THE BIOLOGICAL PHYSICIST

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In this Issue

This issue of THE BIOLOGICAL PHYSICIST brings you a conversation with Paul L. LaCelle about the history of the University of Rochester's Biophysics Department, one of the pioneering interdisciplinary departments in the US. We also bring you PRL and PRE Highlights, the results of the recent DBP elections, the list of 2005 APS Fellows nominated by DBP, and some last-minute reminders for the March Meeting.

See you in Baltimore!

-- SB

FEATURE

Biophysics at the University of Rochester:

A Conversation with Paul L. LaCelle

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S. Bahar

For many years, the Department of Biophysics Department at the University of Rochester, in snowy upstate New York, was one of the few biophysics programs in the country. THE BIOLOGICAL PHYSICIST talks with Paul L. LaCelle, MD, former chair of the Department of Biophysics (and currently Senior Associate Dean for Graduate Education at the University of Rochester Medical Center) about the unique history of this department, and the role it played in the development of interdisciplinary science in the United States.

(Full disclosure: your editor was a graduate student in the Biophysics Department at the University of Rochester from 1991 to 1997, and obtained her doctorate there in the laboratory of Prof. Philip A. Knauf. Yes, this technically means that your editor is a "biophysicist", not a "biological physicist", but hopefully the readers will recall the teachings of Giordano Bruno that everything is everything else, and will therefore forgive this nomenclatural transgression.)

THE BIOLOGICAL PHYSICIST: *Tell us about the early history of the department.*

Paul LaCelle: William Bale was awarded a Ph.D. in Biophysics in 1936, presumably by the Department of Physics, for work having to do with radioisotopes (radioiodine, short-lived K, Na, etc.), and I believe he worked with DuBridge, who was the Chair of Physics, and with George Whipple, who became the first Dean of the School of Medicine and Dentistry (SMD).

It is known that when the first University of Rochester cyclotron was built, Professor DuBridge personally transported isotopes to SMD for research to Pathology (Whipple, Leon Miller, etc.) and Physiology (Fenn and colleagues) to demonstrate "active" membrane transport using K40.

In February 1943 the University of Rochester was asked by leaders of the US Army's Manhattan District to become a part of the research and development leading to the development of the atomic bomb. Rochester's role was to establish exposure parameters to protect workers handling, processing, and possibly even inhaling isotopes, and to devise detection instrumentation. Stafford Warren, Chair of Radiology who had studied effects of radiation on human on human tissues was the leader of the Atomic Energy Project (AEP) at Rochester.

In 1948, the Department of Radiation Biology was established, the first such department in the US, and Harry Blair, a physicist and physiologist, became chair. Support came from the Atomic Energy Commission via the local AEP and included additional funds

supplied to permit development of M.S. and Ph.D. degrees in Radiation Biology, Toxicology, and then later, in the 1960s, a Ph.D. in Biophysics. The Department of Radiation Biology was the primary AEC training facility, first for many US and international military types, and later for civilians. William Bair was awarded the first Ph.D. in Radiation Biology in 1954. Hundreds of students were trained at the M.S. level.

Dr. Tom Gunter working on an EPR apparatus in Rochester, around 1970.

In 1966, the Department was re-named Radiation Biology and Biophysics as a result of the recruitment of physics and mathematically oriented faculty, and a growing emphasis on biophysical problems and methods. By about the 1980s, Rochester's department, the Department of Molecular Biophysics and Biochemistry at Yale and a department/division at Columbia received the largest amounts of federal support from DOE and NIH for Biophysics research; Rochester often was 1st or 2nd of the three.

The Ph.D. in Biophysics which had been a degree obtainable at the University of Rochester since the 1930s, was established in the department, while a Division of Biological Physics remained in Physics and Astronomy. Over time, the discipline of Radiation Biology declined in the US. As far as I am aware, the only such department now remaining in the country is one at Colorado-Fort Collins. Our department was eventually re-named Biophysics. Later, in 1992, the Toxicology faculty formed a new department of Environmental Health Science.

