THE BIOLOGICAL PHYSICIST

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

Vol 1 № 5 Feb 2002

In this Issue

From the Editor

Well, if you thought last issue was a blockbuster, check out this one! We've got lab profiles, conference announcements, and info on the DBP candidates for the Executive Committee (two new members being chosen) and for the DBP Vice Presidential slot.

Also, if you are putting together your schedule for the March Meeting, check out a new feature of the APS Website, at http://www.aps.org/meet/MAR02/baps/unitlist.html#DBP. Here, you can view all the DBP sessions together, instead of having to hunt through the entire program!

See you in Indy!

Dr. Sonya Bahar
Bahar@neurodyn.umsl.edu
http://neurodyn.umsl.edu/~bahar

Laser Damage in Biology and Material Science

Prof. Bernard S. Gerstman

Our research group in theoretical biological physics at Florida International University has several interests, such as the non-linear dynamics of protein folding.[1] In this article, we will describe our research efforts in a different field: laser damage to biological tissue and other materials such as polymers and electronics. This research displays all the aspects that makes biological physics so fascinating. The rigorous mathematical techniques of physics are used to investigate inherently interesting biological systems that are critical for life. Work that begins as curiosity driven, basic research branches out in various directions. Some of these directions lead to applications in a variety of fields. Other directions are even more surprising as research that is intended to use the techniques of physics to uncover new information about biology reverses itself and shows that behavior in biological systems can uncover new and unexpected physics.

Lasers have widespread use in basic science, material science, electronics, medicine, the military, entertainment, and other technological applications. In addition to their beneficial applications, lasers also present a significant risk of damage to the human visual system, other biological systems, and technological materials. The importance of assessing the potential for benefits, as well as the potential for damage, continues to grow as a result of steady advancement in laser technology which provides increasing pulse energies and shorter pulse durations. The ability to maximize the benefits, protect against damage, and set safety standards requires a comprehensive knowledge of all physical processes which might occur.

A commonly occurring system that is especially susceptible to laser effects is that of a strongly absorbing particle immersed in a weakly absorbing medium. This arrangement occurs in many biological systems; the most sensitive one being the retina in the eye which contains strongly absorbing micron size particles called melanosomes. The focusing optics of the eye produce energy densities at the retina that are 10^5 times larger than the energy density entering the eye. Strongly absorbing particles immersed in transparent media also occur in material science, engineering, and electronics applications such as dielectric materials and polymers. In addition to determining the potential for laser induced damage, this work also discovered a new method using lasers for determining the thermo-mechanical properties of micro- and nano-particles used in biophysics, chemistry, and material science for the manipulation of individual molecules. This research also uncovered chaotic behavior in a surprisingly simple system, with important ramifications.

Thermomechanics and equation of state

When a laser pulse is absorbed by a particle, the laser energy can be converted into various forms: heating, phase changes, pressure waves, as well as chemical bond changes (which we will not be discussing). Damage can occur from any of these effects. We are especially interested in determining which of the mechanisms is most likely (requires the least energy) to cause damage when the duration of the laser pulse is shortened. The damage threshold for longer pulses is due to thermal heating. As the pulse duration decreases, the energy required to produce explosive vaporization or shock waves decreases and at short enough pulses these damage mechanisms require less energy than damage from temperature rise. The pulse duration at which threshold damage switches from thermal heating to explosive vaporization depends on the size and properties of the absorbing particle and the surrounding medium. Melanosomes are approximately 1 μm in size and the transition occurs at about 1 μsec. The transition for threshold damage mechanism to switch from vaporization to shock damage may be occurring at 1 ns.

The research that we are carrying out is intended to understand and predict all the biophysical effects of laser absorption by microparticles by analyzing the complex non-linear dynamics and thermodynamics of the laser-absorber system using a first principles approach so that the work is valid for all laser pulses and all absorbers, including electronic and polymer systems as well as the retina. In order to understand the physics of this system that contains strong non-linearities, recent work is based upon absorbing particles that are assumed to be spherical, which simplifies the problem mathematically by making it one dimensional.

The model used consists of a uniform solid spherical absorber surrounded by a transparent medium. The rate of laser energy input per unit mass of the absorber is given by[2]

$$\dot{I}_e = \frac{3 I_o}{4a \tau_o \rho_o}\left[1 - \frac{1}{2\alpha_L^2 a^2}\left(1 - e^{-2a\alpha_L}(1 + 2\alpha_L a)\right)\right] \qquad (1)$$

where I_o is the incident laser fluence in *Joule/cm*^{2}, 'a' is the radius of the absorbing sphere, τ_o is the laser pulse duration, ρ_o is the static density of the sphere, and α_L is the absorption coefficient of the sphere.

The Eulerian coordinate **u**(r,t) is used to denote the position of a unit mass that starts at location **r**. With this notation, the equation of motion of a mass point is $\rho\ddot{u} = -\nabla_u P$ where P is the pressure and $\rho=\rho(t)$ is the time varying density which is related to the static density by mass conservation $\rho_o dV_r = \rho dV_u$. We treat the absorbing particle, such as a melanosome, as a solid object that undergoes only small changes in density and has a bulk modulus B and thermal expansion coefficient α that remain constant. The equation of state (EOS) of the absorber can be written as

$$\frac{\dot{v}}{v} = -\frac{\dot{P}}{B} + \alpha\dot{T} \qquad (2)$$

where $v=1/\rho$ is the specific volume.

Energy conservation in the absorber relates the rate of absorption to the increase in internal energy versus the heat lost through conduction to the surrounding medium. The rise in internal energy results in a temperature rise and volume change:

$$\dot{I}_e = T\dot{s} - \frac{\lambda}{\rho}\nabla_u^2 T = c_v \dot{T} + B\alpha T\dot{v} - \frac{\lambda}{\rho}\nabla_u^2 T \qquad (3)$$

where s is the specific entropy, c_v is the specific heat, and λ is the thermal conductivity of the absorber. The right side of Eq. (3) is only valid when the material remains in the same phase with constant B and α.

Analytical Solution for the Linearized Model: Exploding Particles (Micron Size Handgrenades)

We first analyzed the system[3] using an EOS for the medium of the same form as is used in Eq. (2) for the absorber. This EOS, valid only for acoustic pressure waves and small changes in density, does not treat phase changes (vaporization) or shock waves in the medium. However, it is valid for investigating strong acoustic waves that can lead to damage in biological systems where the surrounding system is cellular fluid. This analysis is also relevant for solid media such as dielectrics and polymer materials. Another important advantage of the use of this EOS for the medium is that it allows the system to be mathematically linearized and solved analytically by first performing a Laplace transformation on time and then applying a Green's function method on the spatial coordinates.

An extremely important result of this work is that the concept of a laser pulse confinement time is not valid for the stresses experienced at the core of the absorber. It was postulated that the transit time for acoustic waves across the absorber, $\tau_c=2a/c$, would act as a "stress confinement time". This would mean that different laser pulses of the same energy would generate the same pressure responses independent of the duration of the pulses as long as the pulses are all of shorter duration than the stress confinement time τ_c. Our recent work[3] established the unexpected result that the tensile stress at the core continued to grow even as the laser pulse duration was made shorter than the acoustic transit time. We found that the amplitude of the maximum tensile pressure varies inversely with the pulse duration: $|P_{max}| \propto 1/\tau_o$ as shown in Fig. 1. The fact that it is the tensile, negative pressure that continues to increase at the core makes the situation especially dangerous. It shows that the same energy delivered in a shorter pulse is increasingly more likely to cause an absorbing particle to explode like a laser-activated handgrenade. Our work as reported in Ref. (3) shows that this dangerous effect will be present not just for melanosomes in the retina, but for any absorbing particle in any media, and for self-focusing in transparent uniform materials such as water or polymers.

