

UPDATE



October 2005

SANTA FE INSTITUTE

INSIDE SFI: ON AND OFF THE COWAN CAMPUS

<http://www.santafe.edu/events/update/insidesfi.php>

NEW ELECTED TRUSTEES

With terms beginning July 1, 2005, SFI has elected two exceptional individuals to serve as members of the Board of Trustees: **Stuart Greenfield**, Chairman, Alternative Investment Group, and **Diana MacArthur**, Co-Founder, Chair & CEO, Dynamac Corporation. In addition **John Holland**, Professor, University of Michigan, and **Dave Robinson**, Consultant, both former trustees, returned to the Board this summer.

Stewart Greenfield divides his time between environmental activities and hedge fund investing. His firm provides conservative multi-manager hedge fund partnerships for endowments and individuals. For many years he has helped preserve tropical rain forests, as a means of reducing global warming and preserving species. His Environmental Venture Fund, in conjunction with the Nature Conservancy, has initiated projects that have preserved over 18 million acres in Bolivia, Brazil, Paraguay, Chile, Panama, and elsewhere. He also has been actively involved in air pollution reduction efforts.

Stewart Greenfield's primary career had been in venture capital. He co-founded Oak Investment Partners in 1978, served as its Chairman, and specialized in funding start-up networking and data storage companies. Oak funded hundreds of technology companies. He organized the advanced Programming Technology Department at IBM in the late '50s, and in 1971 joined DLJ as a VP and General Partner of the Sprout Group. With his son, he continues to make personal venture investments, primarily in medical technology and education.

He is Vice-Chairman of St. John's College, and a director of the Opera Orchestra, New York. He is a retired director of Commonfund Capital, the Dibner Institute for the History of Science at MIT, and The Nature Conservancy (CT). He particularly enjoys hiking, classics, and conversation with good friends.

He is married to Constance Greenfield, and graduated from St. John's College (Annapolis) in 1953.

Diana MacArthur co-founded Dynamac Corporation, a science, engineering, and technology company specializing in space, life, and earth sciences; natural resources management and ecological restoration; environmental management and compliance; and defense services and homeland security. Dynamac provides services to more than 20 federal agencies, including NASA, EPA, and DOD, and numerous state, regional, and commercial clients. Earlier, Mrs. MacArthur was the Director of the Washington, DC, office and Vice President of a public relations firm in the Interpublic Group; was Director of the Office of Private and International Organizations, the Peace Corps; and managed a health education clearinghouse and outreach center for General Electric, which was under contract to an NIH institute.

In recognition of her expertise in science and technology policy and technology transfer, Mrs. MacArthur was appointed by President Clinton to the President's Committee of Advisors on Science and Technology (PCAST); she participated in PCAST studies on energy, biodiversity, and national security.

Mrs. MacArthur serves on the Advisory Board of the Smithsonian Environmental Research Center; on the Board of Directors of the Los Alamos National Laboratory Foundation (Treasurer/Executive Committee), the Lady Bird Johnson National Wildflower Research Center, and the Santa Fe Opera; and on the Board of Visitors of the Menninger—Baylor College of Medicine—The Methodist Hospital Foundation. Previously, she served on the Advisory

October 2005

Board to the Center for Strategic and International Studies, Board of Visitors of the University of Maryland Biotechnology Institute, and Board of Directors of the Atlantic Council of the United States. She was also a member of the Business-Higher Education Forum (Executive Committee) and the Council on Competitiveness.

Mrs. MacArthur holds a B.A. in economics from Vassar College, where she was elected to Phi Beta Kappa. She received the 1993 KPMG Peat Marwick High Tech Entrepreneur Award, which honors individuals who have contributed significantly to the community and to the advancement of the high-technology industry.

GRANT AWARDED

The Directorate for Biological Sciences at the National Science Foundation today announced the Santa Fe Institute (SFI) along with Co-PI's and collaborators from co-operating institutions: George Mason University, University of Colorado, University of Illinois at Urbana-Champaign, Arizona State, and Carnegie Institution of Washington, have been awarded a five-year Frontiers in Integrative Biological Research (FIBR) grant for their joint research project, "The Emergence of Life: From Geochemistry to the Genetic Code." SFI is the lead institution on the grant and the Primary Investigator is **Harold Morowitz**, Chairman of the Santa Fe Institute Science Board, and the Clarence Robinson Professor of Biology and Natural Philosophy at George Mason University.