THE BIOLOGICAL PHYSICIST*: One of the unique aspects of the department, and indeed of the University of Rochester Medical Center, is the tunnel under Elmwood Avenue, connecting Strong Hospital to the Biophysics Annex Building. Many universities have tunnels to shield their students and faculty from the cold weather, but Rochester's tunnel is unique in that, as the tradition goes, a bunch of graduate students got together in the 1960s with some buckets of paint, and painted the dark, depressing tunnel with flowers and song lyrics…*

Paul LaCelle: When the Annex was built in 1943 (February – June!), the tunnel was built for access from the School of Medicine and Dentistry and also as a security device to limit access to the highly classified research in the Annex. The "A" wing housed a million volt X-ray source which was used to examine metal castings for internal defects during World War II. The "B" wing contained the main research laboratories and the animal facility, while the single story "C" wing, farthest east, was the inhalation facility and provided access to the Annex complex. *[Editor's note: As late as 1997, the entrance to the Annex still sported a large rubber doormat emblazoned with "AEC" in large white letters!]*

In 1966, UNESCO sponsored an international Biophysics Training Course in Germany. This largely consisted of laboratory research, with students doing replication of classical work in transport, nerve condition, muscle physiology, etc.; many senior, world-famous scientists were instructors.

In 1968 Rochester was asked to host a similar course. We invited approximately 80 outstanding young biophysics and physiology types from Europe, South America, etc., as well as from within the United States. These students were intrigued by the tunnel and asked me, the course director, if they could paint historical pictures/cartoons and write poetry, etc. – which they did. (The tunnel was later "defaced" by some locals who had no talent.)

Military officers and students working in Rochester's Health Physics / Radiation Biology laboratories in the 1950s.

THE BIOLOGICAL PHYSICIST: *At the medical school side of the tunnel entrance, there is a yellowed sign forbidding the taking of photographs under any circumstances.*

Paul LaCelle: The sign from the 1940's forbade pictures, etc., as part of security. I suppose the sign had no importance after late 1940's.

THE BIOLOGICAL PHYSICIST: *In addition to the Annex, the department also had laboratory space in the main University of Rochester Medical Center complex, at Strong Hospital.*

Paul LaCelle: Yes. In 1946 when the newly formed Atomic Energy Commission became the umbrella organization, education became a primary focus. The "O" Wing (that's the 5700 wing for locals and aficionados) was built in 1946. Upper stories were added two years later. The intent was proximity to the departments in the School of Medicine and Dentistry. Physics was moving into high energy nuclear and particle physics and by the mid 1950s, the Rochester Conference had replaced the original Solvay Conferences, which had been discontinued because of the Second World War. In fact, when I first came to Rochester, every physicist of note – Bohr, Bethe, Heisenberg, Dyson, Feynmann, Uhlenbeck, Weiskopf, etc. – attended these conferences. It was an amazing experience for me to sit in Strong Auditorium and hear these 'greats' speak!

THE BIOLOGICAL PHYSICIST: *Describe your time as Department Chair.*

Paul LaCelle: I was appointed assistant professor in 1967 and professor in 1974; then appointed Department Chair in 1977. The main change during my tenure was the department's evolution as a result of decline of radiation biology and development of biophysics due to the influence of Aser Rothstein, and the NIH sponsored Biophysics Training Grant, which complemented the support of DOE educational funds. During my time, we moved from DOE goal-oriented research to "NIH style". As a result, in 1983, DOE closed out their contract with the department. We deliberately recruited physics, biophysics and engineering faculty and moved Toxicology out, to the new department, Environmental Health Science, to give Toxicology increased visibility, and its own identity. People such as Phil Knauf and Giles Cokelet, as well as prior appointees Bill Bernhard, George Kimmich and Tom Gunter formed the nucleus of the resulting Biophysics Department. The work generally moved

toward cell and molecular topics, although Cokelet and Ingrid Sarelius were microvascular systems bioengineers.

Cast metal busts of J. Robert Oppenheimer and Albert Einstein, which adorned the entrance to Rochester's Biophysics Department for many years.

THE BIOLOGICAL PHYSICIST: *Could you describe some of your own research projects?*

Paul LaCelle: My initial interest focused on the question of how mechanical features of cells contribute to anemia, i.e., shortened erythrocyte life span. The mechanical features of the cell and its membrane were presumed to be important in this regard. The excess surface area of membrane to volume enclosed in the erythrocyte was thought to allow red blood cells to deform readily under the shear forces in the dynamics of circulation. To study erythrocytes, we used a micropipette aspiration technique which had first been described by Schwann in studies of sea urchin eggs.

