

NAS Publishes Report On Interdisciplinary Research

S. Bahar

"If you think of disciplines as organs, true interdisciplinarity is something like blood. It flows. It is a liquid. It is not contained. There is no inside and outside."

-- Alice Gottlieb, Professor of Medicine and Director, Clinical Research Center at the Robert Wood Johnson Medical School

"Only connect."

-- E. M. Forster

DBP members may recall an invitation, in our February 2004 issue, to participate in a survey on interdisciplinary research conducted by the Committee on Facilitating Interdisciplinary Research, an ad hoc committee of the Committee on Science, Engineering and Public Policy (COSEPUP) of The National Academies (which includes the National Academy of Science, the National Academy of Engineering, and the Institute of Medicine, <http://www.nationalacademies.org>). Hopefully some DBP members actually clicked on the link and participated in the survey! The survey, in fact, was only a small part of a massive, comprehensive study undertaken by the Committee on Facilitating Interdisciplinary Research to assess the current status of interdisciplinary research in the United States, and to make recommendations for strengthening interdisciplinary science.

The study was sponsored by the National Academies Keck Futures Initiative, an initiative "launched in 2003 to stimulate new modes of scientific inquiry and break down the conceptual and institutional barriers to interdisciplinary research." The result of this study, entitled *Facilitating Interdisciplinary Research*, was recently published by the National Academies Press (<http://www.nap.edu/books/0309094356/html/>).

The overall findings are likely ones with which most biological physicists would strongly agree. According to the November 19, 2004 press release which accompanied the release of the report, "Advances in science and engineering increasingly require the collaboration of scholars from various fields. This shift is driven by the urgent need to address complex problems that cut across traditional disciplines, and the capacity of new technologies to both transform existing disciplines and generate new ones. At the same time, however, interdisciplinary research is impeded at many institutions by policies on hiring, promotion, tenure, and resource allocation that favor traditional disciplines." For example, should the director of an interdisciplinary center report to a department head, or to an upper-level administrator such as a Dean or Provost? What (and who) should determine the criteria for evaluating an interdisciplinary scientist's tenure application?

A major suggestion made by the Committee was that academia should consider looking to industry and to national labs as a model for conducting research at the boundaries between disciplines. According to the press release, "[i]ndustrial and national laboratories have traditionally operated successful interdisciplinary programs because their research goals are established in terms of projects rather than by discipline. Teams of researchers from various fields are formed to solve particular problems, an approach that stimulates interdisciplinary interactions." The report also cites the growing strength of interdisciplinary science in the Netherlands (p. 23 and pp. 164-65) and the results of the European Union's Research Advisory Board (EURAB) report on overcoming barriers to interdisciplinary research in Europe (p. 24).

Despite their broad mandate, the study committee was deeply aware that there is no one “solution” to facilitating interdisciplinary research and teaching. With this in mind, they provide many case studies that illustrate creative solutions implemented by a variety of universities.

One example of an innovative approach to interdisciplinary research cited by the report is that of the **Cluster Hiring Initiative at the University of Wisconsin at Madison**, which “grew out of the campus strategic planning process of the middle 1990s. The initiative involved a provost-coordinated campus-wide competition to identify groups of new faculty hires, or ‘clusters’, to work together on interdisciplinary programs and emerging fields of inquiry...The provost invited proposals from faculty that identify promising subjects for faculty collaboration. Since 1998, faculty have submitted hundreds of proposals to fund faculty lines to pursue and develop new and promising areas of interdisciplinary and collaborative inquiry. These are permanent lines that remain with the hiring department as long as a cluster faculty [member] remains with the university. Through 2003, 49 clusters with 137 new faculty lines were authorized with central funding, and schools and colleges matched six additional cluster faculty positions.” (*Facilitating Interdisciplinary Research*, pp. 100-101.) Overall, as discussed in a recent Policy Forum article in *Science* magazine (D. Rhoten and A. Parker, *Science* 306: 3046, December 17, 2004), many researchers are coming to see such interdisciplinary efforts as quite beneficial to their careers.