This FIBR project will inject a broad array of novel theory and experimental data into the debate on the origin of life, by placing strong constraints on the likely environment and manner of the emergence of life on Earth. The project will involve an integrated approach that brings together microbiology, geochemistry, physics, biochemistry, computer simulation and a modern understanding of complex dynamical systems to provide, for the first time, a coherent account of the evolution of metabolism and the development of the modern genetic code. The project team, led by Dr. **Harold Morowitz** of George Mason University and the Santa Fe Institute, will formulate and test an integrated theory of the early stages in the emergence of life from abiotic chemistry. The unifying premise of this theory is that robust core pathways and molecular associations

were the statistically favored result of geochemical processes on the early earth, which can be reconstructed computationally and in the laboratory. Stimulation of debate on the chemical origins of life based on data and theory developed in this project will have significant broader impact throughout biology and beyond, in areas such as geochemistry, chemical biology, evolutionary theory, and paleobiology. The project will involve interdisciplinary training of students and the outcome will be disseminated to a broad audience. At the end of the project, a symposium will be organized to summarize its outcome and provide an overview of modern biogenesis, and its broader implications for the prebiotic origins of life.

The Frontiers in Integrative Biological Research (FIBR) Program supports integrative research that addresses major questions in the biological sciences; FIBR encourages investigators to identify major understudied or unanswered questions in biology and to use innovative approaches to address them by integrating the scientific concepts and research tools from across disciplines. For more information please go to: <http://www.nsf.gov>.

DAVID DUNN WINS PRESTIGIOUS 2005 HERB ALPERT AWARD

Local composer and sound artist **David Dunn** received the 2005 Herb Alpert Prize of \$50,000 for his pioneering explorations of electro-acoustic music. Dunn is currently working with **Jim Crutchfield** (SFI External Faculty member) on a project funded by the Delle Foundation (Cowan family) to investigate the bioacoustic environment of the bark beetle and how this affects the pinon devastation.

SFI REU CARL MCTAGUE SCORES HIGHEST IN THE CAMBRIDGE MATHS TRIPOS PROGRAM

Carl McTague, former SFI REU and regular visitor to **Jim Crutchfield's** Dynamics of Learning Group, completed Cambridge University's demanding Mathematics Tripos graduate program. He earned the highest exam score, thereby passing with "Distinction," which guarantees him a place in Cambridge's PhD program.

As he described it before the results were known: "My exams were tough. I felt near death at the end of the rational homotopy theory exam. I'm not sure how well I did; it will come down to where they draw the line in the sand. I'll find out tomorrow morning when they read out the results at the University Senate House. It's a large classical building in the heart of Cambridge consisting almost entirely of a single open space overlooked by a balcony. The Chairman of Examiners will appear on the balcony in his robe, read out everyone's results, and then drop the script into the crowd. (My course is the only one the University reads out like this.)"

Carl will continue his mathematics graduate studies in Heidelberg next year, returning the following year to complete his degree at Cambridge University.

NICHOLAS DE MONCHAUX AWARDED FELLOWSHIP AT NATIONAL AIR AND SPACE MUSEUM

Nicholas de Monchaux (Architecture, University of Virginia, Arlington) was awarded a one-year residency at the National Air and Space Museum to complete his research on the design history of the space suit.

Nicholas was in residence at SFI in 2003. During his visit he gave a public lecture entitled "Spacesuit: 21 Stories and Statements on Technology and Design." He was also involved in a joint workshop between SFI and the Collegium Budapest Institute for Advanced Study entitled "The Integration of Form and Function."

JOSEPH TRAUB APPOINTED CHAIR

Joseph Traub, SFI External Faculty member, has been appointed chair of the Computer Science and Telecommunications Board (CSTB) of the National Academies.

The CSTB deals with critical issues facing the nation in the area of computer science and telecommunications. Projects include cybersecurity research, biometrics, IT to enhance disaster management, and building certifiably dependable systems. For more information, visit www.cstb.org.

Prof. Traub's appointment marks his return to the CSTB, as he was also its founding chair. "In 1986, along with Marjory Blumenthal, Joe's vision and dedication established the model that has made the CSTB one of the strongest boards at the Academies. At this particular point in CSTB's history, I could not think of another person better suited to assume the chair and to guide CSTB to new heights," said Bill Wulf, President of the National Academy of Engineering.

