# THE BIOLOGICAL PHYSICIST

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

Vol 4 № 4 October 2004



## In this Issue



With the October issue of THE BIOLOGICAL PHYSICIST, we inaugurate our new Job Ads section. Details of ad format were sent to you a few weeks ago. Briefly, ads must be submitted by DBP members, be for positions in the field of biological physics or a closely related area, and be about 20 lines long. Ads sent in Microsoft Word format are preferred. Ads can be run for multiple issues; remember that THE BIOLOGICAL PHYSICIST appears every other month.

Also in this issue, we feature a profile of the Center for the Study of Biological Complexity (CSBC) at Virginia Commonwealth University. Turn to page 2 to begin a tour of this exciting research Center!

And, of course, PRE Highlights appear on page 8.

Stay tuned for more exciting biological physics news in the December issue.

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# The Center for the Study of Biological Complexity at Virginia Commonwealth University

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**Tarynn M. Witten, Lemont B. Kier and Gregory A. Buck[*]**

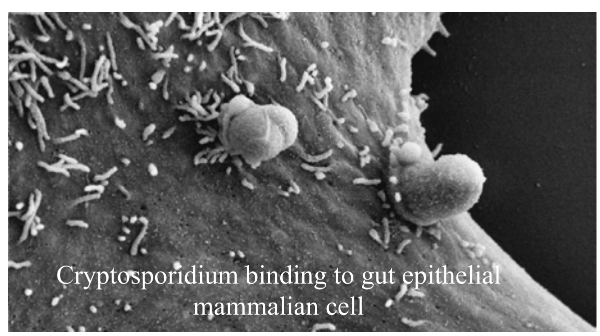
Biological complexity is the study of emergent, adaptive, and evolutionary properties of hierarchical biological systems. In a very real sense, the study of biological complexity is a mathematically and computationally-based extension of discovery science and systems biology. The *Center for the Study of Biological Complexity* was established in 2001 as a new focus of research and scholarly activity at Virginia Commonwealth University (VCU). The mission of the Center is to build an academic community centered on integrative discovery science, systems biology and the principles of complexity to address the challenges of the life sciences revolution of the 21st century.

As recently as the mid-1990s, the dramatic advances in the life sciences — fueled by the re-emergence of "discovery science" and "systems biology" — were largely unanticipated. High throughput genomics, transcriptomics, proteomics – the 'omics' hierarchy – and the development of bioinformatics have created a paradigm shift in life science research that demands application of new integrative methodologies and approaches. The Center was created in VCU Life Sciences to provide an environment that will provide its fellows the opportunity to excel in this new scientific world.

**The Goal.** The overall goal of the Center is to elucidate and understand the functional roles of molecular interactions that vary both temporally and spatially in macromolecules, cells, tissues, organs, organisms, ecosystems and environments. We focus primarily on cellular and organismal systems for which the component parts are becoming available through technologies of the 'omics' hierarchy. Our efforts require identification of the myriad macromolecules that comprise the pathways and cascades of molecular interactions that drive cellular processes, the assessment of time-dependent information flow through the systems in both normal and pathological states, and finally the reduction of the mass of detailed data into a set of interacting theoretical and computational models that describe these processes.

**Research Model – Massively Integrative Science.** Our research model is one in which scientists historically separated by disciplinary boundaries, often referred to as 'silos', work in close collaboration to advance the integrative discovery science and systems biology which have emerged as a consequence of the recent rapid advances in genomics, proteomics, and bioinformatics. Therefore, it is not surprising that the over 80 members of the Center come from 24 departments and six schools within VCU. A growing cadre of external fellows, from diverse backgrounds in academic and research institutions around the world, also participate in Center activities.

**What is complexity?** Complexity-based researchers assume that interactions evoke emergent properties that cannot be predicted or understood from the 'parts list', and must be observed and modeled at higher levels. The Center embraces the concept that we will only understand the function of cells, macromolecules, tissues, organs, organisms, and indeed the secrets



Cryptosporidium binding to gut epithelial mammalian cell of life itself, through an integrative global approach of simultaneously studying all of the parts in a system; e.g., a pathway, organelle, cell or organism, and attempting to derive and validate mathematical and computational descriptions and models of these systems.

The approaching life sciences' revolution requires the capacity to rapidly acquire, decipher and manipulate biological information at a system-wide level. Biological information can be compartmentalized into three categories; *i.e.*, that which is present in genes, that which is present in the three dimensional structure of proteins and other macromolecules, and that which arises from the complex molecular interactions and networks of molecular interactions that differentiate "life" or biology from physics or chemistry. What is striking about these complex systems and networks is the appearance of so-called emergent properties. That is, properties that arise as a consequence of the interaction of many different fundamental units, and that are more than the sum or average of the individual interactions. Thus, emergent properties cannot be predicted *a priori* from the properties or values of the individual units themselves. Studies of emergent properties arising from the complexity of life processes represent the new exciting paradigm for the biomedical scientist.