Another salient example of success at interdisciplinarity cited by the report is that of the **Beckman Institute at the University of Illinois at Urbana-Champaign**. The Beckman Institute is, in a sense, almost a microcosm of a National Laboratory. As described in the report (pp. 104-104), “the director of the Institute has the status of a dean and reports to the provost. All faculty in the institute have appointments in departments and maintain departmental teaching and service obligations. Some faculty are full-time; that is, their research activities are centered at the institute. Others are part-time; they maintain some research space in the institute and some in departments. Still others have looser affiliate appointments; they are

involved in an institute program and may have students or postdocs working there, but they do not maintain offices [at the institute]. About 130 faculty are affiliated with the institute, with some 400-450 graduate students, 200-300 undergraduate students, and 70-80 postdoctoral fellows. A staff of 60-70 provide technical and administrative support.

“The institute is organized along themes that cross-cut and build on university strengths in the physical sciences, engineering, and the cognitive and social sciences. Each of the major research themes is evaluated every few years with the help of external experts. Is the work being done of the highest caliber? Is the research of individual faculty or groups of faculty taking advantage of the uniqueness of the institute? Is it interdisciplinary? When a review is unfavorable, the director has the duty to require faculty or groups of faculty to leave the institute and return to their home departments. The review process is important [to] the success of the institute. Turnover of research programs and individuals is essential to the institute’s long-term viability.”

Still another unique approach was taken by **Penn State** in the formation of its **Huck Institutes of the Life Sciences**. Penn State “dedicated \$5 million to the effort to hire new faculty members, to create an interdisciplinary graduate program, and to build shared technical resources. How was it funded? The provost charged all departments to come up with a 10% reduction in budget – the savings were recycled to the university – and then engaged the faculty in determining new initiatives.” (*Facilitating Interdisciplinary Research*, p. 74.)

Sometimes the interdisciplinary center is not simply located within the university – it may actually be the university. The report cites **Rockefeller University**, on Manhattan’s Upper East Side, as an example of a spectacularly successful “university without departments”. Rockefeller “has been the site of more major discoveries in biomedicine in the 20th century than any other institution in the world. Rockefeller has been associated with 23 Nobel laureates and 19 Lasker Award recipients. Five faculty members have been named MacArthur Fellows and 12 have garnered the National Medal of Science, the

highest science award given by the United States. In addition, 32 Rockefeller faculty are elected members of the National Academy of Sciences.” According to the report, this success stems in great part from “three important characteristics: a high level of scientific diversity, low levels of internal differentiation (i.e., no disciplinary departments), and visionary leadership.

“The Rockefeller Institute was founded not on the basis of a particular field or researcher, but to pursue diverse subjects in biomedical sciences. Researchers with diverse scientific and cultural backgrounds were recruited. Most worked in fields that crossed academic disciplines. In addition, Rockefeller did not organize the production of knowledge around academic disciplines. The institute was originally organized around two departments: the Department of Laboratories and the Department of the Hospital. The university’s laboratory-based organizational structure “without walls” and pared-down layers of administration do away with the schools and academic departments that too often separate scientists. ‘This approach fosters a tremendously rich soup of interdisciplinary research and collaboration,’ says Rockefeller Professor and Nobel laureate Günter Blobel.” (*Facilitating Interdisciplinary Research*, p. 176.)

Nor does growth in interdisciplinary research need to be restricted to major research institutions. “**Haverford College**, an undergraduate institution with about 1,100 students, is on the cusp of a major change in curriculum. Its plan for the next 5-10 years is to do away with general courses in chemistry, physics and biology and to teach them integratively. The idea is to teach chemistry and physics as an integrative course in the first year, providing foundations for further work in the disciplines and a foundation for an integrated course in organic chemistry and molecular biology. The first 2 years of the curriculum would emphasize mathematics and statistics.

“In the junior and senior years, there is already a fairly broad curriculum that is taught in an interdisciplinary way. Juniors in the chemistry, biology and physics departments take introduction-to-research-methods courses instead of traditional

laboratory courses. These intensive courses last for the entire school year.

“In the senior year, students are immersed in research. That is, research is integrated into the curriculum: students are introduced to research methods instead of having to learn physical and chemical laboratory methods, inorganic and organic chemistry, and so on. All these concepts are pulled together into a single laboratory course, which [will] be expanded by units on material[s] science, computational biology, neuroscience, and biophysics, in which students will navigate from module to module across the involved departments. The plan is to weave research and interdisciplinary work completely into the fabric of the curriculum of all the science departments.” (*Facilitating Interdisciplinary Research*, p. 97.) Haverford’s bold plan, if the increase in breadth does not compromise the rigor of the students’ training, could provide the U.S. with a new generation of interdisciplinary scientists.

