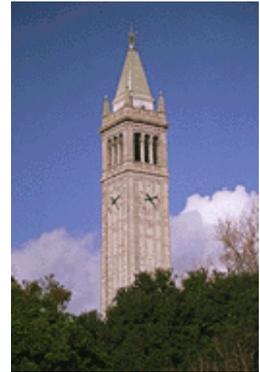


Fall 1999

The Adolph C. and Mary Sprague Miller Institute for Basic Research in Science
University of California, Berkeley

Volume 1, Issue 2

Miller Institute News



Deadlines To Note

Monday, October 4:

Applications due for Miller Research Professorships for terms in 2000-2001

Thursday, October 7

Nominations for Miller Fellowships due for terms 2000-2002

Monday, October 11

Nominations for Visiting Miller Professorships due.

All materials are due by 4:00pm on due dates

The Miller Institute: How It All Began

In 1943, Adolph C. and Mary Sprague Miller entered into a trust with the Board of Regents of the University of California to establish an institute "dedicated to the encouragement of creative thought and conduct of research and investigation in the field of pure science." On February 11, 1955, upon the death of Dr. Miller, a fund in the amount of \$2,856,566 became available to the University. With the Regents' approval, the organization of the Institute began. An additional \$2,159,945 became available when Mrs. Miller died on January 14, 1955. The names of the donors then became public and the Institute was designated: "The Adolph C. and Mary Sprague Miller Institute for Basic Research in Science. To date over 800 scientists have conducted research under the auspices of the Miller endowment. This includes seven

Nobel Prize winners and six Fields Medallists. The Miller Institute is guided by the "Statement Establishing the Institute for Basic Research in Science" and the "Deed of Trust." A seven member Advisory Board is charged with overseeing the Institute. Three of the Advisory Board members are faculty members of Berkeley science departments. They constitute the Executive Committee charged with executing policies determined by the Advisory Board. Currently the Institute administers three programs: Miller Research Fellowships, Miller Research Professorships, and Visiting Miller Research Professorships.

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Miller Fellow Focus: Christopher Lowe

Miller Fellow Chris Lowe describes the motivation for his research as a fascination with weird animals. This interest in strange groups of animals led him to Professor Mike Levine's laboratory in the Genetics division of the Department of Molecular and Cellular Biology and a new molecular approach to address the controversial issue of chordate origins. He explained that "the invertebrate groups most closely related to our own phylum, the chordates have few morphological clues, or

informative fossil records to help reconstruct a series of logical and functional morphological intermediates between the groups." How chordates evolved from their invertebrate ancestors remains one of the major puzzles of zoology and has been debated since before the turn of the century. More recently the problem has been considered intractable by some. However, "the application of DNA

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Awards & Honors

Former Miller Professors **Elwyn Berlekamp** ('74-'75), **Vaughan Jones** ('92 & present Executive Committee member), **Richard Saykally** ('85-'86 & '97-'98), **William "Jack" Welch** ('99-'00) and former Miller Fellow **Kenneth Wachter** ('77-'79) have been elected to the National Academy of Sciences "in recognition of their distinguished and continuing achievements in original research." To be elected to membership in the academy is one of the highest honors for an American scientist or engineer.

Former Miller Professor **Montgomery Slatkin** ('89) of the Department of Integrative Biology has been appointed as a Guggenheim Fellow for 1999 "on the basis of distinguished achievement in the past and exceptional promise for future accomplishment."

Former Visiting Miller Professor **Micheal Klein** ('97) recently received the 1999 Aneesur Rahman prize for Computational Physics presented at the APS Meeting in Atlanta.

Professor **Patrick V. Kirch**, a former Miller Professor ('94) and authority on Polynesia was appointed Director of the Phoebe Apperson Hearst Museum of Anthropology at the University of California, Berkeley. Professor Kirch assumed his position as Director on July 1, 1999.