Our work also showed that laser absorption by a micro- or nano-particle will create acoustic waves in the surrounding medium that have a period of $\tau_c=2a/c$, where $c=(B/\rho)^{1/2}$ is the speed of sound in the absorber.

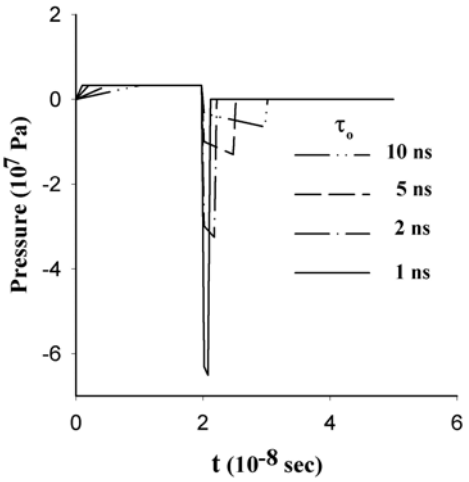

Fig. 1. *Increasing tensile stress in the absorber as the pulse duration τ_o is shortened below τ_c. The absorber modeled has τ_c=40 ns, and t is the observation time after the laser pulse.*

The importance of this result is that it shows how measurements of the wave period in the surrounding medium can be used to get the bulk modulus B of the absorber. This is especially valuable in the case of micro- and nano-particles where the particles are too small to make direct measurements on the particles to get B. We also showed how measurements of the wave amplitude in the surrounding medium can be used to determine the thermal expansion coefficient α of the absorbing particle.

Full Non-Linear Treatment: Shock Waves, Vaporization, and Dangerous Chaotic Dynamics

The linearized, analytical treatment just described gave important physical insight and produced the vital result concerning dangerous tensile stresses that will occur at the absorber's core even for low energy pulses. However, in order to analyze and predict the full range of thermodynamic and hydrodynamic responses in the absorber and the medium for any strength laser pulse, it was necessary to relax the condition that the medium would undergo only small changes in density. Relaxing this condition meant that all physical responses could be investigated, such as shock waves and vaporization. Unfortunately, it also meant that the system would no longer be mathematically linearizable, and the beauty of the analytical solution would be replaced by the perseverance of a numerical solution.

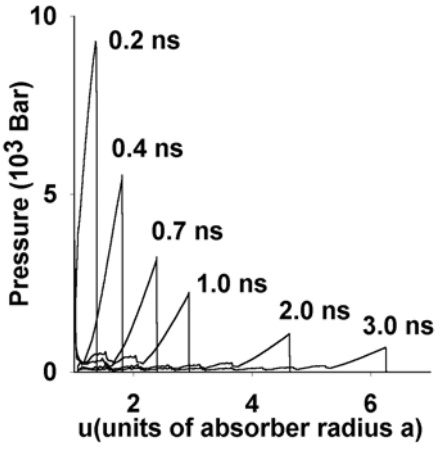

Fig. 2a. *Calculations for the creation and propagation of the shock front.*

In order to be able to predict the shock waves and vaporization generated in the medium from any laser pulse, the simplified EOS of Eq. (2) had to be abandoned for the medium and replaced by a more complete treatment (Ref. 4) that carefully represented variations in all thermodynamic properties: pressure, volume, temperature, entropy. This information is available for water from NBS Steam Tables[5].

With Eq. (3) and a full EOS for the medium, a complete treatment that predicts all thermodynamic and hydrodynamic responses is possible. Reliable predictions required careful implementation of a non-linear numerical algorithm. The numerical algorithm we chose was designed to optimize numerical stability but prevent unphysical numerical diffusion. We implemented a second-order Leap Frog algorithm with Flux Corrected transport. An important aspect of this work is that both shock fronts and vaporization phase changes are calculated in unison from a first principles treatment of the system with no physical constraints

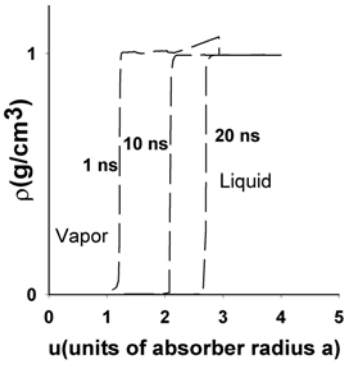

Fig. 2b. *Calculations for the creation and propagation of the expanding bubble in the aqueous medium surrounding an absorbing particle with radius a=1μm. The times listed inside the figure are observation times after the laser pulse, and show that the shock front propagates 10 times faster than the expansion of the bubble.*

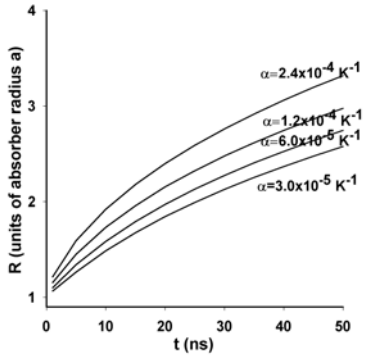

Fig. 3. *Calculations showing the dependence of the bubble size on the thermal expansion coefficient α of the absorber. This dependence was unexpected since bubble creation was thought to be due predominantly to heat conduction.*

that would limit the validity of the treatment. This is shown in Fig. 2. The propagation of a shock wave out into the medium at various times after absorption

by a 1 μm size absorber of a 0.1 ns laser pulse is displayed in Fig. 2a. The expansion in the medium of the bubble produced from the same laser pulse is shown in Fig. 2b.

With this treatment[4], we can now predict all the physical effects that are produced when a laser pulse is absorbed by a spherical particle of any size. This has led to additional results. Figure 3 shows that the growth of the vapor bubble around the absorber depends on the thermal expansion coefficient α of the absorber. This is an unexpected result because it was previously assumed that bubble formation and growth depended only on the heat conducted into the medium. Figure 3 shows that surprisingly this is not true and that the mechanical pulsating of the absorber also affects the formation and growth of the bubble. Therefore, absorbers that undergo larger pulsations will produce larger bubbles.

