and Beyond

to be held at the

Kavli Institute for Theoretical Physics

at the University of California, Santa Barbara

August 24 - September 25, 2009

Applications are due March 1, 2009 at the KITP web site at

<http://www.kitp.ucsb.edu/activities/auto/?id=976>

This five-week program will seek to bring to bear current developments and foundational work in models of morphodynamic processes. Beneficiaries will include biologists who bring their problems, and physicists, applied mathematicians, and computer scientists who bring capabilities to more deeply understand such spatially dynamic problems. KITP programs differ from many conferences and workshops in that they create a situation where scientists learn from each other and actually do substantive research, often collaborating with other participants. To foster these interactions, KITP strongly encourages all theorists to stay for as long as possible, with three weeks being the minimum stay for a regular participant. We understand, however, that experimentalists usually cannot manage long visits but can have a big impact even in a week, so we can be more flexible for them.

For examples of other KITP activities, please see <http://www.kitp.ucsb.edu/activities>.

It is necessary for every participant to set up an account and apply online, even if we have already corresponded with you about the program. Because of space and budget limitations, participation is by invitation only, and we may not be able to accommodate everyone who applies. Late applications will be considered as budget and space permit.

Some level of financial support will be available to invitees, the amount depending both on the needs of the participants and the availability of funds. KITP provides office and computing facilities on its site at UC Santa Barbara and also provides help in finding affordable living accommodations. For participants considering bringing children for periods of four weeks or more, there may be some additional support available through our Rice Family Fund. Actual commitments of office space and financial support can be made only by written formal invitations from the KITP Director, David Gross, regardless of any communications you may have had with us.

Conference Coordinators:

Eric Mjolsness (emj@uci.edu)

Elliot M. Meyerowitz (meyerow@caltech.edu)

Clare Yu (cyu@uci.edu)

SPECIAL DBP ANNOUNCEMENT

Announcing the

2009 Shirley Chan Student Travel Grant Competition

The Division of Biological Physics will award several travel grants of up to \$400 each for a graduate student first author of a contributed paper (talk or poster) in sessions sponsored by DBP at the APS March Meeting.

Applicants will be chosen on the basis of the quality of their work as evidenced by the abstract of the paper, a letter of support from their thesis advisor and the travel distance to attend the conference.

Both student and advisor, domestic or foreign, must be members of the DBP, not just of the APS.

New members can sign up at <http://www.aps.org/membership/join.cfm> , and are encouraged to do as soon as possible for verification purposes.

Look for an application form at <http://apsweb.aps.org/units/dbp/>.

CALL FOR PAPERS

**Call for papers for a forthcoming Special Issue of
The Journal of Biological Physics
NEURON-GLIA INTERACTIONS:
NEW PERSPECTIVES IN HUMAN INFORMATION PROCESSING**

**Guest Editor:
Giovanni Pioggia (University of Pisa)**

New reports are constantly enhancing our understanding of the bidirectional signaling between neurons and glia, opening fascinating perspectives over the role of these cells in human brain information processing. The underlying mechanisms and the crucial modulating role of glia are becoming clearer through the study of synaptic activities. Re-examinations and refinements of existing studies on dynamics of neuron-glia interactions are needed. Self-consistent models of the neuron-glia information processes able to capture the synaptic dynamical and computational properties will have an impact both in brain neurophysiology and in network and non-linear dynamics theory, defining a new path for neuroscience.

As a reflection of the growing importance of these research topics the Journal of Biological Physics will publish a special issue dedicated to the role of glia in information processing. Challenging mathematical efforts and in-depth analysis, as well as new perspectives, devoted to the development of biophysically-consistent models of the neuron-glia role and signaling will be reported. These contributions investigate a part of the brain that is largely unexplored and we hope that they will encourage and inspire researchers looking beyond neurons.

Contributors:

**Eshel Ben-Jacob, Tel Aviv University
Maurizio De Pittà, Tel Aviv University
Ludo Van Den Bosch, Catholic University of Leuven
Angelo Di Garbo, Institute of Biophysics of National Research Council, Italy
Fábio Augusto Furlan, University of Marília
Renato Nobili, University of Padua
Alfredo Pereira Jr, São Paulo State University
Dmitry Postnov, Saratov State University
Vladislav Volman, University of California at San Diego**

Papers to be considered for this special issue should be submitted via the link below, specifically choosing as article type “Neuron-glia interactions”.