Acclaimed mathematician Professor **Grigory Barenblatt**, former Visiting Miller Professor ('96), has been awarded the Maxwell Prize. The Maxwell Prize is a new international prize in applied mathematics. The International Congress on Industrial and Applied Mathematics (ICIAM) established the Maxwell Prize this year. The prize was named after James Clerk Maxwell, a 19th-Century Scottish physicist.

Professor **Robert Zucker**, a Spring 1999 Miller Professor in the Department of Molecular and Cell Biology: Division of Neurobiology, was recently elected a fellow in the American Association for the Advancement of Sciences (AAAS). The AAAS is the largest scientific organization in the United States.

Professor **Jean E. Taylor**, a Spring 1999 Visiting Miller Professor in the Department of Materials Science & Mineral Engineering, was elected a Fellow of the American Academy of Arts and Sciences and a Fellow of the Association for Women in Science. Professor Taylor also received the Rutgers College Class of 1962 Presidential Public Service Award from Rutgers University. The award is a Rutgers University Board of Governor's Award, sponsored by the Rutgers College class of 1962.

Professor **Alexander Pines**, former Miller Professor ('77-'78, '89, '98-'99), was elected as a member of the American Academy of Arts and Sciences. Professor Pines also received a Docteur Honoris Causa from the University of Paris and gave the Lord Todd Lecture at Cambridge University.

Current Miller Professor **Christopher McKee** was elected as a member of the American Academy of Arts and Sciences, "an honorary learned society that recognizes distinction and achievement in the natural sciences, social sciences, arts and humanities."

Former Miller Professor **Hans J. Queisser** ('98) was awarded the Seibold Prize by the German Research Organization, in recognition of his work in scientific collaboration between Japan and Germany.

Please help us keep this column updated by sharing the news of any recent awards or honors.

Executive Committee

Professor David Bentley of the Department of MCB has been on the Executive Committee since July 1, 1998 and is serving his first term. Currently, Professor Bentley is involved in the study of the growth of nerve cells, in particular, how they extend fibers through the embryo. According to Professor Bentley, extending fibers have at their terminus a special structure called a growth cone, which is sort of like a crawling hand. The "fingers" of this hand are very fine processes termed "filopodia" which reach out, attach to the substrate, and pull the growth cone forward. The force in filopodia is generated by actin and myosin, as in muscle. Professor Bentley is looking at the growth cones of various *Drosophila* (fruit fly) mutants, trying to identify proteins that are important in the construction of filopodia.

Professor Raymond Jeanloz of the Departments Geology & Geophysics and Astronomy is the Institute's Executive Director. He has served on the Executive Committee since July 1994 and assumed the role of Director, July 1, 1998. Using the laser - heated diamond cell along with spectroscopy and synchrotron x-ray diffraction, Professor Jeanloz and his group have recently found that methane (CH_4) decomposes to diamond and hydrocarbons at the pressures and temperatures existing deep within planets, such that diamond may be "hailing" down inside the methane-bearing objects Uranus, Neptune and the brown-dwarf star Gliese 229B. The high pressure-temperature chemistry of water (H_2O), ammonia (NH_3) and other important planetary molecules are almost completely unknown, so they are a focus of upcoming research. Studies of natural rock samples, periodotite and mid-ocean ridge basalt, taken to the conditions of the Earth's deep interior reveal that high-pressure transformations of the mineral phases significantly influence the way the planet has evolved over geological time. Finally, high-pressure experiments are showing that disordered (glassy) materials can have entropy comparable toeven less than??.....the corresponding ordered (crystalline) states.

Professor Vaughan Jones of the Department of Mathematics is interested in several areas of mathematics, especially as they relate to physics and quantum theory. This has led Professor Jones to study algebra of operators on Hilbert Space (von Neumann algebra) and their subalgebra. According to Professor Jones, there is a kind of Galois theory going on which has a rich structure. Professor Jones discovered a connection with knot theory and has since become interested in low dimensional topology. After a year sabbatical, Professor Jones has returned to serve second term on the Executive Committee.

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Miller Fellow Focus: Christopher Lowe

technology provides powerful new tools to take a fresh look at this question," remarked Dr. Lowe.