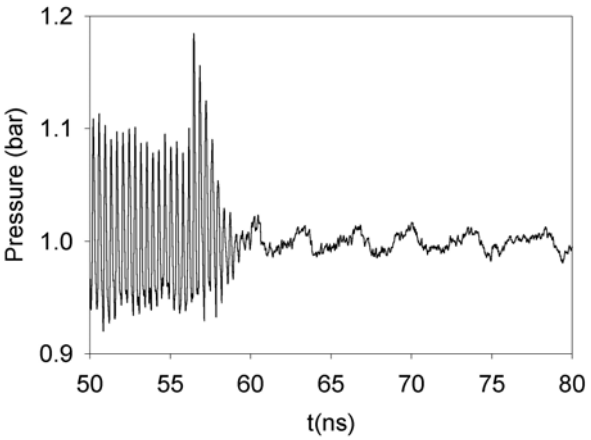

Fig. 4. *Calculations showing chaotic behavior in this simple absorber-medium system. The absorber was hit with a single laser pulse of duration τ_o=10ns. At a time of 60ns after the pulse, the pressure oscillations in the surrounding medium spontaneously transform and become weaker and slower. For other laser pulses, the transformation is opposite in nature, implying that some laser durations and energies may be especially damaging.*

In addition to the above results, recent investigations uncovered an important surprise. Though the system appears simple, a spherical absorber in a transparent medium, the underlying physics is highly non-linear. We have found that this system displays chaotic dynamics, which may have major implications for damage and safety considerations. Figure 4 displays the pressure signal as a function of time at a location in the medium that is 4a from the center of the absorber. For this figure, the laser pulse had a duration of τ_o=1.0 nsec and a fluence of I_o= 0.14 J/cm^2. It can be seen that at approximately 60 nsec after the laser pulse, the pressure oscillations in the medium undergo a spontaneous change in frequency. More importantly, the pressure oscillations which had been decreasing in strength, spontaneously increase dramatically in strength. These spontaneous fluctuations may result in much greater damage from the laser pulse than otherwise expected. The investigation and prediction of this chaotic behavior is only possible with the present model which analyzes the dynamics in terms of the underlying thermodynamic physics of the laser-matter interactions.

The research reported in this article was kindly supported by the Air Force Office of Scientific Research.

Contact Information

Prof. Bernard S. Gerstman
Department of Physics
Florida International University
Miani, FL 33199

305-348-3115
gerstman@biophys.fiu.edu

References

1)B. Gerstman and Y. Garbourg, "Structural Information Content and Lyapunov Exponent Calculation in Protein Unfolding", Journal of Polymer Science B: Polymer Physics, **36**, 2761-2769, 1998.

2)B. S. Gerstman, C. R. Thompson, S. L. Jacques, and M. E. Rogers, "Laser Induced Bubble Formation in the Retina", Lasers in Surgery and Medicine, **18**(1), 10-21, 1996.

3)J. Sun and B. Gerstman, "Photoacoustic Generation for a Spherical Absorber with Impedance Mismatch with the Surrounding Media", Physical Review E, **59(5)**, 5772-5789, 1999.

4)J. M. Sun, B. S. Gerstman, and B. Li, "Bubble Dynamics and Shock Waves Generated by Laser Absorption of a Photoacoustic Sphere", Journal of Applied Physics, **88(5)**, 2353-2362, 2000.

5)L. Haar, J. S. Gallagher, and G. S. Kell, NBS/NRC Steam Tables, Hemisphere Publishing, New York, 1984.

DNA Transport in a Single Nanometer-Scale Pore

John J. Kasianowicz, Ph.D.

Ion channels are nanometer-scale pores formed by membrane-spanning proteins. The most well-known channels are the Na^+ and K^+ selective pores which provide the molecular basis of nerve activity. More than fifty years of research into the structure and function of ion channels demonstrates that a seemingly simple motif, a nanopore, is used in many different roles in cells and organelles. For example, in addition to neuronal signal transmission, these roles include antibiotic activity and the transduction of signals within and between cells.

Biological nanopores also facilitate the transport of macromolecules in a wide variety of processes including protein translocation across membranes, gene transduction between bacteria, and the transfer of genetic information from some viruses and bacteriophage to host cells. With the goal of understanding the physics of macromolecular transport through such structures, we have been studying the ability of flexible linear polymers, including single stranded RNA and DNA, to partition into and thread through single channels formed by *Staphylococcus aureus* alpha-hemolysin (alpha-HL).

Like many other ion channels, the alpha-HL channel gates, or switches, between different conducting states. However, in the late 1980s, I developed a method to keep the channel fully open for extended periods. I took advantage of this property and used the channel as a nanoscale test tube to study rapid chemical reactions [1,2,3] and polymer transport processes [3-9] as they occur within a highly confined space.

The alpha-HL channel has an additional feature that makes it highly suitable for polymer transport studies. My friend Dr. Sergey Bezrukov of the NIH and I found that the residence time for neutral polymers in this channel was several orders of magnitude greater than one would predict using a one dimensional diffusion equation and the bulk properties of the polymer [4,5]. Because of this surprising result, the transit events of single polymers through this channel are easily detected using conventional electrophysiology techniques.

This key finding made it possible to consider using the pore to study the transport of other polymers in highly confined spaces. For example, in collaboration with Drs. Deamer, Branton and Brandin, I demonstrated that

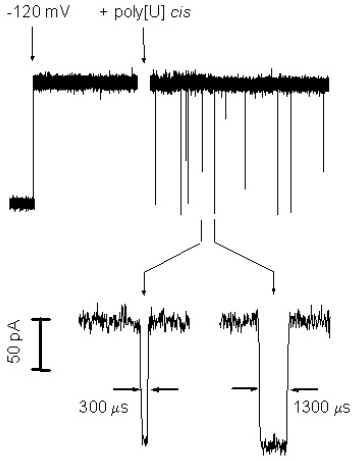

Fig. 1. *The transport of individual polynucleotides through a single alpha-HL channel causes transient blockades in the ionic current. (Left) In the absence of ssDNA, the single channel current is stable. (Right) Adding 210-nucleotide long poly[U] caused short-lived blockades in the ionic current. The blockades are well defined in current amplitude and in lifetime. Qualitatively similar results were obtained with many different homopolymeric DNA polynucleotides. An all-points histogram analysis demonstrated that the lifetimes of poly[U]-induced current blockades were described well by three Gaussian distributions. From [6].*

individual molecules of single-stranded RNA and DNA can be detected and characterized as they are driven electrophoretically through a single

channel formed by *Staphylococcus aureus* alpha-hemolysin [6]. As the molecules traverse the pore, they partially block the ionic current that otherwise flows freely (Fig. 1). Because the lifetime of the current blockades was proportional to the polynucleotide's contour length, we suggested that the polymers thread through the channel as extended chains. In that report, we proposed that single nanopores might permit ultra-rapid sequencing of long DNA strands by measuring the pore's conductance as a function of time. [6,7]. While that technique may ultimately be realized, there are other technologies that can readily be achieved based on the interaction between polymers and single nanopores. For example, several colleagues at NIST and I demonstrated that this system can be used to detect analytes in solution (Fig. 2 and [8]). We are currently exploring the possibility of extending this method to detect deadly pathogens.

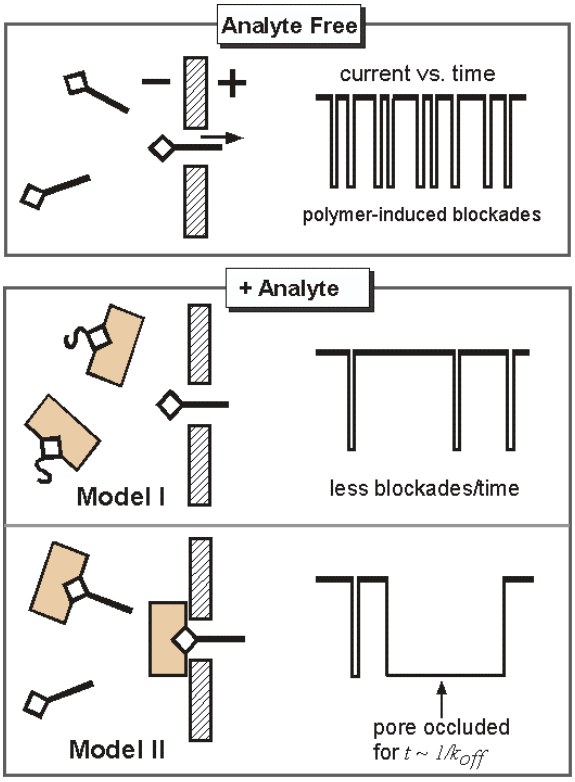

Fig 2. *Analyte detection method using polymers and a nanopore. In the absence of analyte, polymers with covalently attached ligand binding sites traverse the pore and cause transient current blockades (top). Analyte alters the polymer's ability to traverse the pore: the polymer becomes unable to partition into the pore (Model I) or the complex blocks the pore for a time commensurate with the mean lifetime of the complex (i.e., 1/koff) (Model II). In a Model I system, the analyte concentration is deduced from the decrease in the mean number of blockades per unit time. In a Model II system, the analyte concentration is estimated from the mean time to pore occlusion. The kinetic information inherent in the second mechanism could help reduce false positive reports. From [8].*