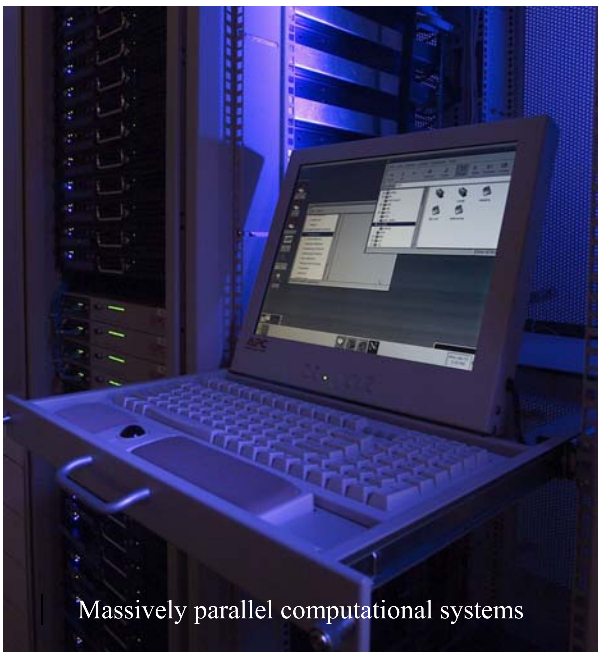
**Discovery Science and Systems Biology provide the 'parts lists'.** Three areas of Life Sciences: bioinformatics, genomics, and proteomics; lead to discovery of gene, RNA, and protein 'parts lists', and are crucial in the germination of Center activities. Our focus on microbes and other cellular systems reflects the availability of these component lists for these systems. Rapidly expanding capabilities to manipulate gene content and expression in microbial and multi-cellular organisms, detect protein-protein interactions, and quantify the activities of macromolecules in vivo suggest the capacity to predict quantitatively the altered behavior of these systems that results from their genetic or pharmacological manipulation. Bioinformatics has recently emerged, as the size of data sets in biomedical research has increased, as an essential component of this work. Progress in the new integrative discovery science and systems biology is inconceivable without bioinformatics; *i.e.*, bioinformatics is intrinsic to and irreplaceable in the new paradigm of biomedical research that is now developing in the Center.

**Complexity Science provides interpretations and testable hypotheses.** The study of complex biological systems depends upon information derived from discovery and systems-based technologies. However, a simple analysis of the components of a system is incapable of detecting, measuring or characterizing emergent properties that derive from the interactions of the components and processes comprising the system. Complexity analyses invoke a non-linear reconstruction or synthesis of that part of the system under study. This analysis is accomplished using computational or what is sometimes called '*in silico* modeling'. Applying such modeling strategies is central to the mission of the Center for the Study of Biological Complexity at VCU.

Examples of *in silico* modeling methods include but are not limited to: a) molecular orbital calculations, molecular electrostatic potential mapping, and topological calculations, b) dynamic simulations based on molecular dynamics and Monte Carlo simulations, c) and dynamic systems simulations using cellular automata and d) Large-scale high performance computational simulations and simulation laboratories. These methods generate information about the emergent properties and the perpetual novelty of complex systems. These studies are one part of the research and academic activity underway in the Center.

**Tools and infrastructure for System Oriented Biological Complexity Research.** To accomplish our goals, the Center has developed human assets, research infrastructure, and training programs. *Human resources* have been a primary focus of our initial investments. The Center functions as a broad-based 'think tank' for groups of like-minded, but diverse scientists that include both internal and external fellows. Through Center efforts, 80 plus biologists, biomedical scientists, physicists, chemists, mathematicians and investigators from other fields have coalesced as a critical mass of scientists applying the principles of complexity to life's processes. In addition, the Center has recruited and hired a dozen new scientists to our programs in as many disciplines, including biology, infectious diseases and microbiology, biostatistics, pharmacogenomics, bioinformatics and chemical engineering, and recruiting is continuing apace. We are currently recruiting a mid-level established mathematical biologist with interests in cellular and other biological modeling (http://www.vcu.edu/csbc/employment.html). Finally, our unique External Fellows and Visiting Scientist programs provide opportunities for scientists from all over the world to visit, use Center facilities and resources, and work with our internal fellows.

*Research infrastructure* has also been a strong focus of continuing investment. Facilities of the Center include: 1) the Bioinformatics Computational Core Laboratories, housing VCU's supercomputer systems and all bioinformatics software and databases; 2) the Advanced



Massively parallel computational systems

Scientific Visualization laboratory which maintains infrastructure for visualization and rendering of scientific data and simulation output; 3) the Nucleic Acids Research Facilities, which house our genomics, transcriptomics, and molecular interactions infrastructure; 4) the Mass Spectrometry Resource for Biological Complexity, which maintains our proteomics capabilities; and 5) the Structural Biology and Pharmacogenomics Core, which provides structural analyses from X-Ray crystallography to *in silico* molecular modeling and rational drug design. Resources are now available to implement Phase II of the development of our bioinformatics computational capability in the form of a new Center for Advanced Scientific Computation (CASC). Please see our web site for more information about these resources (http://www.vcu.edu/csbc).