<http://www.springer.com/physics/biophysics/journal/10867>

CALL FOR PAPERS

**Call for papers for a forthcoming Special Issue of
*The Journal of Biological Physics***

BOUNDARIES OF BRAIN INFORMATION PROCESSING

Guest Editors:

Jose Luis Perez Velazquez (University of Toronto)

Jack Tuszynski (University of Alberta)

Luis Garcia Dominguez (University of Toronto)

It is a fundamental goal of neuroscience to understand the limitations of information processing in nervous systems and particularly in the mammalian brain, not only to better comprehend cognitive functions and the perception of reality, but also to characterise pathological mental/brain states. Equally important is the understanding of self-consciousness, that is, that the brain is not only aware of its surroundings but also of its own functioning. This scheme contains the implicit assumption that brain states like the "self" can be comprehended by the brain itself. The constraints imposed by autonomous neural/mental activity and internal brain architecture have to be acknowledged as much as those imposed by the environment. In addition to the limits imposed by the intricacy of the brain's cellular circuitry, other logical limitations may also play a role, specifically the highly debatable issue of whether the fundamental limitative theorems in mathematical logic can also apply or are relevant to the mind as a formal system.

The Journal of Biological Physics is preparing a special issue dedicated to the boundaries of brain information processing that will include works that deal with different aspects of brain and machine information processing, and from distinct perspectives: mathematical, physical and philosophical, as the examination of these queries requires a multidisciplinary approach. We hope that these contributions will stimulate readers to further explore the complexities of the mental world that brains create.

Contributors:

Jeff Buechner, Rutgers University

Christopher Cherniak, University of Maryland

Stuart Hameroff, University of Arizona

Andrei Khrennikov, University of Vaxjo

John Taylor, King's College, London

Jack Tuszynski, University of Alberta

David Wolpert, NASA Ames Research Center

Paola Zizzi, University of Padova

Papers to be considered for this special issue should be submitted via the link below, specifically choosing as article type "brain information processing".

<http://www.springer.com/physics/biophysics/journal/10867>

PRL HIGHLIGHTS

Soft Matter, Biological, &
Inter-disciplinary Physics Articles from
Physical Review Letters

3 October 2008

**Vol 101, Number 14, Articles (14xxxx)
Articles published 27 Sept - 3 Oct 2008**

<http://scitation.aip.org/dbt/dbt.jsp?KEY=PRLTAO&Volume=101&Issue=14>

**Topology of Smectic Order on Compact
Substrates**

Xiangjun Xing

Published 1 October 2008 // 147801

**Reentrant Condensation of Proteins in
Solution Induced by Multivalent
Counterions**

F. Zhang, M. W. A. Skoda, R. M. J. Jacobs, S.
Zorn, R. A. Martin, C. M. Martin, G. F. Clark,
S. Weggler, A. Hildebrandt, O. Kohlbacher,
and F. Schreiber

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JOB AD

Postdoctoral Position Available in Single Molecule Biophysics

A position is available in the group of Professor Lori Goldner at the Department of Physics at the University of Massachusetts, Amherst, for an individual interested in studying molecular folding and/or interactions in crowded or confining environments using single molecule optical techniques. Existing or planned projects include a study of protein aggregation or polymerization one-molecule-at-a-time; the measurement of structural changes during transient nucleic acid/protein complex formation; or the triggering and observation of irreversible transformation on a single protein or complex.

The use of confining environments – such as subfemtoliter water droplets, liposomes, or cell compartments – both facilitates these studies and enhances their relevance to biological systems. The use of single molecule measurement techniques permits us to understand in detail the dynamics and kinetics of biological molecular interactions. The use of techniques that involve single molecule manipulation permits us to construct complex systems from their individual building blocks, and to study and control the emergence of new collective properties and behaviors.

The successful candidate will work as part of an exciting and growing effort at the University of Massachusetts in single molecule techniques, cytoskeletal biophysics, protein folding and membrane biophysics. There is considerable opportunity for a sufficiently motivated and talented individual to forge new collaborations and propose related projects.