To understand the mechanism by which individual single-stranded DNA molecules enter a nanometer-scale pore, Sarah Henrickson, Drs. Martin Misakian and Baldwin Robertson (NIST)

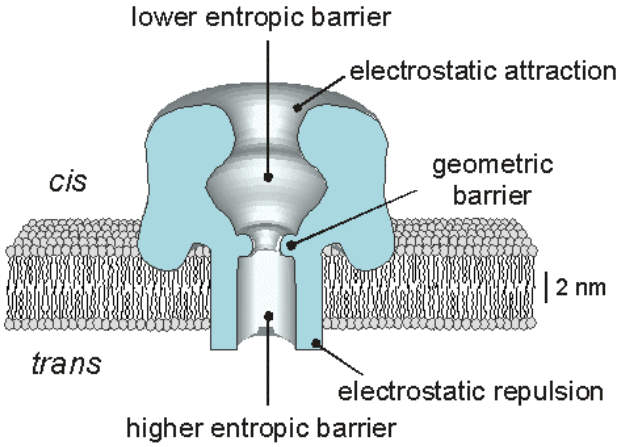

Fig. 3. *Several putative mechanisms for the asymmetric partitioning of polynucleotides into the alpha-HL channel. Polymer entry from the trans side may be less favorable because of the negatively charged side-chains at the pore's entrance or the smaller pore diameter which is a greater entropic barrier than that of the cis vestibule. From [9].*

and I studied the concentration, voltage and sidedness dependence of polynucleotide-induced current blockades of a single alpha-HL channel. For relatively short polynucleotides, the mean polymer-induced current blockade frequency is proportional to the polynucleotide concentration, increases exponentially with the applied potential and that the polymer enters more readily into one side of the pore than the other [9]. A classical Van't Hoff-Arrhenius rate law was fit to the data and permitted us to estimate both the height of the energy barrier that limits polynucleotide

entry into the channel and the number of charges on polyanionic single-stranded DNA that initiate voltage-driven transport through the channel. The results are consistent with the channel's crystal structure, which shows that the two pore entrances have different mean diameters and fixed electrostatic charge densities (cartoon illustration, Fig. 3). Specifically, the asymmetric polynucleotide partitioning may be due to differences in the entropic barriers or electrostatic repulsion on either side of the channel. We are currently studying the effects of electrostatic repulsion on DNA transport through this pore and. In collaboration with Zoran Konkoli, Peter Appell, and Tobias Ambjornsson of Göteborg, Sweden, we are developing more physical theories that better describe polymer entry into nanopores.

Finally, in collaboration with S. Henrickson and Dr. Edmund DiMarzio (NIST), I demonstrated that polynucleotides can be used as molecular rulers to probe the structure of the alpha-HL channel. We determined the location inside the pore that commits the polynucleotides to transport and the length of the channel in terms of the number of nucleotides that span the pore.

Contact Information

John J. Kasianowicz, Ph.D.
Leader, Biomolecular Materials Group
Biotechnology Division
Gaithersburg, MD 20899

john.kasianowicz@nist.gov
301.975.5853

References

1) Bezrukov, S.M., Kasianowicz, J.J. (1993) Current noise reveals protonation kinetics and number of ionizable sites in an open protein ion channel. *Phys. Rev. Lett.* **70**, 2352

2) Kasianowicz, J.J., Bezrukov S.M. (1995) Protonation dynamics of the alpha-toxin ion channel from spectral analysis of pH-dependent current fluctuations. *Biophys. J.* **69**, 94

3) Kasianowicz J.J., Burden D.L., Han L., Cheley S., Bayley H. (1999) Genetically engineered metal ion binding sites on the outside of a channel's transmembrane beta-barrel. *Biophys. J.* **76**, 837.

4) Bezrukov, S.M., Vodyanoy, I., Brutyan, R.A., Kasianowicz, J.J. (1996) Dynamics and free energy of polymers partitioning into a nanoscale pore. *Macromolecules* **29**, 8517

5) Bezrukov, S.M., Kasianowicz, J.J. (1997) The charge state of an ion channel controls neutral polymer entry into its pore. *Eur. Biophys. J.* **26**, 471

6) Kasianowicz, J.J., Brandin, E., Branton, D., Deamer, D.W. (1996) Characterization of individual polynucleotide molecules using a membrane channel. *Proc. Natl. Acad. Sci. (USA)* **93**, 13770

7) Akeson, D., Branton, D., Kasianowicz, J.J., Brandin, E., Deamer, D.W. (1999) Microsecond time-scale discrimination between polycytidylic acid and polyadenylic acid segments within single RNA molecules. *Biophys. J.* **77**, 3227

8) Kasianowicz, J.J., Henrickson, S.E., Weetall, H., Robertson, B. (2001) Simultaneous multianalyte detection with a nanometer-scale pore. *Anal. Chem.* **79**, 2632

9) Henrickson, S.E., Misakian, M., Robertson, B., Kasianowicz, J.J. (2000) Asymmetric driven DNA transport into a nanometer-scale pore. *Phys. Rev. Lett.* **85**, 3057

HUMAN FRONTIER SCIENCE PROGRAM (HFSP)

Bureaux Europe, 20 place des Halles, 67080 STRASBOURG Cedex, FRANCE

Web site: http://www.hfsp.org

NEW UNIFIED PROGRAM OF RESEARCH SUPPORT

The Human Frontier Science Program (HFSP) supports basic research with emphasis placed on **novel**, **innovative** and **interdisciplinary** approaches to basic research which involve scientific exchanges across national boundaries. HFSP previously supported 2 scientific programs focused on neuroscience and molecular biology. With the dissolving of boundaries separating traditional biological fields, and the need to involve disciplines outside biology in life sciences research, these separate programs have been unified into a **single program on complex mechanisms of living organisms** by the HFSP Board of Trustees. Henceforth, a single committee will review all grant applications, while a second committee will review all long-term fellowship applications. Both committees are composed of internationally-leading scientists.

CALL FOR LETTERS OF INTENT TO APPLY FOR A RESEARCH GRANT FOR AWARD YEAR 2003

The new HFSP research grant program places special emphasis on the involvement of other disciplines such as chemistry, physics, mathematics, computer science and engineering in projects within the general areas of neuroscience and molecular approaches to biological functions. Significant new ideas, techniques and discoveries often arise at the boundaries between traditional disciplines. To stimulate novel, daring ideas and innovative approaches, preliminary results are not required in research grant applications. Applicants are expected to develop new lines of research through the collaboration; projects must be distinct from applicants' other research funded by other sources. HFSP supports only international, collaborative teams, with an emphasis on encouraging scientists early in their careers.