*Training Programs*. Prosecution of complexity-based science requires a continuous influx of young, enthusiastic, idealistic and non-traditional trainees. We have addressed this need at VCU at both the undergraduate and graduate levels. Thus, the Center offers undergraduate and graduate programs in bioinformatics - a new integrative discipline that applies state-of-the-art advances in information technology to advanced biological and biomedical research (http://www.vcu.edu/csbc/bioinformatics). We elected to create these programs in bioinformatics

Teaching bioinformatics in the Center

as the most appropriate degree for a new generation of scientists applying the principles of complexity to study biological systems; i.e., bioinformatics provides the means to analyze, interpret, and model data sets generated in contemporary systems-wide investigations spawned by the ongoing genomic revolution in biological research. Programs, offered include Virginia's first undergraduate major in bioinformatics and two master's options. The Bachelor and Master of Science degrees offer three tracks focusing on Biology and Genomics, the Computational Sciences, or the Quantitative Sciences and Statistics.

The master's program offers two options - a traditional 'thesis'-based Master of Science in Bioinformatics and a professional Master of Bioinformatics. The Master of Science in Bioinformatics provides in-depth advanced academic research preparation for leadership positions in biological and biomedical research in academia or industry, or leading to a Ph.D. program. The Master of Bioinformatics provides MBA-like training in bioinformatics and includes semester-long industrial externships and associated training that will prepare students for research positions in the pharmaceutical, biotechnical or medical industries. Development of the Master of Bioinformatics option was supported by a grant from the Alfred P. Sloan Foundation's Professional Science Master's Degrees program (http://www.sciencemasters.com/).

**Bioinformatics training at VCU:**

- **Bachelor of Science**
- **Accelerated (5 year) combined BS - Masters**
- **Master of Bioinformatics (Sloan – funded)**
- **MS in Bioinformatics**
- **Ph.D. in Integrative Life Sciences**

A unique, accelerated, combined B.S.-M.S. degree program provides select students an opportunity to complete both degrees in a five-year time frame. This program is available for both the thesis and professional master's programs, and provides an attractive alternative for very talented, highly-motivated students to move through their undergraduate and graduate training at an accelerated pace.

"Bioinformatics is the application of contemporary information technology to solve new and very complex biological problems," said Gregory A. Buck, Ph.D., director of the Center. "Genomic, global systems-wide research strategies have revolutionized biological research and future biological scientists need new, non-traditional tools to compete." Bioinformatics is central to research focusing on integrative systems biology and biological complexity. Our interdisciplinary programs in bioinformatics were developed to prepare our students for this challenge.

We have also developed a Ph.D. option for bioinformatics students and for students focused specifically on systems biology and biological complexity research. This program, the Ph.D. in Integrative Life Sciences at VCU, has flexible requirements that permit the student and his or her advisors to tailor a training plan that is appropriate to the needs of the incoming Ph.D. student.

Finally, complementing and feeding these new bioinformatics programs, the Center was recently funded by the National Science Foundation and the National Institutes of Health to create the Bioinformatics and Bioengineering Summer Institute (http://www.vcu.edu/csbc/bbsi) at VCU, one of only nine such programs in the nation. This unusual two-year summer program exposes upper level undergraduates from across the U.S. to the principles and practices of bioinformatics and bioengineering. VCU's program began in summer 2003 and runs for 10 weeks each year. Last summer, 30 outstanding undergraduates from across the U.S. learned and practiced bioinformatics and bioengineering in our BBSI program. Several of these individuals have now joined our graduate programs, creating a pipeline of new disciples to the principles of systems biology and complexity and strengthening our research efforts.

CHEMISTRY & BIODIVERSITY

*Other Scholarly Activities*. The Center partnered with Verlag Helvetica Chimica Acta AG, to create a new journal -- ***Chemistry and Biodiversity*** – launched in January of 2004. This new journal focuses on the biological complexity at the chemical level. This relationship with this publisher reflects our keen interest in cooperative relations with scholarly and educational publications. Working through *Chemistry and Biodiversity*, the Center will disseminate research results in the chemical and biochemical areas of complexity science. In addition, we anticipate that other scientific and educational writings will come from Center Fellows and will find its way to other scientists and students through the skilled hands of the journal publisher. The new journal is listed as an official publication of the Center. Dr. Bernard Testa, a computational chemist from the University of Lausanne and an External Fellow of the Center is the Editor-in-Chief, and Dr. Lemont Kier, a Senior Fellow of the Center at VCU, is the Associate Editor for North America.