INNOVATION IN EVOLUTION

Doug Erwin and **David Krakauer**, SFI Resident Faculty, held the third in a series of meetings entitled "Innovation in Natural, Experimental, and Applied Evolution" on August 22-25, 2005. The meetings focused on ecological and behavioral aspects of biological evolution, a critical area that had not been well represented in previous meetings. The nine participants, plus several others from the SFI residential community, had three and a half days of intense discussions and presentations about topics ranging from the pattern of innovations associated with the evolution of land plants through more theoretical discussions about the ecological and behavioral contexts of evolutionary innovation. Among the issues discussed were the relationship between construction of new morphologies, adoption of a new lifestyle or acquisition of a new resource, increases in taxonomic diversity (number of species) and changes in morphological variety (known as disparity), and how these areas are related to changes in the physical environment. Each of these areas is potentially independent and one of the challenges for the future is to define the relationships between them. The meeting was sufficiently stimulating that the group decided to prepare a position paper for a major journal with the goal of framing the discussion for future work. Two members of the group stayed at SFI for several days to generate a first draft of this manuscript. We also began planning for a final workshop in this initial phase of the innovation program. This workshop will involve 25-30 participants and may be held in Washington DC in the summer of 2006. There will be a schedule of public lectures in addition to the smaller discussion group. We also plan to prepare an edited volume of papers from this meeting.

IN THE NEWS

In an invited article "Is Economics the Next Physical Science?" in the September 2005 issue of *Physics Today*, **J. Doyne Farmer**, **Martin Shubik**, and **Eric Smith** reviewed recent developments that are making some interesting problems in economics look a lot like interesting problems in physics as well.

Since the end of the second world war, economics has become an increasingly mathematically sophisticated subject, but the ways economists and physicists frame problems and interpret data have remained different and even dissonant. That is changing on several fronts, though, say these authors. High-frequency data from financial markets is beginning to reveal striking regularities when interpreted with the aid of physical principles like dimensional analysis, statistical universality and scale invariance, and frustration. From another direction, recent extensions of physics, especially to complex computational and agent-based systems, provide new models for cognition and decision making.

SFI was the birthplace of many of these approaches to economics, and supports ongoing scientific collaborations among the three authors. Martin Shubik is an SFI external faculty member and the Seymour Knox Professor of Mathematical Institutional Economics at Yale University. **Doyne Farmer** and **Eric Smith** are research professors at SFI, both trained originally in physics. To *Physics Today's* credit, the invitation for this article was extended to economist. The authors emphasize that if economics someday becomes a physical science, that will happen only with the conceptual growth of physics along with that in economics.

BUSINESS NETWORK NEWS

<http://www.santafe.edu/events/update/businessnetwork.php>

AGENT MODELS IN FINANCIAL ECONOMICS

October 21, 2005, New York, New York

A critical feature that distinguishes economics from other sciences is in its modeling of agents who plan, anticipate each others' plans, and decide. Agents have traditionally been modeled as rational, though

cognitive sciences reveal human beings to be far from perfect in making their decisions when they act by their intuition. The result is that, as **Ken Arrow** put it at a recent conference at the Santa Fe Institute, "modern economics is in chaos."

At this one-day meeting we will survey several different approaches that have emerged as alternatives to the standard rational choice model. These will include purely data driven methods, zero intelligence, behavioral models based on psychology and economics experiments and neuroscience, and models of decision making based on learning and artificial intelligence. We will review the empirical evidence driving these approaches, and discuss their potential to provide answers to an unsolved problem in financial economics: What drives price formation?

Confirmed Speakers: **J. Doyne Farmer**, Research Professor, Santa Fe Institute; **Blake LeBaron**, Professor, Economics, Brandeis University; **Andrew Lo**, Professor, Economics, MIT; **Benoit Mandelbrot**, Professor, Mathematics, Yale University; and **Shyam Sunder**, Professor, Economics, Yale University

Hosted by **Credit Suisse First Boston** and **Legg Mason Funds Management**, this event is for Santa Fe Institute's Business Network members only. To register, please contact **Susan Ballati** at susanb@santafe.edu or 505-946-2726.

BUSINESS NETWORK TOPICAL MEETING: FOURTH ANNUAL ADAPTIVE AND RESILIENT COMPUTING SECURITY WORKSHOP (ARCS2005)

November 2-3, 2005, Santa Fe, New Mexico

ARCS 2005 is the fourth meeting of a workshop designed to bring together senior industrial researchers, policy makers, and leading academics in the area of adaptive approaches to computer security. The format of the meeting is two days of presentations and discussions. **BT** and the **Santa Fe Institute** sponsor this two-day meeting.