Interested individuals should contact Professor Goldner at lgoldner@physics.umass.edu or call 413 545 0594, and send a CV and contact information for 3 references.

JOB AD

COMPUTATIONAL MODELING OF MOLECULAR MOTORS AND INTRACELLULAR TRANSPORT POSTDOCTORAL POSITION

The University of California, Irvine anticipates the availability of 1 or 2 postdoctoral positions in theoretical biological physics beginning as early as 2009. The successful candidate will model intracellular transport, e.g., motor proteins carrying cargos along filaments. The successful applicant will have a strong theoretical physics background and computer skills, as well as an interest in understanding biology. Further, they must work well with others, as significant collaboration with experimentalists will be necessary. Experience with Monte Carlo simulations and C++ is useful. The minimum qualification is a Ph.D. in physics or a closely related field. Applications (including a CV, list of publications, and three reference letters) should be sent to Prof. Clare Yu, Department of Physics and Astronomy, University of California, Irvine, CA 92697-4575. For full consideration, applications should be submitted by January 5, 2009. UCI is an equal opportunity employer committed to excellence through diversity.

JOB AD

EXPERIMENTAL POSTDOCTORAL POSITION MOLECULAR MOTORS AND INTRACELLULAR TRANSPORT

The University of California, Irvine anticipates the availability of a postdoctoral position in experimental biophysics beginning as early as 2009. The successful candidate will do in vitro (and in vivo) experiments on molecular motors, looking at a variety of issues related to how multiple motors function together. While a strong background in biology is not required, the successful applicant will be expected to have an interest in understanding biology, and will need to learn a great deal of biology to be successful. Experimentally, some knowledge of optics, electronics, and computer control of instrumentation is important, since the project involves optical traps and advanced instrumentation. Because the project will be multi-disciplinary, a desire to learn new approaches is critical. The applicant will be expected to work well as part of a group, and collaborate with theorists. The minimum qualification is a Ph.D. in physics, biomedical engineering, chemistry, or a closely related field. Applications (including a CV, list of publications, and three reference letters) should be sent to Prof. Steven Gross, Department of Dev. and Cell Biology, University of California, Irvine, CA 92697. For full consideration, applications should be submitted by January 5, 2009. UCI is an equal opportunity employer committed to excellence through diversity.

JOB AD

Princeton University Postdoctoral Research Associate

The successful candidate will undertake joint experimental/theoretical research into how bacterial cells establish, maintain, and change their shapes. This is a fundamental open question in the biology of bacteria. While the chemical composition of the cell wall that gives these cells their shape is well characterized, the way in which the cell wall is organized and rearranged to achieve the wide variety of observed shapes and permit continuous growth remains unclear. To begin to address these questions, we have developed a computational, biophysical model for cell-wall organization. We envision extending these studies by combining experimental microscopy and molecular genetics approaches with computational data analysis and additional theoretical modeling of cell-wall structure. Important new areas of focus include the cell-wall dynamics during cell growth and division. The research will provide opportunities for learning both experimental and computational/modeling approaches as it will be conducted as a close collaboration between the Gitai and Wingreen labs, exploiting the Gitai lab's experimental expertise with advanced live-cell imaging and molecular genetics and the Wingreen lab's expertise in data analysis and modeling. The position is available immediately. All interested candidates should submit a CV, cover letter, and three letters of recommendation.

A Ph.D. in Physics, Applied Physics, Biophysics or a closely related field is required, as is experience in computer programming.

A strong interest in biology and the desire to pursuing a career in research at the interface of physics and biology is preferred.

Princeton University is an equal opportunity employer and complies with applicable EEO and affirmative action regulations. You may apply online at <http://jobs.princeton.edu> (search on requisition number 0800330) or for general application information and information on how to self-identify, please see <http://www.princeton.edu/dof/ApplicantsInfo.htm>. We strongly request that all interested candidates use the online application process.

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 quantitative PhD and experience in computational modeling. The position is available from now until Sept 2009; however, the ideal start date is April 2009. Please submit your CV and up to three letters of recommendation to andrew.rutenberg@dal.ca The position is for one year, though additional funding should become available.