Center Fellows are extremely active in international research, leading such efforts as the *Cryptosporidium hominis* Genome Project (http://www.hominis.mic.vcu.edu/), the *Streptococcus sanguis* Sequencing Project (http://www.sanguis.mic.vcu.edu/), the International Cyanobacteria Genome Annotation Project (http://www.vcu.edu/cyanonews/), the Virginia Cancer Genome Project (http://www.ctrf-cagenomics.vcu.edu/) the Virginia Bioinformatics Consortium (http://vabioinfo.org/), and the *Trypanosoma cruzi* Functional Genomics Project.

**Research in the Center.** Research activities at the Center for the Study of Biological Complexity at Virginia Commonwealth University range through the hierarchy of complex biosystems from water through ecology. Though our scope is broad (see table), a significant concentration of our research is in the area of microbial and other cellular systems. To briefly highlight some of these activities it is convenient to step through this scheme of biological complexity and to illuminate a few active projects.

**Research Foci in the Center**

- **Microbial systems biology & pathogenesis**
- **Gene networks and cellular control mechanism**
- **Structural biology and pharmacogenomics**
- **Environmental and ecological systems**
- **Mathematical and computational biology**

*Molecular Systems.* An active program at this level of complexity is the development and use of quantum mechanical programs to explore the structure attributes of biologically active molecules. These studies are directed toward molecules such as melatonin and the neurotransmitters, dopamine and serotonin and their inhibitors. The complex systems formed from the encounter of ligands, receptors and water result in emergent properties labeled biological activity. Current studies at the Center examine these compounds as agents in these complex systems and relate their structures to emergent behavior. The goal is prediction based on a model and molecular design from the information.

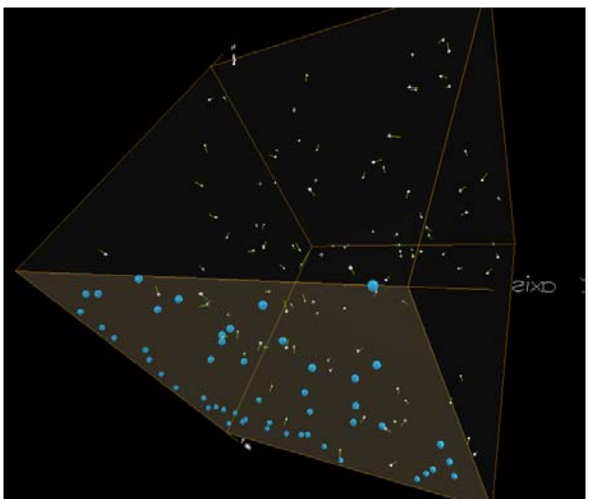
Another area of research at the molecular systems level explores the solvent behavior of water. This vital member of the trio described above has a dramatic influence on the emergent properties of solvents in its embrace. The behavior of solutes, due in part to their hydropathic states, is another molecular system study at the Center. This work has led to a computational approach that encodes the realms of varying hydropathic states on a molecule. In another area of research, the development of quantitative structure activity models, QSAR, enhances the molecular design potential.

Research is being conducted on protein and enzyme electron transfer associated with ligand-receptor binding. One study is directed toward cytochtome-C oxidase in lipid bilayers. Other projects study RNA-drug and RNA-protein interactions. The use of NMR and X-ray crystallography is well suited to address these interactions and to shed light on the emergent properties arising from the synergy into complex systems experienced by these agents. The toxicity of aminoglycoside antibiotics is another focus in this area of research, designed to understand and control, by molecular modification this activity.

*Cellular Systems.* Working at a higher hierarchical level of complexity are groups at the Center studying the cellular-level complex systems with emphasis on microbial systems and the disease states produced by microorganisms and forced upon normal cells as infections. The intrinsic complexity and the emergent properties at this level are of prime interest in these studies. There is recognition that emergent properties arise from the information generated by agents at lower levels, for example the macromolecules associated with the genetic guidance within the cell, the interaction of the products of genes, and the dynamics related to enzymatic and physiological networks and pathways. The genomes of these microbial pathogens and their hosts provide the 'parts lists', their transcriptomes and proteomes provide the dynamic data sets, and the 'interactomes' provide the networks and pathways that manifest as emergent properties that must be interpreted and modeled using the principles of complexity.

*Organisms.* At the multicellular level of complex systems are the realm of disease, ecological systems and the human condition. A number of Center research programs fall into this category. Several studies are directed toward diseases caused by single celled microbial pathogens. Multi-scale *in silico* models of these conditions and the epidemiology of these complex systems at several levels are defining new strategies for understanding the nature of these diseases and providing new insights into development of prevention and treatment modalities. Other organismal studies focus on the human host, and examine processes such as aging and multi-organ trauma or shock.

**Information and Theory.** A central theme among all of the groups in the Center is the need to generate, encode, and use large complex data sets.