International teams of scientists interested in submitting applications for support must first submit a letter of intent online via the HFSP web site. The guidelines for potential applicants and further instructions are available on the HFSP web site (www.hfsp.org).

Research grants provide support for basic research *(up to 3 years)* carried out jointly by research teams in different countries. The principal applicant must be from one of the member countries* but co-investigators may be from any country. Preference is given to intercontinental teams. The size of the team should normally be 2 – 4 members with not more than one member from any one country.

TWO TYPES OF GRANT ARE AVAILABLE:

Young Investigators' Grants are for teams of scientists who are all within 5 years of establishing an independent laboratory and within 10 years of obtaining their PhDs. Successful teams will receive a standard amount of $250,000 per year for the whole team.

Program Grants may be applied for by independent scientists at all stages of their careers, although the participation of younger scientists is especially encouraged. Up to $500,000 may be applied for per year for the whole team, including approximately $100,000 per team member per year plus some additional funds for essential equipment related to the collaboration.

Deadline for Letters of Intent: 3 APRIL 2002 (Info: grant@hfsp.org)

LONG-TERM FELLOWSHIPS

Long-Term Fellowships provide 3 years of support for postdoctoral research abroad in a laboratory of the fellow's choice. Applicants are expected to explore a **new area of research** since frontier life science research in the 21st century will require investigators able to span more than one traditional scientific discipline. More information is available on the HFSP web site. **The next deadline for Long-term Fellowships is 2 September 2002 (Info: fellow@hfsp.org)**

SHORT TERM FELLOWSHIPS

Provide up to three months of support to learn new techniques or establish new collaborations in another country. Applications are accepted throughout the year. **Guidelines and application forms** are available on the HFSP web site **(www.hfsp.org)**

**Current member countries include Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, Luxembourg, the Netherlands, Portugal, the Republic of Ireland, Spain, Sweden, Switzerland, UK and USA*

Annual Biomedical Research Conference for Minority Students (ABRCMS)

"Preparing Scientists for the 21st Century"

In July 2000, the National Institute of General Medical Science (NIGMS), Division of Minority Opportunities in Research (MORE) awarded the American Society for Microbiology (ASM) a five-year grant to manage the Annual Biomedical Research Conference for Minority Students (ABRCMS), formerly the MARC/MBRS Symposium.

The ABRCMS is a national conference designed to encourage students to pursue advanced training in the biomedical sciences and provide faculty mentors and advisors with the resources for facilitating students' success. Through scientific presentations, professional development workshops, poster and oral presentation competitions, numerous networking opportunities with faculty and administrators from graduate schools, government agencies, scientific societies and foundations, the ABRCMS brings together the best and brightest minority students committed to advance training and careers in the biomedical sciences.

The first ABRCMS, held in Orlando, Florida on October 31 – November 3, 2001, was a resounding success. More than 1800 individuals, including approximately 1200 students and 600 faculty and administrators in higher education were in attendance. During the three-day conference, more than 750 students participated in poster and/or oral presentations. The presentations represented nine subdisciplines in the biomedical sciences. Representatives from professional scientific societies sponsored awards, offering $250 to the top poster and oral student presentations. 120 graduate programs at US colleges and universities as well as government agencies, foundations and professional societies comprised the conference exhibits program.

The majority of students who attended the 2001 ABRCMS were supported by NIGMS's programs, which include the Minority Biomedical Research Support (MBRS), the Minority Access to Research Careers (MARC) and BRIDGES to the future programs. Other students were sponsored by professional scientific societies, national minority programs, and foundations, such as the National Science Foundation Alliance for Minority Participation Program, the U.S. Department of Education Ronald McNair Program, the Howard Hughes Medical Institute, the NIH Predoctoral Fellowship Program, the American Chemical Society Scholars Program, and the American Society for Microbiology Minority Undergraduate Research Fellowship Program.

Plans are well underway for the 2002 ABRCMS, scheduled for November 13 – 16, 2002 in New Orleans, Louisiana. The program will be comprised of scientific sessions, professional development workshops, student oral and poster presentations, and exhibits. Invited speakers include Dr. Bernard Harris (former astronaut), Dr. Antonia Novello (Commissioner, New York State Health Department), Dr. Francis Collins (Director, Human Genome Institute), Dr. Ruth Kirschstein (Acting Director, NIH), Dr. Alfred Gilman (1994 Nobel Prize Winner in Physiology or Medicine), and Dr. Thomas Cech (1989 Nobel Prize Winner in Chemistry). In addition, as 2002 marks the 40th anniversary of NIGMS and the 30th anniversary of the MARC/MBRS programs, several special events have been planned during the conference to celebrate this momentous occasion. The honorable Louis Stokes, former U.S. Congressman, will be giving the Keynote address during the Anniversary Celebration.

For additional information on the 2002 ABRCMS, please visit the conference Web site at www.abrcms.org or contact the ABRCMS staff: E-mail: abrcms@asmusa.org; Tel: 202-942-9228; Fax: 202-942-9329.

MARK YOUR CALENDAR!!!

2002 ANNUAL BIOMEDICAL RESEARCH CONFERENCE FOR MINORITY STUDENTS (ABRCMS)

"Preparing Scientists for the 21st Century"

November 13 - 16, 2002
Hyatt Regency, New Orleans, LA

Celebrating 30 years of the NIGMS MARC/MBRS Programs

Opening Keynote Address: Dr. Bernard Harris
(Former Astronaut)

Anniversary Celebration Keynote Address: The Honorable Louis Stokes
(Former U.S. Congressman)

Closing Keynote Address: Dr. Antonia Novello
(Commissioner, New York State Health Department and Former Assistant Surgeon General)

Students, Faculty Mentors and Faculty Advisors:
Advance Your Knowledge♦ Share your Expertise ♦Explore New Opportunities

Conference features include:

- Scientific Sessions
- Professional Development Workshops
- Student Poster and Oral Presentations
- Exhibits

Sponsored by: *Division of Minority Opportunities in Research of the National Institute of General Medical Sciences (NIGMS)*

Managed by: *American Society for Microbiology (ASM), Education Department (Winner of the 2000 Presidential Award for Mentoring)*

For additional information on the 2002 ABRCMS, please visit the conference Web site at www.abrcms.org or contact the ABRCMS staff: E-mail: abrcms@asmusa.org; Tel: 202-942-9228; Fax: 202-942-9329.

VOTE EARLY AND OFTEN!

By now you have all received your email ballots from Paul Gailey. You may vote for two candidates for the Executive Committee, and select one Vice Chair. The deadline for voting (FORWARD your email ballot back to Paul at pgailey@fetzer.org) is February 28, 2002. Nominee biographies and statements of intent are posted online at http://www.aps.org/DBP/nominees.html, and are reprinted here in the newsletter for your convenience. Your vote is important! Please read over the information below and return your ballot to Paul if you haven't done so yet.