In addition to discussing creative solutions to the difficulties of interdisciplinary science, the report addresses the barriers to interdisciplinary research and teaching (Chapter 3), the role of professional societies and journals (Chapter 7) and funding organizations (Chapter 6) in promoting interdisciplinary research. Examples of the latter include the major role played by the **Whitaker Foundation** in the development of the field of biomedical engineering (page 133), and the **NSF IGERT (Integrative Graduate Education and Research Trainee) Program**. *Facilitating Interdisciplinary Research* emphasizes the education of interdisciplinary scientists at all levels, from undergraduate courses through postdoctoral training. The survey results appear in Appendix E.

Implemented in a myriad of ways, the call for facilitating interdisciplinary research may ultimately come down to one fundamental idea: we must break bread together. Literally. The report quotes Pierre Wiltzius, director of the Beckman Institute at UIUC: “The last thing I am going to shut down in my building is the cafeteria. It is tremendously important to bring people out of their buildings, out of their offices, out of their labs, and into a common space, and then they start talking.”

Which is, perhaps, how the best interdisciplinary research has always done. Examples of the great success of this “bread-breaking” approach include the **Bio-X program at Stanford** (<http://biox.stanford.edu/>) and the **Howard Hughes Medical Institute’s Janelia Farm** (<http://www.hhmi.org/janelia/>), as well as the Beckman Institute.

Indeed, the idea of physically shared laboratory spaces for the facilitation of interdisciplinary work is gaining more and more interest within the wider academic community, as discussed in Lila Guterman’s recent article in the *Chronicle of*

Higher Education, “Space Odyssey” (<http://chronicle.com/free/v51/i16/16a01201.htm>).

Broad in its scope and deep in its implications for biological physicists “in the trenches” of interdisciplinary science, the NAS’s report is essential reading for all scientists living and working “at the interface”.

For more information, the reader can visit <http://www.nationalacademies.org/interdisciplinary>.

PRE HIGHLIGHTS

Biological Physics articles from **Physical Review E**

(Statistical, Nonlinear, and Soft Matter Physics)

October 2004

Volume 70, Number 4, Articles (04xxxx)

<http://scitation.aip.org/dbt/dbt.jsp?KEY=PLEEER&Volume=70&Issue=4>

RAPID COMMUNICATIONS

Unfolding single RNA molecules by mechanical force: A stochastic kinetic method

[Fei Liu](#) and [Zhong-can Ou-Yang](#)

Published 14 October 2004 (4 pages)

040901(R)

ARTICLES

Base-sequence-dependent sliding of proteins on DNA

[M. Barbi](#), [C. Place](#), [V. Popkov](#), and [M. Salerno](#)

Published 6 October 2004 (6 pages)

041901

Stochastic models in population biology and their deterministic analogs

[A. J. McKane](#) and [T. J. Newman](#)

Published 13 October 2004 (19 pages)

041902

Stimulation of unidirectional pulses in excitable systems

[M. Friedman](#), [I. E. Ovsyshcher](#), [I. Fleidervish](#), [E. Crystal](#), and [A. Rabinovitch](#)

Published 21 October 2004 (7 pages)

041903

Delayed feedback control of collective synchrony: An approach to suppression of pathological brain rhythms

[Michael Rosenblum](#) and [Arkady Pikovsky](#)

Published 21 October 2004 (11 pages)

041904

Unified perspective on proteins: A physics approach

[Jayanth R. Banavar](#), [Trinh X. Hoang](#), [Amos Maritan](#), [Flavio Seno](#), and [Antonio Trovato](#)

Published 27 October 2004 (25 pages)

041905

Structure-function relationship of biological gels revealed by multiple-particle tracking and differential interference contrast microscopy: The case of human lamin networks

[Porntula Panorchan](#), [Denis Wirtz](#), and [Yiider Tseng](#)

Published 27 October 2004 (7 pages)
041906

Fluctuations-induced switch in the gene transcriptional regulatory system

[Quan Liu](#) and [Ya Jia](#)