Virtual parasite modeling

A cadre of Center theorists is developing new approaches to addressing this essential component of studying complex systems. This research invokes mathematics, computer science, information theory and *in silico* modeling.

Other studies focus on the theoretical analysis of and applications of non-linear difference equations and discrete time dynamic systems modeling. Topics in these studies range from studies of deterministic chaos to the understanding of the stability of cycles. Prediction of behavioral patterns of these models, patterns such as oscillatory convergent or unbounded dynamics, are among a few of the objectives of these studies.

Other projects makes use of graph theoretic and network analysis models to construct multi-species longevity-gene networks and to understand, through theoretical methods similarities and differences between these networks and how those differences may be used to further understand the biology of aging.

Cellular automata models of complex systems are prominent in many modeling projects exploring emergent properties and the decline of agent property space in a process called dissolvence. Many of these models are directed toward water, solutions and molecular system behavior. Another active project in the Center is our attempt to quantify complexity in topological systems.

**Summary.** The Center for the Study of Biological Complexity at VCU represents our response to the ongoing revolution in life science research spawned primarily by the advances in genomic science. At the Center, we accept the premise that living processes are complex systems, and that study of these systems requires the integrative, multidisciplinary approaches of systems biology. We have created an environment which fosters development of an interactive and cooperative spirit among investigators in widely disparate fields. Our Fellows represent over two dozen departments in six schools at VCU. Mathematicians, biologists, physicists, chemists, and engineers work side by side on new research projects. Recruitment of new faculty, external fellows and visiting investigators has advanced a 'think tank' like environment in the Center. Facilities and infrastructure that promote systems-based approaches; i.e., high throughput genomics, proteomics, interactomics, and pharmaco-genomics, have been enhanced or created. Bioinformatics has been fostered through development of computational hardware, software and personnel, and further enhanced by the creation of undergraduate and graduate training programs. An emergent property of this effort has been the synergistic development of a plethora of new interdisciplinary research projects.

Interestingly, the result of our effort indicates that the Center itself can be viewed as a complex system. The Center has synergistically self-organized. The components; i.e., personnel from multiple disciplines, infrastructure for high throughput systems biology and bioinformatics, dedicated and ambitious students and trainees, and complex multidisciplinary research interests, have coalesced spontaneously into new research collaborations, strategies, technologies and goals. In a real sense, we view the synergistic development of our Center as a true validation of the principles of complexity for which it is named.

*Tarynn M. Witten, Ph.D., is Senior Fellow and Director of Research and Development in the Center; Lemont B. Kier, Ph.D., is Senior Fellow and Director of Programs and Fellows in the Center; Gregory A. Buck, Ph.D., is Director of the Center.*

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*Gregory A. Buck: buck@mail2.vcu.edu*

# PRE HIGHLIGHTS

## Biological Physics Articles From Physical Review E

## August 2004

**Volume 70, Number 2,**
**Articles (02xxxx)**
http://scitation.aip.org/dbt/dbt.jsp?KEY=PLEEE8&Volume=70&Issue=2

***RAPID COMMUNICATIONS***

**Molecular discreteness in reaction-diffusion systems yields steady states not seen in the continuum limit**
Yuichi Togashi and Kunihiko Kaneko
Published 23 August 2004 (*4 pages*)
020901(R)

**Effects of stacking on the configurations and elasticity of single-stranded nucleic acids**
A. Buhot and A. Halperin
Published 24 August 2004 (*4 pages*)
020902(R)

***ARTICLES***

**Mean-field approaches to the totally asymmetric exclusion process with quenched disorder and large particles**
Leah B. Shaw, James P. Sethna, and Kelvin H. Lee
Published 4 August 2004 (*7 pages*)
021901

**Lateral organization of cholesterol molecules in lipid-cholesterol assemblies**
Pinaki Sengupta, Rajiv R. P. Singh, Daniel L. Cox, and Alex Slepoy
Published 9 August 2004 (*6 pages*)
021902

**Solution of the quasispecies model for an arbitrary gene network**
Emmanuel Tannenbaum and Eugene I. Shakhnovich
Published 11 August 2004 (*15 pages*)
021903

**Coupled oscillator systems of cultured cardiac myocytes: Fluctuation and scaling properties**
Mitsuru Yoneyama and Koichi Kawahara
Published 11 August 2004 (*9 pages*)
021904

***BRIEF REPORTS***

## September 2004

**Volume 70, Number 3,**
**Articles (03xxxx)**
http://scitation.aip.org/dbt/dbt.jsp?KEY=PLEEE8&Volume=70&Issue=3

***RAPID COMMUNICATIONS***

**Multiphoton switching dynamics of single green fluorescent proteins**
G. Chirico, F. Cannone, A. Diaspro, S. Bologna, V. Pellegrini, R. Nifosì, and F. Beltram
Published 21 September 2004 (*4 pages*)
030901(R)