Our studies showed that the viscoelastic properties of the membrane were not limiting. But, however, the presence of reduced membrane area (hereditary spherocytosis) or adherence of abnormal or denatured hemoglobin did influence viscoelastic properties. It became obvious that although membrane viscoelasticity and cellular properties could be characterized with great sensitivity, the total system – cells interacting in flow channels of capillaries and vascular endothelium, or unique passages in special organs like the spleen – must be studied to understand the overall dynamics and pathophysiology. Thus, all subsequent work was performed in glass capillary single channels, multiple channels, or more sophisticated channels such as living microvascular tissue. Later, our work turned toward leukocytes and their interactions with endothelium in flow systems.

Our first major paper, work initiated by Robert Weed, led to a listing in the top 100 papers (1950 – 1980) in biomedical journals. (Our department had six such papers in that period; work by Phillip Chen and Taft Toribara was particularly highly cited.)

THE BIOLOGICAL PHYSICIST: *What do you think of the nomenclature debate – is there a difference between "biophysics and "biological physics"? Does it matter?*

Paul LaCelle: Biophysics tends to have been used among physiologists while Biological Physics is preferred by physicists. Similarly, engineers prefer "biological engineering" or "bioengineering" over "biomedical engineering", since the former is a broader, more inclusive term.

According to location, the definitions vary. Physicists always include critical analyses in the model work whereas many "biophysicists" are self-styled biochemists, pharmacologists, etc. and in many instances are not individuals who approach problems with application of physical methodology and analysis.

PRL HIGHLIGHTS

Soft Matter, Biological, and Interdisciplinary Physics
Biological Physics Letters from
Physical Review Letters
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Dynamics of Nematic Liquid Crystal with Quenched Disorder in the Random Dilution and Random Field Regimes
M. Marinelli, F. Mercuri, S. Paoloni, and U. Zammit
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Kayaking and Wagging of Rods in Shear Flow
Yu-Guo Tao, W. K. den Otter, and W. J. Briels
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Spicules and the Effect of Rigid Rods on Enclosing Membrane Tubes
D. R. Daniels and M. S. Turner
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Wave Grouping of a Meandering Spiral Induced by Doppler Effects and Oscillatory Dispersion
Hui-Min Liao, Lu-Qun Zhou, Chun-Xia Zhang, and Qi Ouyang
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S. Manley, H. M. Wyss, K. Miyazaki, J. C. Conrad, V. Trappe, L. J. Kaufman, D. R. Reichman, and D. A. Weitz
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Percolation Transition of Hydration Water: From Planar Hydrophilic Surfaces to Proteins
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248301

Simulation of the Burridge-Knopoff Model of Earthquakes with Variable Range Stress Transfer
Junchao Xia, Harvey Gould, W. Klein, and J. B. Rundle
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Exact Results for the Barabási Model of Human Dynamics
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Published 6 December 2005
248701

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Xenon Melting Curve to 80 GPa and 5*p*-*d* Hybridization
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Scaling of Polymers in Aligned Rods
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Published 15 December 2005
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Granular Leidenfrost Effect: Experiment and Theory of Floating Particle Clusters
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General Formula for Fan-Beam Computed Tomography
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Effect of Rare Events on Out-of-Equilibrium Relaxation
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Compression and Free Expansion of Single DNA Molecules in Nanochannels
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Orthogonal Orientations for Solvation of Polymer Molecules in Smectic Solvents
Stephan Link, Wei-Shun Chang, Arun Yethiraj, and Paul F. Barbara
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Stiff Polymers, Foams, and Fiber Networks
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Aeolian Sand Ripples: Experimental Study of Fully Developed States
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Structure Formation under Steady-State Isothermal Planar Elongational Flow of *n*-Eicosane: A Comparison between Simulation and Experiment
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Direct Observation of Large Temperature Fluctuations during DNA Thermal Denaturation
K. S. Nagapriya, A. K. Raychaudhuri, and Dipankar Chatterji
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Jae-Ho Lee, Vivek Agarwal, Arijit Bose, Gregory F. Payne, and Srinivasa R. Raghavan

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Branching of Colloidal Chains in Capillary-Confined Nematics
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Density Functional Theory for Polyelectrolytes near Oppositely Charged Surfaces
Zhidong Li and Jianzhong Wu
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Noboru Osaka and Mitsuhiro Shibayama
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RAPID COMMUNICATIONS

Nematic and polar order in active filament solutions
A. Ahmadi, T. B. Liverpool, and M. C. Marchetti
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Kazumoto Iguchi, Shuichi Kinoshita, and Hiroaki Yamada

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Protein-mediated DNA loops: Effects of protein bridge size and kinks
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Structural and energetic model of the mechanisms for reduced self-diffusion in a lipid bilayer with increasing ionic strength
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SPECIAL DBP ANNOUNCEMENT

2006 DBP Election Results

Vice Chair

James Glazier

Members-at-Large

Brian Salzberg

Reka Albert

The total number of electronic and paper ballots cast was 347 out of a total 1764 members, almost 20% participation. Indeed the races were so very close that every vote mattered! On behalf of all 6 candidates, I would like to thank all those who have exercised the right to vote.