Published 28 October 2004 (8 pages)
041907

Solvable biological evolution models with general fitness functions and multiple mutations in parallel mutation-selection scheme

[David B. Saakian](#), [Chin-Kun Hu](#), and [H. Khachatryan](#)

Published 28 October 2004 (12 pages)
041908

Effects of noise in a cortical neural model

[Maria Marinaro](#) and [Silvia Scarpetta](#)

Published 29 October 2004 (11 pages)
041909

Stochastic analysis of the Lotka-Volterra model for ecosystems

[G. Q. Cai](#) and [Y. K. Lin](#)

Published 29 October 2004 (7 pages)
041910

Developmental waves in myxobacteria: A distinctive pattern formation mechanism

[Oleg A. Igoshin](#), [John Neu](#), and [George Oster](#)

Published 29 October 2004 (11 pages)
041911

Interaction of a polar molecule with an ion channel

[V. Levadny](#), [V. M. Aguilera](#), [M. Aguilera-Arzo](#), and [M. Belaya](#)

Published 29 October 2004 (9 pages)
041912

BRIEF REPORTS

Solvable null model for the distribution of word frequencies

[J. F. Fontanari](#) and [L. I. Perlovsky](#)

Published 25 October 2004 (4 pages)
042901

November 2004

Volume 70, Number 5, Articles (05xxxx)

<http://scitation.aip.org/dbt/dbt.jsp?KEY=PL.EEE8&Volume=70&Issue=5>

RAPID COMMUNICATIONS

1/f scaling in heart rate requires antagonistic autonomic control

[Zbigniew R. Struzik](#), [Junichiro Hayano](#), [Seiichiro Sakata](#), [Shin Kwak](#), and [Yoshiharu Yamamoto](#)

Published 16 November 2004 (4 pages)
050901(R)

Granger causality and information flow in multivariate processes

[Katarzyna J. Blinowska](#), [Rafał Kuś](#), and [Maciej Kamiński](#)

Published 22 November 2004 (4 pages)
050902(R)

ARTICLES

Unfolding and unzipping of single-stranded DNA by stretching

[Alexei V. Tkachenko](#)

Published 2 November 2004 (6 pages)
051901

General equilibrium shape equations of polymer chains

[Shengli Zhang](#), [Xianjun Zuo](#), [Minggang Xia](#), [Shumin Zhao](#), and [Erhu Zhang](#)

Published 3 November 2004 (6 pages)
051902

Nonlinear excitations in DNA: Aperiodic models versus actual genome sequences

[Sara Cuenda](#) and [Angel Sánchez](#)

Published 9 November 2004 (8 pages)
051903

Model for the dynamics of a water cluster in an x-ray free electron laser beam

[Magnus Bergh](#), [Nicușor Tîmneanu](#), and [David van der Spoel](#)

Published 11 November 2004 (7 pages)
051904

Self-assembly of polyhedral shells: A molecular dynamics study

[D. C. Rapaport](#)

Published 15 November 2004 (*13 pages*)
051905

Efficient expansion, folding, and unfolding of proteins

[Erik D. Nelson](#) and [Nick V. Grishin](#)

Published 15 November 2004 (*7 pages*)
051906

Statistical mechanics of base stacking and pairing in DNA melting

[Vassili Ivanov](#), [Yan Zeng](#), and [Giovanni Zocchi](#)

Published 16 November 2004 (*6 pages*)
051907

Sequence-related human proteins cluster by degree of evolutionary conservation

[Ralf Mrowka](#), [Andreas Patzak](#), [Hanspeter Herzel](#), and [Dirk Holste](#)

Published 17 November 2004 (*6 pages*)
051908

High-order events in cortical networks: A lower bound

[Andrea Benucci](#), [Paul F. M. J. Verschure](#), and [Peter König](#)

Published 17 November 2004 (*8 pages*)
051909

Simple bit-string model for lineage branching

[P. M. C. de Oliveira](#), [J. S. Sá Martins](#), [D. Stauffer](#), and [S. Moss de Oliveira](#)

Published 22 November 2004 (*8 pages*)
051910

Dynamical model of birdsong maintenance and control

[Henry D. I. Abarbanel](#), [Sachin S. Talathi](#), [Gabriel Mindlin](#), [Misha Rabinovich](#), and [Leif Gibb](#)