**Unexpected epidemic thresholds in heterogeneous networks: The role of disease transmission**
Ronen Olinky and Lewi Stone
Published 24 September 2004 (*4 pages*)
030902(R)

**Teaching computers to fold proteins**
Ole Winther and Anders Krogh
Published 27 September 2004 (*4 pages*)
030903(R)

***ARTICLES***

**Half-soliton interaction of population taxis waves in predator-prey systems with pursuit and evasion**
M. A. Tsyganov and V. N. Biktashev
Published 14 September 2004 (*10 pages*)
031901

**Quantum models of the mind: Are they compatible with environment decoherence?**
Luiz Pinguelli Rosa and Jean Faber
Published 15 September 2004 (*6 pages*)
031902

**Bioinspired laser-operated molecular locomotive**
Zhisong Wang
Published 15 September 2004 (*8 pages*)
031903

**Influence of time-delayed feedback in the firing pattern of thermally sensitive neurons**
M. Sainz-Trapága, C. Masoller, H. A. Braun, and M. T. Huber
Published 15 September 2004 (*11 pages*)
031904

**Self-organized pattern formation in motor-microtubule mixtures**
Sumithra Sankararaman, Gautam I. Menon, and P. B. Sunil Kumar
Published 16 September 2004 (*18 pages*)
031905

**Spatially resolved electronic detection of biopolymers**
F. Pouthas, C. Gentil, D. Côte, G. Zeck, B. Straub, and U. Bockelmann
Published 21 September 2004 (*8 pages*)
031906

**Motion-contrast computation without directionally selective motion sensors**
B. K. Dellen, J. W. Clark, and R. Wessel
Published 21 September 2004 (*7 pages*)
031907

**Epidemic spreading in a hierarchical social network**
A. Grabowski and R. A. Kosiński
Published 21 September 2004 (*7 pages*)
031908

**Topological generalizations of network motifs**
N. Kashtan, S. Itzkovitz, R. Milo, and U. Alon
Published 23 September 2004 (*12 pages*)
031909

**Spectrum and symbol distribution of nucleotide sequences**
Vera Afreixo, Paulo J. S. G. Ferreira, and Dorabella Santos
Published 23 September 2004 (*4 pages*)
031910

**Robust stochastic resonance for simple threshold neurons**
Bart Kosko and Sanya Mitaim
Published 27 September 2004 (*10 pages*)
031911

**Periodically varying externally imposed environmental effects on population dynamics**
M. Ballard, V. M. Kenkre, and M. N. Kuperman
Published 28 September 2004 (*7 pages*)
031912

**Multidelayed random walks: Theory and application to the neolithic transition in Europe**
Joaquim Fort, Debnarayan Jana, and Josep Humet
Published 28 September 2004 (*6 pages*)
031913

**Solitons in $\alpha$-helical proteins**
L. Brizhik, A. Eremko, B. Piette, and W. Zakrzewski
Published 29 September 2004 (*16 pages*)
031914

**Double-wavelet approach to study frequency and amplitude modulation in renal autoregulation**
O. V. Sosnovtseva, A. N. Pavlov, E. Mosekilde, N.-H. Holstein-Rathlou, and D. J. Marsh
Published 30 September 2004 (*8 pages*)
031915

**Spectra and waiting-time densities in firing resonant and nonresonant neurons**
T. Verechtchaguina, L. Schimansky-Geier, and I. M. Sokolov
Published 30 September 2004 (*8 pages*)
031916

**Thermoelectricity in natural and synthetic hydrogels**
Brandon R. Brown, Mary E. Hughes, and Clementina Russo
Published 30 September 2004 (*7 pages*)
031917

***BRIEF REPORTS***

**Steady states of a microtubule assembly in a confined geometry**
Bindu S. Govindan and William B. Spillman, Jr.
Published 8 September 2004 (*4 pages*)
032901

**Stabilization of surface-immobilized enzymes using grafted polymers**
Yevgeny Moskovitz and Simcha Srebnik
Published 13 September 2004 (*4 pages*)
032902

**Complex dynamics of the formation of spatially localized standing structures in the vicinity of saddle-node bifurcations of waves in the reaction-diffusion model of blood clotting**
E. S. Lobanova, E. E. Shnol, and F. I. Ataullakhanov
Published 14 September 2004 (*4 pages*)
032903

## BIOPHYSICS FACULTY POSITION AT CITY COLLEGE

The physics department at City College of New York is looking for a Biophysicist. Physics at City College has long-standing strengths in condensed matter physics, high energy theory and a growing emphasis on biophysics. City College has has a strong, growing, interdisciplinary biophysics program bringing together scientists from Physics, Chemistry, and Engineering. The New York Structural Biology Center, which provides access to high field NMR and cryo-EM to member institutions, is located on our campus. Candidates should have a Ph.D. degree and post-doctoral experience, a strong record of original research and the ability to establish active, independent, extramurally funded research programs. They must also demonstrate ability and commitment to teaching physics at both the undergraduate and graduate level. Applicants should submit a CV, a list of publications and a research plan and should arrange for three letters of reference to be sent as soon as possible to: Faculty Search Committee, Department of Physics, Room J419, The City College of New York, Convent Avenue and 138th Street, New York, NY 10031.