We are seeking high quality presentations that can educate and stimulate discussion. In order to attend, please submit a 2-4-page paper to the Program Chair. The deadline for submissions is July 31, 2005. The topic areas of relevance are broadly in adaptive and biologically inspired approaches to all aspects of computer security: Buffer overflow mitigation, worm

and virus containment, anti-virus, anti-spyware, denial of service protection, effects of diversity, immunological approaches, topological effects in computer network, machine learning and defense strategies, design of self-healing networks, and alternative models—economic, predator/prey etc.

For more information please visit the workshop's website at <http://www.arcs-workshop.org>.

JOINT BUSINESS NETWORK AND BOARD OF TRUSTEES SEMINAR, NOVEMBER 4-5, 2005, SANTA FE, NM

Interdisciplinary Collaborative Research: Success Stories from the Santa Fe Institute

In academia, government agencies, and private industry there is a growing trend toward research that transcends discipline specific conceptual frameworks and different tools to work interactively to address common questions, problems, and themes. While the goal is noble, achieving it is quite difficult. Issues such as differing experience with domain-specific knowledge, differing vocabularies and jargon, and radically different research methodologies make interdisciplinary work both frustrating and, when it all comes together, extremely rewarding. The Santa Fe Institute has been a center for interdisciplinary collaborative research since its founding and SFI interdisciplinary work has had a significant impact across many domains of science. Over the two days of the joint Business Network and Board of Trustees seminar, we will share of some SFI's interdisciplinary successes and attempt to identify some of the key elements that contribute to their success.

This event is by invitation only. Please contact **Ann Stagg** at annstagg@santafe.edu or 505-946-2724 for more information.

NOTES FROM THE INTERNATIONAL PROGRAM

<http://www.santafe.edu/events/update/international.php>

2006-2008 INTERNATIONAL FELLOWSHIPS

The International Program is pleased to announce the call for applications for the 2006-2008 International Fellowship. Approximately three fellowships will be awarded to exceptional researchers from developing countries. The application deadline is **November 1, 2005**. The finalists will be selected by a committee of resident and external faculty. More information is available at <http://www.santafe.edu/education/intlannounce.html>

INTERNATIONAL FELLOW VISITS SFI

Beata Oborny, of the Department of Plant Taxonomy and Ecology at Loránd Eötvös University in Budapest, Hungary, returned to SFI to continue her work on scaling relationships in biology to collaborate with **Geoffrey West** and **Jim Brown** (University of New Mexico and SFI External Faculty member).

PUBLICATIONS

<http://www.santafe.edu/events/update/publications.php>

REFEREED LITERATURE

<http://www.santafe.edu/events/update/publications.php>

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Jen, E., ed. *Robust Design: A Repertoire of Biological, Ecological, and Engineering Case Studies*. Santa Fe Institute Studies in the Sciences of Complexity. New York: Oxford University Press, 2005.

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LIBRARY ACQUISITIONS

For a list of recent purchases by the SFI library, please see <http://www.santafe.edu/events/update/library.php>

CALENDAR OF EVENTS

<http://www.santafe.edu/events/calendar.php>

November 2-3

Business Network Topical Meeting—Fourth Annual Adaptive and Resilient Computing Security Workshop (ARCS2005), organized by Robert Ghanea-Hercock

November 4-5

Business Network Meeting—Santa Fe Institute Annual Business Network Meeting and Fall Trustees' Symposium, organized by Susan Ballati and Ann Staggs

OCTOBER VISITORS AND ARRIVALS

<http://www.santafe.edu/events/monthlyvisitors.php>

Lauren Buckley (10/3-2), Department of Biological Sciences, Stanford University

Doug Erwin (10/14-14—10/31-11/6), National Museum of Natural History, Smithsonian Institution

Duncan Foley (10/24-11/11), Economics, New School for Social Research

Miguel Fuentes (10/4-12/25), Fisica Estadística, Centro Atómico Bariloche

Michael Gastner (10/1-9/30), Physics, University of Michigan

Elizabeth Hughes (10/14-14—10/31-11/6), Senior Vice President/Director of Corporate Strategy, Legg Mason Capital Management

Ray Jackendoff (10/24-30), Volen Center for Complex Systems, Brandeis University

Erica Jen (10/4-14), Faculty, Santa Fe Institute

Arkadiusz Majka (10/30-11/27), Interdisciplinary Center for Mathematical and Computational Modeling, Warsaw University

Gunnar Pruessner (10/10-30), Physics Department, Virginia Tech

Ford Rowan (10/14-14—10/31-11/6), National Center for Critical Incident Analysis

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