Published 22 November 2004 (*16 pages*)
051911

Saturation of conductance in single ion channels: The blocking effect of the near reaction field

[Boaz Nadler](#), [Zeev Schuss](#), [Uwe Hollerbach](#), and [R. S. Eisenberg](#)

Published 23 November 2004 (*11 pages*)
051912

DNA-DNA interaction beyond the ground state

[D. J. Lee](#), [A. Wynveen](#), and [A. A. Kornyshev](#)

Published 23 November 2004 (*12 pages*)
051913

"Smart" baroreception along the aortic arch, with reference to essential hypertension

[G. C. Kember](#), [M. Zamir](#), and [J. A. Armour](#)

Published 24 November 2004 (*5 pages*)
051914

Fractional diffusion modeling of ion channel gating

[Igor Goychuk](#) and [Peter Hänggi](#)

Published 24 November 2004 (*9 pages*)
051915

Many-body theory of chemotactic cell-cell interactions

[T. J. Newman](#) and [R. Grima](#)

Published 29 November 2004 (*15 pages*)
051916

Designing specificity of protein-substrate interactions

[Ivan Coluzza](#) and [Daan Frenkel](#)

Published 30 November 2004 (*8 pages*)
051917

BRIEF REPORTS

Water-network percolation transitions in hydrated yeast

[Dagmara Sokołowska](#), [Agnieszka Król-Otwinowska](#), and [Józef K. Mościcki](#)

Published 3 November 2004 (*4 pages*)
052901

Effects of nonlocal feedback on traveling fronts in neural fields subject to transmission delay

[A. Hutt](#)

Published 11 November 2004 (*4 pages*)
052902

Finite-size dynamics of inhibitory and excitatory interacting spiking neurons

[Maurizio Mattia](#) and [Paolo Del Giudice](#)

Published 23 November 2004 (4 pages)
052903

**Relaxation to native conformation of a
bond-fluctuating protein chain with**

hydrophobic and polar nodes

[Johan Bjursell](#) and [R. B. Pandey](#)

Published 30 November 2004 (4 pages)
052904

Announcement: Student Travel Grants for APS March Meeting

The Division of Biological Physics will provide several travel grants of up to \$300 each to students as the first author of contributed papers (talks or posters) in Biological Physics at the 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 distances. Both student and advisor, domestic or foreign, must be members of the DBP. No more than 2 students from one advisor may apply. Please include the abstract, the assigned session number, a letter of recommendation, membership numbers for both student and advisor, home address, and

the social security number for domestic applicants.

Submit all applications via email to both the Chair, Dr. Denis Rousseau, at rousseau@aecom.yu.edu, and the Secretary-Treasurer, Dr. Shirley Chan, at ShirleyChan@mailaps.org.

The deadline is February 1, 2005. Applicants will be notified by email before the Meeting for the grants and instructions. See also <http://www.aps.org/units/dbp/fellow.cfm#grants>.

Announcement: Election of DBP Councilor

By the voting deadline of October 11, 2004, 354 ballots were received from DBP members (about 22%). The result was a tie between the two candidates, Dean Astumian and Robert Eisenberg, an unprecedented situation within all APS units' elections. According to the Bylaws, the Executive Committee Members were called to vote with a new ballot in order to break the tie.

Eisenberg received one vote more than Astumian. Therefore, Bob Eisenberg is re-elected to serve as our Councilor from January 2005 to December 2008. Congratulations to Bob Eisenberg. Thank you very much to all members who participated in the election.

-- Dr. Shirley Chan
*Secretary-Treasurer,
Division of Biological Physics*

Announcement: Call for 2005 APS Fellowship Nominations

It is time to start the process of nominating some of your colleagues to become APS Fellows in 2005. Currently DBP has over 1600 members, and will be allowed to nominate 8 candidates for the consideration. An important part of being a member of the DBP is to promote qualified members to be recognized with this honor. However, DBP historically gets less nominations than the available quota. We had only 4 members elected as 2004 Fellows. Thus, your attention and cooperation for this process are most important so that the DBP can be better represented within the APS.

The instructions and forms for the nominations are available on APS website, <http://www.aps.org/fellowship/index.cfm>.