■ ***Dr. Shirley Chan, Secretary-Treasurer, DBP***

SPECIAL DBP ANNOUNCEMENT

Visit Congress!

The APS Office of Public Affairs (OPA) is organizing Congressional Visits during the 2006 APS March Meeting in Baltimore and seeks your participation since carrying the message to individual offices remains one of the best means of influencing a Member of Congress. The advantageous location of this year's meeting provides an exciting opportunity to have attendees to educate Congress on the importance of science research funding. The Visit days are scheduled for Wednesday, March 15th and Thursday March 16th.

To sign up, or to obtain more information about the Congressional Visits, please go to: http://www.aps.org/public_affairs/marchmeeting.cfm.

Postdoc: Imaging live malarial parasites

A postdoctoral position is available immediately to join an interdisciplinary team of scientists studying red blood cells infected with the malarial parasite *Plasmodium falciparum*. We use a variety of interdisciplinary approaches including novel live cell imaging and image processing techniques, fluorescent probe development, and recombinant DNA technologies. We have developed a high-speed, high resolution confocal/DIC microscope with an integrated laser tweezer and capacity for localized photo-release and photo-activation. The successful applicant will have the opportunity to develop new applications of this instrument to study fundamental biophysical process including invasion of the red blood cell by the malaria parasite, vesicle trafficking, and the phenomenon of endo-reduplication. Intraerythrocytic malarial parasites present a fascinating and profoundly important topic for study.

For more information, see http://bouman.chem.georgetown.edu/roepe/ and http://www.physics.georgetown.edu/~urbach/dil.html

Please send a CV, a description of your research interests, and the names of at least 3 references to urbach@physics.georgetown.edu.

SPECIAL DBP ANNOUNCEMENT

2005 APS Fellows
Nominated by DBP

Ben-Jacob, Eshel (Tel Aviv University, Israel)

Citation: For innovative applications of nonequilibrium physics to complex biological systems,especially bacterial colony patterns and cultured neuron activity.

Ha, Taekjip (University of Illinois, Urbana-Champaign)

Citation: For innovative work in the determination of nucleic acids structure and dynamics using single molecule fluorescence resonance energy transfer.

Hummer, Gerhard (National Institutes of Health)

Citation: For his pioneering research on the hydrophobic effect and the role of water in the energetics and functional dynamics of biomolecular systems.

Mackey, Michael C. (McGill University, Canada)

Citation: For the application of nonlinear dynamics to the understanding of abnormal physiological function, and in particular, of the bifurcations that lead to periodic haematological diseases related to apoptosis.

Majewski, Jaroslaw (Los Alamos Neutron Scattering Center)

Citation: For contribution to understand the structural properties of Langmuir films and model biomembranes at solid-liquid interfaces using x-ray and neutron scattering.

Mohanty, Udayan (Eugene F. Merkert Chemistry Center)

Citation: For his advances in the theory of polyelectrolyte behavior and its application to the understanding of the structure and transport properties of nucleic acids in free solution and in gels.

Schiff, Steven J. (Krasnow Institute for Advanced Study, George Mason University)

Citation: For his contributions to the physical and biological understanding and control of the dynamics of neural signals in the brain.

Schlick, Tamar (New York University)

Citation: Dr. Tamar Schlick has developed methods for molecular dynamics computations of biological molecules that have elucidated the structure and function of supercoiled DNA and chromatin, and led to new insights into DNA polymerase mechanisms and RNA structure.

Thompson, Nancy L. (University of North Carolina at Chapel Hill)

Citation: Nancy L. Thompson is recognized for pioneering fundamental contributions to fluorescence spectroscopy; binding kinetics and transport processes on surfaces; and molecular interactions on and within biological membranes.

APS Workshop on Opportunities in Biological Physics

March 12, 2006

Baltimore Convention Center, Baltimore, Maryland

Organized by APS Division of Biological Physics

http://www.aps.org/units/dbp/meetings.cfm

Biology is a rapidly changing field that has been making tremendous strides forward in recent years. Biology is changing from a descriptive to a quantitative and conceptually profound field. This workshop will showcase a sample of the rich opportunities in biology for physicists. It is aimed at physicists, especially graduate students and postdocs, who are curious about how a background in physics can provide a unique perspective of biological systems. We believe that physicists will make a substantial contribution to this revolution by working together with biologists.