Executive Committee candidates

Anjum Ansari	UI at Chicago	ansari@uic.edu	(312) 996-8735
T. Gregory Dewey	Keck Genome Institute	greg_dewey@kgi.edu	(303) 871-3100
Leon Glass	McGill U.	glass@cnd.mcgill.ca	(514) 398-4338
Andrea Markelz	SUNY Buffalo	amarkelz@buffalo.edu	(716) 645-2006
Vijay Pande	Stanford	pande@stanford.edu	(650) 723-3660
Joan-Emma Shea	UCSB	shea@chem.ucsb.edu	(805) 893-5604
Aihua Xie	Oklahoma State	aihua@westlake.phys.okstate.edu	(405) 744-6589

Vice Chair candidates

Phil Nelson	U. Penn	nelson@physics.upenn.edu	(215) 898-7001
Jose N. Onuchic	UCSD	jonuchic@ucsd.edu	(858) 534-7067

Anjum Ansari

PHYSICS DEPARTMENT, UNIVERSITY OF ILLINOIS AT CHICAGO

Biography

My research is at the interface of physics, chemistry, and biology. The focus of my research is the study of the dynamics of biological macromolecules in solution. In particular, I am using laser temperature-jump techniques with time-resolved absorbance and fluorescence measurements to elucidate the fast dynamics (with nanosecond time-resolution) of (i) secondary structure formation in single-stranded DNA and RNA, (ii) early events in the folding of proteins, and (iii) conformational changes associated with binding of proteins to DNA. I received a CAREER award from the National Science Foundation in 1997.

Statement of Intent

I am interested in serving on the Executive committee of the DBP division of APS. My primary interest in running for this office is to help in the organization of the March meeting, and to help establish contacts with other members in Biological Physics through Web pages, newsletters, etc.

T. Gregory Dewey

KECK GRADUATE INSTITUTE OF APPLIED LIFE SCIENCES, CLAREMONT, CA

Biography

Dewey has broad research and teaching interests in the fields of biophysics and computational biology. A central focus of his work is on the mathematical modeling of complex biological phenomena. Dewey has co-authored over 80 scientific publications and his book, “Fractals in Molecular Biophysics” was recently published by Oxford University Press. In 1999 he was named a Fellow of the American Physical Society through the Division of Biological Physics. Greg Dewey is a member of the founding faculty of the newly founded Keck Graduate Institute of Applied Life Sciences (KGI), the latest member of the Claremont University Consortium. In addition to his research

interests, Dewey has been active in creating the interdisciplinary curriculum at KGI that combines computational biology, bioengineering and systems biology. Before arriving at KGI, Dewey was Professor and Chair of the Department of Chemistry and Biochemistry at the University of Denver. He spent a sabbatical year at Duke University as an NIH Senior Fellow in 1988. Dewey received his undergraduate degree from Carnegie-Mellon University. His doctoral work was done at the University of Rochester and focused on the biophysics of nucleic acids. He was an NIH Postdoctoral Fellow under Gordon G. Hammes at Cornell University.

Statement of Intent:
Physics and Biology in the Post-Genomic Era

We are currently in an era of impressive technological advances in molecular biology and biochemistry. This era is seeing the completion of genome projects, the development of DNA chip and phage display technologies and the computational power to store and retrieve information in large databases. Given the confluence of these technological advances, we appear to be on the way to establishing a new "quantitative biology". This biology is being referred to as “systems biology” because of its quantitative whole-genome approach. It is unclear at this stage, what discipline the practitioners and teachers of the new systems biology will come from. This is a time of opportunity for the community of biological physicists. If elected to the Executive Council of the Division of Biological Physics, I would promote an agenda where biological physicists are made more aware of opportunities for research and training in Systems Biology and in Computational Biology. These infant disciplines need the expertise and perspectives that physicists can bring to problems presented by complex biological systems. To promote awareness of these opportunities, I would work with the Council to encourage symposia, identify funding opportunities and to publicize the ongoing development in these fields. In a very true sense, the emerging biological technologies have outstripped the discipline itself, forcing an interdisciplinary approach on the "new biology". The challenge and the excitement for physicists is to move into this new area where signposts do not exist and advance our fundamental knowledge of systems biology.

Leon Glass

McGill University, Montreal, Quebec, Canada

Biography

Leon Glass obtained a Ph.D. on the theory of atomic motions in simple liquids in 1968 from the University of Chicago. He then was a Postdoctoral Fellow in Machine Intelligence and Perception (University of Edinburgh), Theoretical Biology (University of Chicago), and Physics and Astronomy (University of Rochester). He has been at McGill University, Montreal, Quebec, Canada since 1975, where he is the Isadore Rosenfeld Chair in Cardiology and a Professor in the Department of Physiology. He was a Visiting Professor at the University of California at San Diego during 1984-85. In 1994-95 he received a Guggenheim Fellowship to study ``Nonlinear Dynamics and Sudden Cardiac Death" at Beth Israel Hospital in Boston while a Visiting Professor at Harvard Medical School. In 2001-2002 he is a Visiting Professor at the Department of Biomedical Engineering at Boston University. He has carried out studies on the application of nonlinear dynamics to physiology and medicine. In particular he has worked on problems associated with visual perception, respiratory rhythmogenesis and the effects of periodic forcing on respiration, dynamics of tremor and motor control, and dynamics of cardiac arrhythmia. He is a Fellow of the Royal Society of Canada and the American Physical Society, and a former President of the Society for Mathematical Biology. His books, "From Clocks to Chaos: the Rhythms of Life" (Princeton University Press, 1988) with Michael C. Mackey and "Understanding Nonlinear Dynamics" (Springer-Verlag, 1995) with Daniel Kaplan, deal with quantitative approaches to study complex biological dynamics.

Statement of Intent

Physicists have made profound contributions to biology. Advances from physics now reach across all disciplines and include development of theoretical and experimental approaches, as well as the design of equipment that is essential for the modern hospital or biology laboratory. The revolutionary progress in genomics and proteomics in recent years poses new puzzles that will demand the expertise of those with strong quantitative and theoretical skills to sort out the underlying mechanisms of life from the molecular to the organismal levels. The subset of physicists who address these questions will not only be challenged by the scientific problems, but also by the structural and cultural impediments at various bureaucratic levels that make it difficult to pursue interdisciplinary work. The

Division of Biological Physics has a role to play by helping to educate the physics and biological communities about the opportunities provided by biology to physical scientists, by working with funding agencies to help foster the development of interdisciplinary research programs, and by reaching out to other professional societies to help develop new ways to organize education and research to reflect the realities of the current scientific milieu. Finally, the Division of Biological Physics should develop ways to help educate and initiate into research young physicists with a passionate fascination with biology.

Andrea Markelz

Department of Physics, SUNY at Buffalo

Biography

Andrea Markelz is currently an Assistant Professor at the University at Buffalo, State University of New York (UB, SUNY), an adjunct faculty member of the Department of Structural Biology and a member of the Institute for Lasers, Photonics and Biophotonics (ILPB) at UB, SUNY. Her affiliations include ACS, Sigma Xi and OSA. She graduated from UC Santa Barbara Fall 1995 with a degree in nonlinear terahertz studies of semiconductor heterstructures. The optical and electrical properties of biosystems, their emerging tailorability through mutagenisis and their ability to self assemble into regular periodic structures, suggested that a new materials science field of technology based on biosystems could emerge as an alternative technology to the current cut away semiconductor systems. Dr. Markelz began to move to biophysical studies through an NRC postdoctoral fellowship at NIST, Gaithersburg beginning the application of terahertz time resolved spectroscopy to biomolecules. This technique accesses the frequency regime, (2 - 100 cm^{-1}), where the bulk of the vibrational modes associated with conformational change occur. Her current research concerns applications of terahertz time resolved spectroscopy to conformational dynamics and conformational flexibility measurements of proteins. These studies are in collaboration with researchers at University of Connecticut and the Hauptman Woodward Institute for protein crystallography. The goals of this research are both basic and applied. The understanding and quantitative measurement of conformational dynamics and flexibility will assist in the understanding of biochemical processes. In addition through the ILPB she is working towards the engineering of biosystems for photonic applications. She is using TTDS as a rapid assessment tool for the conformational flexibility of the mutants and the relationship of the flexibility to photonic and electronic properties.