Fellowship nominations may be submitted at any time, but must be received by April 1, 2005, for the next review.

All forms and supporting papers for the nominations should be sent to: Executive Officer, The American Physical Society, One Physics Ellipse College Park, MD 20740, ATTN: Fellowship Program.

Please also notify me of your nomination intention at e-mail: ShirleyChan@mailaps.org.

For any questions, please contact the Fellowship Office directly at e-mail: fellowship@aps.org, or telephone: (301) 209-3268. Thank you very much.

-- Dr. Shirley Chan
*Secretary-Treasurer,
Division of Biological Physics*

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.

Postdoctoral Position in Cartilage μ MRI

A postdoctoral position will soon be available* in the Microscopic NMR Imaging (μ MRI) 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 μ MRI, 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 μ MRI 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.*

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.

Computational Bioinformaticist - Faculty

The Department of Computer Science and the Center for the Study of Biological Complexity at Virginia Commonwealth University anticipate openings for a tenure-track faculty position in computational bioinformatics/computer science. The successful candidate will hold the PhD in Computer Science or a closely related field, have demonstrated ability to develop a program of externally funded research or show great potential with respect to developing such a program. He or she will participate in collaborative teaching within the new Bioinformatics program. Research interests should include algorithm development for the analysis, interpretation, and visualization of multi-scale/multi-dimensional biological datasets, database architecture and algorithm design, simulation of complex biological systems, or other relevant areas of computational biology and bioinformatics.

The successful applicant will join a rapidly expanding Department of Computer Science (<http://www.egr.vcu.edu>) and the unique Center for the Study of Biological Complexity (<http://www.vcu.edu/csbc/>). Computer Science is one of five departments in VCU's new School of Engineering, launched in 1996 and now enrolling over 1000 students. The Center for the Study of Biological Complexity is a new academic think tank at VCU promoting integrative and broadly interdisciplinary approaches to biological and biomedical research. Center activities invoke the mathematical and computational principles of complexity to solve biological problems and interpret life's functions. The Center is home to VCU's high performance computing facilities, including hardware, software, data bases and support for bioinformatics, modeling and scientific visualization. The Center also maintains state of the art resources for genomic, proteomic and pharmacogenomic research, and houses students in VCU's undergraduate and graduate programs in bioinformatics and systems biology.

Please send letters of interest, curriculum vitae, three references and supporting documents to Gregory A. Buck, Center for the Study of Biological Complexity, Virginia Commonwealth University, P.O. Box 842030, Richmond, Virginia 23284-2030. Applications preferred by e-mail: buck@mail2.vcu.edu.

VCU is an equal opportunity /affirmative action employer. Women, minorities and persons with disabilities are encouraged to apply.

Mathematical Biologist – Faculty

The Departments of Mathematics and Applied Mathematics and Biology, and the Center for the Study of Biological Complexity at Virginia Commonwealth University invite applications for a tenure-track or tenured faculty position in applied mathematics/mathematical biology. The successful candidate will have a Ph.D. in Mathematics or a related field, and is expected to develop a strong, externally funded research program and to interact with other faculty members in Mathematics, Biology, and the Center. He or she will participate in collaborative teaching in appropriate applied mathematics and other relevant courses. Research interests should be in applied mathematical modeling in biological systems, genome/cellular-level metabolic network and pathway analysis, development of strategies for modeling complex multi-scale biological processes, complex dynamical systems, or other relevant areas. Experience generating and testing hypotheses at the systems level and a track record of independent funding are essential.

The successful applicant will join a rapidly expanding interdisciplinary mathematical biology group focused around the Center for the Study of Biological Complexity and the Departments of Mathematics and Applied Mathematics, and Biology. The Center (<http://www.vcu.edu/csbc/>) is a new academic think tank promoting integrative and broadly interdisciplinary approaches to biological and biomedical research. Center activities invoke the mathematical and computational principles of complexity to solve biological problems and interpret life's functions. The Center houses state of the art facilities for high performance computing, bioinformatics, genomic, proteomic and pharmacogenomic research, and houses VCU's undergraduate and graduate programs in bioinformatics and systems biology. Mathematics and Biology are established and dynamic programs in the College of Humanities and Sciences and support an interdisciplinary emphasis on mathematical biology and systems biology.