## Postdoctoral Position in Cartilage µMRI

A postdoctoral position will soon be available* in the Microscopic NMR Imaging (µMRI) Lab in Department of Physics, Oakland University. OU is located in suburban Rochester, Michigan, in north Oakland County, which boasts one of the most picturesque campuses in the country.

The work will center on quantitative and microscopic imaging studies of articular cartilage using multidisciplinary techniques, including non-invasive µMRI, polarized light microscopy and histology, Fourier-transform infrared imaging (FTIRI) system, and biochemical and mechanical calibrations. The results from these fundamental research at microscopic resolution will be used to determine a set of baselines / guidelines for the successful MRI application in clinics, which is also an aim of our study.

Our MRI instrumentation consists of a Bruker AMX 300 NMR system with 7T wide-bore superconducting magnet, microimaging accessories, and a SGI workstation running ParaVision software package. In addition, research times on a Bruker 7T/20cm system and a GE 3T whole-body system are available at a nearby institution. Other major instruments in our lab include an EnduraTec ELF 3200 mechanical testing system, a Leica DM RXP polarized light microscope interfaced with a 12-bit CCD camera, a soon-to-be-installed modern FTIRI system, and a number of personal computers running Macintosh, UNIX, and Windows operating systems.

Applicants should have a PhD or equivalent in physical sciences, engineering, or a related field. A background and previous experience in NMR and MRI of connective tissue is preferred. We also strongly encourage applications from individuals who have the solid expertise in cartilage biology and the desire to learn µMRI techniques, or who have expertise in other areas of biological NMR and MRI.

Interested individuals should send their CV, statements of research experience and research interest, and the names, telephone numbers, and e-mail addresses of at least three references to:

Dr. Yang Xia
Associate Professor of Physics
Dept of Physics, Oakland University, Rochester, MI 48309, USA
**Tel:** 248-370-3420; **Fax:** 248-370-3408; **E-mail:** xia@oakland.edu
**Web:** http://www.oakland.edu/~xia/XiaLab_index.html.

** Pending final budgetary approval. OU is an equal opportunity employer.*

**Tenure Track Assistant Professor - Biophysics**

The Department of Physics and Astronomy at the College of Charleston anticipates hiring a tenure track biophysicist at the rank of assistant professor to begin in August 2005. The successful candidate will be expected to teach physics courses in support of the department's mission and to develop and seek extramural funding for an independent research program in an area at the interface of physics and biology. This research should employ the tools of physics to address biological, cellular and/or molecular problems. Qualified applicants should submit: 1) a complete curriculum vitae, 2) a statement of teaching philosophy and research objectives with reference to potential undergraduate involvement, and 3) the names, addresses, e-mail addresses, and telephone numbers of three references who may be contacted.

A Ph.D. in physics or a closely related field is required, and teaching and post-doctoral experience are preferred. Applicants must provide evidence of the ability to work in the United States prior to the interview process, if not a U.S. citizen. Applications should be sent to: Dr. Linda Jones, Biophysics Search Committee Chair, Department of Physics and Astronomy, College of Charleston, Charleston, SC 29424. Review of applications will begin on November 15, 2004.

# TENURE-TRACK POSITIONS IN BIOLOGICAL PHYSICS
## DEPARTMENT OF PHYSICS, UNIVERSITY OF OTTAWA

The Department of Physics wishes to expand its strength in biological physics. We invite applications for two regular faculty positions, as well as for a Tier II Canada Research Chair in this area (http://www.chairs.gc.ca/). The emphasis is on innovative computational approaches to study biological systems, which may be carried out in conjunction with experimental and/or theoretical approaches. Appointments of outstanding candidates will normally be at the Assistant Professor level, but applications for higher ranks will be considered as well. Cross-appointment with other departments in the Faculty of Science or Medicine is possible. The Department is building its interdisciplinary strength in areas such as, but not limited to, biological modeling and computation, neurophysics, computational biology, cellular interactions, genomics, proteomics, molecular biophysics and the physics of complex biological networks. More information can be obtained at http://www.science.uottawa.ca/phy/eng/welcome.html. Canadians and permanent residents will be given priority. As the University of Ottawa is a bilingual institution, bilingualism is an asset. Applicants are requested to send a curriculum vitae, the names of at least three referees, and a statement of research interests to: Search Committee (c/o Dr. André Longtin), Department of Physics, University of Ottawa, 150 Louis Pasteur, Ottawa, Ont. Canada K1N 6N5. Applications will be reviewed starting in January 2005; reviewing will continue until the positions are filled.