Statement of Intent

Interdisciplinary research is essential to biological physics, creating a unique need for students well versed in math, physics and biology. However our students are falling behind in math and physics. We have all seen this in the context of our introductory physics courses. In addition the number of students pursuing undergraduate degrees in physics is falling. This is in part due to their lack of appreciation of the applications of these skills. When most students think of physics they think of the more "traditional" fields of solid state physics and high energy physics. As a member at large I would like to use the resources of the APS and DBP to develop outreach and recruitment programs for the public. Clearly web-based methods would be the easiest to implement. For example, the main link on the APS homepage for education is the www.physicscentral.com link. While this site is a wonderful educational tool, a search of the site for biomolecules, biophysics, biophotonics or biosystems results in "zero items found". The Internet Resources page of the APS website is also missing any mention of biophysics. These missed opportunities for outreach can easily be corrected. However, I would also investigate if current programs of the APS, NSF and NIH may enable the DBP to recruit analytically gifted students who do not see themselves pursuing "traditional" physics. I would like to see this discussion topic included at the annual meeting.

Vijay Pande

Stanford University

Biography

Vijay Pande is an Assistant Professor in the Departments of Chemistry, Structural Biology, and the Stanford Synchrotron Radiation Lab at Stanford University. In 1992, he received a BA in physics at Princeton University, where he wrote an undergraduate thesis under P. W. Anderson on spin glass models of prebiotic systems. In 1995, he received his PhD in physics from MIT, where he studied statistical mechanics models of protein folding and protein design under T. Tanaka and A. Grosberg. Before coming to Stanford in 1999, he was a Miller fellow in Physics at UC Berkley, working with D. Rokhsar. He has had interests in biological physics starting from his undergraduate work and has been active in protein folding, polymer physics, and biomaterials throughout his career. Most recently, he has had success with atomistic folding of proteins using worldwide distributed computing; this project, dubbed "Folding@Home" (http://folding.stanford.edu) has simulated orders of magnitude longer timescales than

previous simulations and has folded proteins with quantitative agreement with experiment.

Statement of Intent

The rise of biological science has been undeniable and the number of dramatic results continues to grow. It is equally clear that physical methods and insight will play a large role in the future of biology, especially molecular biophysics and chemical biology. My interests on the executive committee are in positioning biophysics – and most importantly physical scientists -- in a central role in the future of these areas. Perhaps the most important step is our training of physicists to work in these areas. In particular, I would like to see the biological physics division of the APS support these areas in education, both for graduate students, as well as physicists looking to enter this exciting area. Towards this goal, I would suggest workshops in key areas in biology, which would offer both an introduction to the relevant biological questions, physical approaches to their solution, as well as an opportunity to interact with the leaders of these respective fields. I hope that such efforts would greatly aid physical scientists, with our strengths in quantitative, theoretical, and physical approaches, to have a significant impact in biology.

Joan-Emma Shea

Department of Chemistry and Biochemistry, University of California, Santa Barbara

Biography

Joan-Emma Shea is an assistant professor in the department of Chemistry and Biochemistry at the University of California, Santa Barbara. Joan received a Bachelor of Science degree in 1992 from McGill University, Canada and a Ph.D. from the Massachusetts Institute of Technology in 1997. She pursued her post-doctoral studies jointly in the department of Molecular Biology at the Scripps Research Institute and in the department of Physics at the University of California, San Diego. After a year as an assistant professor in the department of Chemistry and the James Franck Institute at the University of Chicago, Joan joined the faculty at UC Santa Barbara in 2001. Joan's research interests include statistical mechanics and theoretical and computational biophysics. Currently she is studying the processes of protein folding and protein aggregation.

Statement of Intent

Biologists and physicists tend to approach biophysical questions very differently. While biologists and biochemists focus on the complex details of the biological machinery, physicists strive to understand the fundamental physical principles underlying the biophysical processes. Neither approach can be successful without the influence of the other and it is crucial that both communities interact to share their knowledge. The APS biological division provides a forum for experimental and theoretical biophysicists from a variety of backgrounds to come together and exchange insights and ideas.

As a member of the Executive Committee for the Biological Sciences, I will strive to create a more dynamic and vibrant biophysical community within the APS. Regrettably, our division is one of the smallest in the APS. I will actively seek to increase our visibility and membership from both the physical and biological ranks. I will work toward making APS meetings an effective medium to disseminate the latest advances in biophysical research.

Aihua Xie

Oklahoma State University

Biography

Dr. Aihua Xie is an Associate Professor of Physics at Oklahoma State University. She received her Ph.D. in physics and biophysics from Carnegie Mellon University in 1987, and performed postdoctoral research on protein dynamics at the University of Illinois, Urbana-Champaign (1987-92). She joined the faculty of Department of Physiology and Biophysics at Albert Einstein College of Medicine as an Instructor (1993-1997) and served as Associate Director of the Regional Center for Time-resolved Synchrotron Spectroscopy of Biomolecules based on the NSLS at the Brookhaven National Lab (1994-1996). In 2000 she received the junior faculty award for scholarly excellence from the College of Arts and Sciences at Oklahoma State University. Her research interests are in structure and function of photoreceptor proteins, intra- and inter-proton transfer in proteins, and energy flow in proteins. She has been invited to give many research presentations, including four invited talks at international conferences (1998-2002).

Statement of Intent

Based on her research experience, Dr. Xie will actively promote interdisciplinary education in biological physics and annual workshops to help new investigators in the field of biological physics and to support the growth of the Division of Biological Physics.

Phil Nelson

University of Pennsylvania, Philadelphia, PA

Biography

Biological physics:	biopolymers; molecular motors; self-assembly; DNA topology and elasticity
Condensed matter physics:	complex fluids; bilayer membranes; dynamical pattern formation; colloidal forces; entropic forces

Statement of Intent

I'm delighted by the recent spectacular rise of Biological Physics within the physics community. Realistically, however, I believe our field must consolidate these gains by anchoring itself within the administrative structure of US universities. One way to accomplish this is by having a lasting impact on undergraduate and graduate curricula. The time is ripe: we are also in a period of strong student interest in, and demand for, Biological Physics. I'd like to see the DBP play a role in coordinating curricular innovation. (I personally have made a big investment in education, spending the past two years developing a new course and writing a textbook on BP; see http://www.physics.upenn.edu/~biophys/frontmatter.pdf).

I'd also like to see the DBP reaching out more to other subdisciplines, including both hard and soft condensed matter, nonlinear science, and so on, capitalizing on the influx of talented people with these backgrounds.

Third, I'd like to see DBP create some material aimed at graduate students or physics seniors, outlining the many career options in biological physics and the many different ways to get training in this field. Too many students don't really see the options---and our students are our future.

As a relative newcomer to this field, I can mainly offer my willingness to do lot of hard work, which in any case is a primary qualification for the job. I am eager to learn much more than I know about the research of all the DPB members, and to help put together some really cutting-edge conferences.

Jose N. Onuchic

University of California at San Diego, San Diego, CA

Biography

Education
Ph.D. , California Institute of Technology, March 1987.