The workshop will start at 8 am with both morning and afternoon sessions. Participants are on their own for lunch.

Invited speakers include:
William Bialek (Princeton)
Robijn Bruinsma (UCLA)
Hans Frauenfelder (Los Alamos)
Klaus Lehnertz (Bonn)
Yale Goldman (Penn)
Charles Stevens (Salk Institute)
Zuzanna Siwy (Irvine)
Sunney Xie (Harvard)

Co-chairs of Steering Committee:
Dean Astumian, DBP Vice Chair, astumian@maine.edu
Clare Yu, cyu@uci.edu

Steering Committee:
Shirley Chan, DBP Secretary/Treasurer
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Marilyn Gunner, DBP Chair-Elect
Steve Hagen, DBP Member-at-Large
Peter Jung, DBP Chair
Herbert Levine, DBP Member-at-Large
Heiner Linke
Denis Rousseau, DBP Past-Chair
Zuzanna Siwy
Xiaowei Zhuang

Foreign speakers sponsored by the International Institute for Complex Adaptive Matter (I2CAM).

REGISTRATION FORM

APS Workshop on Opportunities in Biological Physics

March 12, 2006

Baltimore Convention Center

Baltimore, Maryland

Organized by APS Division of Biological Physics

Please print all information.

First Name: _____ Last Name: _____

Institution: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Email: _____ Phone: _____

Registration Fee:
A conference fee is required for registration. $25 will be added for late registration. Payment may be made by Credit Card, Personal Check or Business Check.

Please make checks payable to the American Physical Society.

PAYMENT

- ☐ Personal Check
- ☐ Business/Institution Check
- ☐ Credit Card
  - ☐ Amex
  - ☐ Mastercard
  - ☐ Visa
  - ☐ Diners Club
  - ☐ Discover

FEES:

$25	Student
$50	Postdoc
$75	All other participants

NOTE: On-site registration is CASH ONLY!

Complete this form and return it by **February 20, 2006.** Fax: 301-209-0865. Mailing Address: Biological Physics Workshop, Attn. Ken Cole, American Physical Society, One Physics Ellipse, College Park Maryland 20740.

Credit Card #: _____ Exp. Date: _____

Signature: _____ TOTAL: $_____

HUMAN FRONTIER SCIENCE PROGRAM (HFSP)

12 quai St. Jean, 67080 STRASBOURG Cedex, FRANCE

E-mail: grant@hfsp.org
Web site: http://www.hfsp.org

OPPORTUNITIES FOR INTERDISCIPLINARY RESEARCH

The Human Frontier Science Program (HFSP) supports **international** collaborations in basic research with emphasis placed on *novel*, **innovative** and **interdisciplinary** approaches to fundamental investigations in the life sciences. Applications are invited for grants to support projects on **complex mechanisms of living organisms.**

CALL FOR LETTERS OF INTENT FOR RESEARCH GRANTS: AWARD YEAR 2007

The HFSP research grant program aims to stimulate novel, daring ideas by supporting collaborative research involving biologists together with scientists from other disciplines such as chemistry, physics, mathematics, computer science and engineering. Recent developments in the biological and physical sciences and emerging disciplines such as computational biology and nanoscience open up new approaches to understanding the complex mechanisms underlying biological functions in living organisms. 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 3 years support for teams with 2 – 4 members, with not more than one member from any one country, unless more members are absolutely necessary for the interdisciplinary nature of the project, which is an essential selection criterion. Applicants may also establish a local **interdisciplinary** collaboration as a component of an international team but will be considered as 1.5 team members for budgetary purposes (see below). The principal applicant must be located in one of the member countries* but co-investigators may be from any other country. Clear preference is given to **intercontinental** teams.

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.

Program Grants are for independent scientists at all stages of their careers, although the participation of younger scientists is especially encouraged.

Awards are dependent upon team size and successful teams will receive up to $450,000 per year for the whole team.

Important Deadlines :
Compulsory pre-registration for password: 20 MARCH 2006
Submission of Letters of Intent: 30 MARCH 2006

**Members are Australia, Canada, the European Union, France, Germany, Italy, Japan, the Republic of Korea, Switzerland, the United Kingdom and the United States*.