**Tenure-track positions, Faculty of Medicine**
**Department of Cellular and Molecular Medicine, University of Ottawa**

The Department of Cellular and Molecular Medicine wishes to expand its strength in Computational and Systems Neuroscience. We are seeking dynamic individuals to fill several tenure-track positions at the junior or senior level. Strong candidates using innovative theoretical and experimental approaches to study neural function are encouraged to apply. These experimental approaches may range from the molecular to the systems level, but must be strongly coupled with computational modeling and theory. The ideal candidate will have an excellent track record of research that combines theory and experimentation, either within their own program, or in collaboration. Outstanding candidates will be eligible for Canada Research Chairs.Successful candidates will have the opportunity for cross-appointment with Departments in the Faculty of Science. They will also have the opportunity to interact with the large contingent of neuroscience researchers distributed throughout the Faculty of Medicine as well as within Federal government laboratories in Ottawa. Attractive start-up packages are available. Candidates will be expected to contribute to the teaching mission of the Department, including developing an interdisciplinary curriculum in Computational and Systems Neuroscience. Since the University of Ottawa is a bilingual institution, proficiency in both English and French would be an asset.

As Canada's National Capital, Ottawa is a vibrant and attractive city with a high standard of living. It has several cultural amenities and offers easy access to summer and winter outdoor activities.

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. Equity is a University of Ottawa policy; women, aboriginal people, members of visible minorities and persons with disabilities are invited to apply. More information on the Department can be obtained at:http://www.uottawa.ca/academic/med/cellmed

Interested individuals are requested to submit a curriculum vitae, a list of at least three references and a statement of research interests to: Dr. Bernard J. Jasmin jasmin@uottawa.ca, Professor and Chair, Department of Cellular and Molecular Medicine, Faculty of Medicine,University of Ottawa
451 Smyth Road Ottawa, Ontario K1H 8M5

Applications will be reviewed until the positions are filled.

## Assistant Professorship in Theory in Biological Physics and/or Theoretical Biochemistry Arizona State University

The Department of Physics & Astronomy and the Department of Chemistry & Biochemistry at Arizona State University seek candidates for a tenure-track assistant professorship in theoretical/computational biological physics and/or theoretical/computational biochemistry starting August 2005. Applicants must have a Ph.D. degree in physics, chemistry or biochemistry or a closely related discipline by the time of appointment, a strong demonstrated research history, the potential to attract external funding, and a commitment to effective teaching, appropriate to rank. Experience working in an interdisciplinary environment is desired. As part of its development plan, Arizona State University is expanding all aspects of interdisciplinary biology research, which includes the new BioDesign Institute. Research in this area spans the range from the most fundamental questions through biotechnology. Joint appointments as appropriate are encouraged involving both departments and the BioDesign Institute. Applicants must send a resume and a statement describing their current and future research interests, and arrange to have three or more letters of recommendation sent on their behalf. Initial review of applications will begin on December 1, 2004, and if not filled will continue every two weeks until the search is closed. Further information about this position can be obtained from Michael Thorpe (mft@asu.edu). Please send application materials to: Theory Search, c/o Ms. Peg Stuart (peg.stuart@asu.edu), Arizona State University, Department of Physics and Astronomy, PO Box 871504, Tempe, AZ 85287-1504. ASU is an equal opportunity/affirmative action employer, and actively seeks diversity among applicants and promotes a diverse workforce.

## FACULTY POSITIONS IN CELLULAR IMAGING

Dept of Anatomy and Structural Biology
Albert Einstein College of Medicine

The Dept of Anatomy and Structural Biology is seeking quantitative scientists for a tenure track faculty position with an emphasis on microscopy and imaging. The Department has superb optical and electron microscopes and a faculty with a demonstrated record of development of novel imaging technologies and has begun a Center for Biophotonics. The candidate's laboratory will be part of that Center in the new Genetic and Translational Medicine building that includes: chemical genomics, bioinformatics and computational biology, and genetics, including a repository, microarray and sequencing facilities, protein chemistry and proteomics, gene therapy and transgenic mice. The successful candidate will likely have a background in physics, engineering, biology or chemistry and a desire to work at the biological interface. The Department is committed to providing the infrastructure required to establish the candidate's laboratory and to facilitating a cohesive interaction among an interdisciplinary group of scientists who are applying biophotonics in order to elucidate the cellular basis of human disease. The Biophotonics Center will have a laser workshop, multiphoton microscopes, rapid live cell imaging microscopes, FRET/FLIM, single molecule detection and optical and software engineering support. The department also maintains an Analytic Imaging Facility for light, electron and cryo-electron microscopy. Applicants should send a CV and names of three references to: Biophotonics Search, Dept of Anatomy and Structural Biology, Albert Einstein College of Medicine, Jack and Pearl Resnick Campus, 1300 Morris Park Avenue, Bronx, NY 10461. EOE.