Please send letters of research and teaching interests, curriculum vitae, three references and supporting documents by December 15, 2004, to Gregory A. Buck, Center for the Study of Biological Complexity, Virginia Commonwealth University, P.O. Box 842030, Richmond, Virginia 23284-2030. Applications preferred by e-mail: buck@mail2.vcu.edu.

VCU is an equal opportunity /affirmative action employer. Women, minorities and persons with disabilities are encouraged to apply.

Microbial Systems Biology - Postdoctoral

We are seeking individuals to join a multidisciplinary research team studying the functional genomics and pathogenesis of *Cryptosporidium hominis* and *Trypanosoma cruzi* in the Center for the Study of Biological Complexity at Virginia Commonwealth University. You will join an international group applying systems biology strategies and complexity science to study these pathogens. Projects include: 1) transcriptional profiling of host cellular responses to parasite invasion; 2) transcriptional profiling and proteomics in parasite differentiation; 3) global interactomics; 4) comparative genomics; 5) reverse vaccinology; and 6) in silico modeling of eukaryotic microbes. For additional information, see <http://www.vcu.edu/micro/faculty/buck.htm>. The successful applicant will have expertise in bioinformatics, gene networks, molecular parasitology, functional genomics, proteomics, or a related field, and the ability to work in an interdisciplinary team dissecting the molecular pathogenesis of these parasites.

The Center (<http://www.vcu.edu/csbc/>) is an academic think tank promoting interdisciplinary approaches to biological and biomedical research. Center fellows apply the mathematical and computational principles of complexity and systems biology to solve problems in the life sciences. The Center houses facilities for high performance computing, genomic, proteomic and pharmacogenomic research, and academic training programs in bioinformatics and systems biology.

Send letters of interest, curriculum vitae, three references, and supporting documents by December 15, 2004, to Gregory A. Buck, Center for the Study of Biological Complexity, Virginia Commonwealth University, P.O. Box 842030, Richmond, Virginia 23284-2030. Applications by e-mail to: buck@mail2.vcu.edu.

VCU is an equal opportunity /affirmative action employer. Women, minorities and persons with disabilities are encouraged to apply.

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.

Tenure Track Faculty Position Experimental Biological or Condensed Matter Physics

The Department of Physics and Astronomy at the University of Rochester invites applications for a faculty position in Experimental Biological Physics or Experimental Condensed Matter Physics. Applicants should have a Ph.D., an outstanding record of research, and a commitment to excellence in teaching at both the undergraduate and the graduate level. The position is for a junior tenure track appointment, however applicants at a more senior level may also be considered. Applicants whose research involves optical techniques would leverage Rochester's strength in this area and are of particular interest.

Candidates should submit a letter of application, a curriculum vita including a list of publications, a description of research plans, and arrange for at least four letters of recommendation to be sent to:

Experimental Search Committee
c/o Prof. N. P. Bigelow
Department of Physics and Astronomy
University of Rochester
Rochester, NY 14627

Applications will be considered on an ongoing basis. The University of Rochester is an Equal Opportunity/Affirmative Action employer and encourages applicants from members of minority groups and women. All applications are considered without regard to race, sex, age, religion or national origin. Salary will be competitive.

Faculty Position in Biophysics

The Department of Physics and the James Franck Institute at the University of Chicago seek an outstanding candidate in Experimental or Theoretical Biophysics for an Assistant Professor Position.

The University of Chicago offers a highly collaborative environment bridging the fields of Chemistry, Biology and Physics, as well as excellent opportunities for collaboration with forefront Biological Research at the Institute for Biophysical Dynamics, the Howard Hughes Medical Center and the Ben May Institute for cancer research.

Candidates are required to have a Ph.D., to have demonstrated a high degree of excellence in their research, and to have a strong interest and ability in teaching.

Applicants should send a resume, a list of publications, and a description of their research interests to Prof. Steven J. Sibener, Director, The James Franck Institute, Biophysics Faculty Search, The University of Chicago, 5640 S. Ellis Ave., Chicago, IL 60637.

Applicants should also arrange for three letters of recommendation to be sent directly to the same address. Complete applications should reach us by January 7, 2005, to receive full consideration.

The University of Chicago is an Affirmative Action/Equal Opportunity Employer.
<http://jfi.uchicago.edu/>