While morphology of both living and fossil animals provides one means of reconstructing evolutionary history, more recent advances in the field of developmental genetics provides a novel set of data to help test evolutionary hypotheses. Comparisons of how genes act to mold animal morphology has revealed unexpected similarities in distantly related groups of animals. Dr. Lowe's research is using developmental genes as another tool to investigate chordate origins.

The weird organisms holding the secret of this puzzle are the echinoderms (including sea urchins and sea stars) and hemichordates, a lesser known group of marine

worms that burrow in muddy or sandy sediment who possess characteristics of both invertebrates and chordates.

Dr. Lowe's major challenge this past year has been finding a species of this phylum which could be brought into the laboratory for detailed genetic study.

This quest has led him to Australia's Great Barrier Reef and Berkeley's Gump Biological Research Station in Moorea. He stated, "It seemed to me strange that there were so few studies on the developmental biology of such a key group of animals, but I rapidly found out why." Dr. Lowe spent several weeks chasing worms, which can grow to over a meter in length, down their burrows, without retrieving a single intact animal. Even when his colleague, Miller Fellow David Keys, succeeded in digging out

worms from North Carolina, they could not be persuaded to part with their eggs.

Dr. Lowe explains that these sorts of challenges are what he enjoys most about his research, as it requires an integrative approach to biology: in this case combining ecology and life history evolution with molecular biology.

Currently, Dr. Lowe is collaborating with Berkeley Professor John Gerhart at Wood's Hole Marine Lab on Cape Cod with some success in rearing the larvae of a more accessible species.

Dr. Lowe received his Ph.D. in 1998 from the Department of Ecology and Evolution, State University of New York at Stony Brook. He is a continuing second year Fellow.



Fall Tuesday Lunch Talks

August

31 - Welcome/Miller Fellow Introductions 10:30am

September

- 7 - Raisa Talroze, Visiting Miller Professor, Chemical Engineering
- 14 - Frank Sulloway, Visiting Miller Professor, Psychology
- 21 - Stephen Hedrick, Visiting Miller Professor, MCB
- 28 - Martin Scharlemann, Miller Professor, Mathematics

Formal talks begin on August 31, 1999, in the Seaborg room at The Faculty Club. All lunches begin at 12:00 noon and are open to Miller Institute members only.

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Members' Recent Publications

Visiting Miller Professor Lu J. Sham published two papers during his Fall 1998 term with the Miller Institute: "Theory of exciton-exciton correlation in nonlinear optical response," with Th. Östreich, and K. Schönhammer, *Phys. Rev. B* (1998) and "Correlation effects in the spatial and temporal evolution of coherent excitons," with Th. Östreich, *Bull. Am. Phys. Soc.* March Meeting, 1999.

Miller Professor William H. Miller had a bountiful term (July '98 - June '99) with the Miller Institute publishing five papers: "Quantum and Semiclassical Theory of Chemical Reaction Rates," *Faraday Disc. Chem. Soc.* 110, 1 (1998), "Semiclassical Study of Electronically Nonadiabatic Dynamics in the Condensed-Phase: Spin-Boson Problem with Debye Spectral Density," with H. Wang, X. Song, and D. Chandler, *J. Chem. Phys.* 110, 4828 (1999), "Application of the Semiclassical Initial Value Representation and Its Linearized Approximation to Inelastic Scattering," with D. Skinner, *Chem. Phys. Lett.* 300, 20 (1999), "Femtosecond Photoelectron Spectroscopy of the I_2^- Anion: A Semiclassical Molecular Dynamics Simulation Method," with V. S. Batista, M. T. Zanni, B. J. Greenblatt, and D. M. Neumark, *J. Chem. Phys.* 110, 3736 (1999), and "Forward-Backward Initial Value Representation for Semiclassical Time Correlation Functions," with X. Sun, *J. Chem. Phys.* 110, 6635 (1999).

Miller Professor Robert Zucker completed a paper during his Spring term, 1999: "Calcium and activity-dependent synaptic plasticity," *Curr. Opin. Neurobiol.* 9:305-313, 1999.