Current Positions
Professor of Physics, University of California, San Diego.
Co-Director, La Jolla Interfaces in Science (supported by the Burroughs Wellcome Fund).
Senior Fellow, San Diego Supercomputer Center.

Theoretical and computational methods for molecular biophysics and chemical reactions in condensed matter. In protein folding, we introduced the concept of protein folding funnels as a mechanism for the folding of small fast folding proteins. Convergent kinetic pathways, or folding funnels, guide folding to a unique, stable, native conformation. Energy landscape theory and the funnel concept provide the theoretical framework needed both to pose and to address the questions of protein folding mechanisms. Connections between our theoretical advances and experiments are central for the development of this new view for protein folding. A second effort of our group focuses on the theory of chemical reactions in condensed matter with emphasis on biological electron transfer reactions. These reactionsare central to the bioenergetic pathways of both animals and plants on earth, such as the early steps of photosynthesis. We have investigated several aspects of this problem: the role of quantum dissipation and coherence, adiabaticity and non-adiabaticity of reaction rates, energy redistribution, the validity of the Born-Oppenheimer approximation and two-level system Hamiltonians in biochemical reactions. Most of our recent work deals with the electronic coupling between the donor and acceptor sites. The concept of tunneling pathways and the methodology for reducing the protein into a combination of relevant tubes of pathways create a new way of designing electron transfer proteins. The connection between this theoretical approach and experiments on electron transfer proteins has substantially improved our understanding of these electron transfer processes.

Statement of Intent

No statement available.

UPoN'2002 to Be Held In Washington DC, Sept. 2-6

Dear Colleague,

As you may know, I am organizing the Third international conference on Unsolved Problems of Noise and fluctuations in physics, biology, and high technology (UPoN'2002) to be held September 2 - September 6, 2002 in Washington, DC.

If you are interested in participating, please submit your proposal. At this moment I need only a tentative title of your contribution.

Best wishes,
Sergey Bezrukov, Conference Chair
bezrukov@helix.nih.gov

History of the UpoN Conferences

The first conference, organized by Laszlo Kish, was held in Szeged, Hungary in 1996 and was mostly devoted to high technology devices. The second one, organized by Derek Abbott, was hosted by Adelaide, Australia in 1999 and focused mainly on mathematical aspects and paradoxes in noise and fluctuation research. The second conference received coverage in Nature (Random fluctuations - Unsolved problems of noise, Nature 401, p.23, Sept. 2, 1999).

More about UpoN'2002

The purview of this third conference, which is to be held at the National Institutes of Health campus in Bethesda (Washington, DC metro area), will be shifted toward biology and medicine. The conference is supposed to bring together scientists from physics, biophysics, biomedical engineering, biology, and medicine to promote the penetration of concepts and quantitative methods of physics of fluctuations into biological sciences and medicine. Among the topics covered will be: the constructive role of noise in sensory transduction (hearing in humans, electroreception in marine animals), encoding of information into nerve pulse trains, single molecules and noise (including single molecule detection and characterization by nanopores -- molecular 'Coulter counting'), concepts of noise in neurophysiology (randomness and order in brain and heart electrical activities under normal conditions and in pathology), the dynamics of human posture and eye adaptation, the role of noise in genetic regulation and gene expression, bioinformatics, biosensors, etc.

In order to avoid parallel sessions and to ensure lively general discussions, the total number of participants will be limited to approximately 100. The room that I booked has maximum capacity of 150 persons.

One of the goals of UPoN'2002 is to attract more funding from NIH to biological physics and to our field in particular. I will do my best to advertise our conference among NIH funding agencies and to get their officials into the conference audience.

Important notice: The conference tradition dictates that in order to be accepted each proposal has to be reviewed using double-blind refereeing process by appropriate members of the Scientific Committee.

UPoN'2002 Committee members

Derek Abbott, dabbott@eleceng.adelaide.edu.au
Robert Austin, rha@suiling.princeton.edu
Dean Astumian, astumian@maine.edu
Sergey Bezrukov, bezrukov@helix.nih.gov
Gijs Bosman, gbosm@ece.ufl.edu
Adi Bulsara, bulsara@spawar.navy.mil
Jim Collins, jcollins@bu.edu
David Deamer, deamer@hydrogen.ucsc.edu
Louis DeFelice, Lou.DeFelice@mcmail.vanderbilt.edu
Jamal Deen, jamal@ece.eng.mcmaster.ca
Charlie Doering, doering@math.lsa.umich.edu
Peter Hanggi, Peter.Hanggi@Physik.Uni-Augsburg.DE
Nico van Kampen, N.G.vanKampen@phys.uu.nl
Laszlo B. Kish, Laszlo.Kish@ee.tamu.edu
Misha Levinstein, melev@nimis.ioffe.rssi.ru
Andre Longtin, alongtin@physics.uottawa.ca
Peter McClintock, p.v.e.mcclintock@lancaster.ac.uk
Frank Moss, mossf@umsl.edu
Ralph Nossal, rjn@helix.nih.gov
Lino Reggiani, lino.reggiani@unile.it
Barry J. Richmond, bjr@ln.nimh.nih.gov
Lutz Schimansky-Geier, alsg@physik.hu-berlin.de
Michael Shlesinger, SHLESIM@ONR.NAVY.MIL
Gene Stanley, hes@meta.bu.edu
Charles Stevens, stevens@salk.edu
Lode Vandamme, L.K.J.Vandamme@ele.tue.nl
Michael Weissman, mbw@uiuc.edu
Kurt Wiesenfeld, kurt.wiesenfeld@physics.gatech.edu

APS BIOPHYISCS WORKSHOP PLANNED FOR SEPTEMBER 2002

The text below is partially reprinted from an article to appear in the February issue of the APS News.

The APS, together with its Division of Biological Physics, is organizing a topical conference entitled "Opportunities in Biology for Physicists," to be held September 27-29 2002 in Boston, Massachusetts. The conference is aimed primarily at graduate students and postdocs who are considering moving their areas of research concentration to biological topics, not at those who already work in the field of Biological physics or biophysics.

Attendance will be limited to about 250 participants. Unlike the Society's more traditional meetings, this conference is not intended to be a place where scien tists present their own new research. Rather, leading physicists and biologists will be asked to give broad overviews of their selected areas of expertise at the interface between physics and biology. There will also be lectures offering practical advice on how to move from physics into the physics-biology interface, and an afternoon reception for those who fund biological physics research and those who hire biological physicists to meet with the participants and to display posters or set up booths.

Five topics have been selected for emphasis: genomics and evolution, biological networks, biomolecular dynamics, high-resolution imaging of living cells, and physical devices for biological investigation. Each of these topics is an area that offers significant opportunities for the techniques and problem-solving skills of physicists.

"We hope that this workshop will help introduce young physicists to the great opportunities that exist in modern biology, and catalyze the enrichment that modern biology can bring to physics," said Robert Austin (Princeton University), who is chairing the program committee for the conference.

For more information about the conference, see **http://www.aps.org/meet/biology-physics/.**

APS MEMBERSHIP DRIVE IS ON NOW!!

From now until the end of February the American Physical Society is offering one year of membership at half price to new and lapsed members. Please encourage your students and colleagues to join APS. While you're at it, get them join DBP! Tell them how much fun it is to be a member of DBP and to enjoy great perks like

THE BIOLOGICAL PHYSICIST!

http://www.aps.org/memb/halfprice.html