**RESEARCH NEWS**

**Linking evolutionary history to species interactions**

A uniquely diverse group of experts met in early April at SFI to study an emerging tool for ecological network research: ecophylogeny. Ecophylogeny combines ecology with evolutionary history, or phylogeny, to find relationships between ecological organization and relatedness among its species.

*“We want to bring evolution into ecology and vice versa,” says working group co-organizer and SFI Research Professor Jennifer Dunne.*

Intertidal food web of Sarnaki Island in the Aleutian archipelago, with lower trophic levels toward the bottom. (Image: foodwebs.org)

“Integrating them in the context of networks of species interactions can provide a powerful new framework to understand impacts of invasions, losing species, and habitat loss, which can better inform conservation.”

Seven official participants, including SFI evolutionary theorist Jon Wilkins, and four additional SFI postdocs started by holding informal tutorials related to compelling research questions. Members then identified projects to start working on, including drawing from extensive empirical studies on food webs in mangrove islets, Antarctica, and an Aleutian archipelago. Long-term goals are to study how ecological patterns relate to evolutionary history and develop theory to predict how diversity and phylogeny scale from tidepools to oceans.

Jennifer, who co-directs the Pacific Eco-informatics and Computational Ecology Lab in Berkeley, organized the working group with SFI External Professor Jessica Green. “The field of community phylogenetics has exploded over the past decade,” says Jessica. “Most scientists have focused their attention on the drivers of community assembly within a single trophic level. Expanding the phylogenetic framework to the study of entire food webs will revolutionize biodiversity science.”

This fall, a critical mass of working group participants will be based at SFI and will work on research papers and proposals for future funding.

---

**RESEARCH NEWS**

**Working group ponders how people strategize**

A small group of researchers has big goals for their working group. The session, “Reasoning, Perception, and Beliefs in Strategic Settings,” will discuss future directions in the study of strategic interactions. They hope to weave theory, decision theory, cognitive neuroscience, psychology, and computer science will discuss future directions in the study of strategic interactions. They hope to weave together the growing number of SFI ambassadors around the world, and strengthen science education generally.

The Complex Systems Summer School, SFI’s signature school for graduate students and postdoctoral fellows pursuing interdisciplinary research, is a three-week program that combines collaboration with seasoned complexity scientists and lectures on complex behavior in mathematical, physical, living, and social systems.
The Update interviewed Daniel Dennett recently about his six-month sabbatical at the Institute as SFI’s first Miller Scholar.

In Meaning and the Lexicon (Oxford University Press, April 2010), SFI External Professor Ray Jackendoff (Tufts University) reviews 35 years of work on language, drawing from a variety of fields, and traces the development of his parallel architecture theory of mind and language. He also presents his latest thinking on key issues in meaning and communication.

The 504-page book is intended for linguists of all theoretical persuasions, as well as cognitive scientists, philosophers, and anyone interested in how language operates in the mind, brain, and human communication.

In her email, Valerie Plame-Wilson, the SFI Update’s Coordinator, states that the update is published bi-monthly by the Institute to keep our community informed of all theoretical persuasions, as well as cognitive scientists, philosophers, and anyone interested in how language operates in the mind, brain, and human communication.

The update is available online at www.santafe.edu.

In particular, I’ve been thinking for some months now about how to clarify the questions surrounding the origins of life. There are a number of people here who are on the cutting edge of this work. Talking to them and reading their work has been valuable to me. I haven’t published in this area yet but I may have something coming out soon.

How did you come to know about SFI?

I can’t recall exactly. I probably read some article by or about somebody here, and then read Gleick’s book [James Gleick’s Chaos: Making a New Science], and then was invited to a few workshops here. It is a great honor to be the first Miller Scholar, and it is a great position to be in. I hope I have come to some thinking here. I know I have been here catalyzing some of my thinking.

What will you do next?

I am going back to Tufts and will be teaching some of the ideas I’ve developed here. This fall I will teach a seminar on the neuroscience of free will, and in the spring a seminar on evolutionary theory. Have you had a chance to see any of the state?

Yes, we’ve seen the museums on Museum Hill [in Santa Fe] and other local points of interest, traveled to Taos, and been down to Carlsbad and White Sands. Just spectacular. We’ve hit the corners of the state pretty well, and made a visit to the Grand Canyon.

Flow of science continued from page 1

Illuminating changes in the way genes turn one another on and off when a cell becomes cancerous. It could even show the changes in air traffic patterns as the airlines were deregulated and then as airlines constricted after 9/11.

SFI External Professor Luis Bettencourt and colleagues are involved in another major effort directed at understanding the structure of science. They are using citation data to map scientific curiosity, manifested in online click-stream data that logs scientists’ patterns as they follow one journal article to another (Update, May-June 2009).

Neuroscience emerged as its own field in the last decade, as the chart showing the evolution of citation network among scientific journals shows. (Image: Martin Roswall and Carl Bergstrom)
Schellnhuber named SFI External Professor

Hans Joachim Schellnhuber, founding director of the Potsdam Institute for Climate Impact Research (PIK) and professor for Theoret- ical Physics at Pots- dam University, has been named an SFI External Professor. The appointment term is January 2010 through June 2013.

Schellnhuber is one of nine members of the German Advisory Council on Global Change.

He has a doctorate in theoretical physics from the University of Regensburg. John is a member of the Max Planck Society, the German National Academy, the US National Academy of Sciences, the Leibniz-Sciences, the Geological Society of London, and the International Research School SIGMA XI. He is also a longstanding member of the Intergovernmental Panel on Climate Change (IPCC), which was awarded the Nobel Peace Prize in 2007. He is on the editorial boards of several scientific journals.

Collaborating with SFI Professor Doyle Farmer, John will continue to explore global sustainability as an emerging field of complex- ity science. He plans to lecture at SFI's 2010 Global Sustainability Summer School in July.


Simple SFI recipes

Simple Recipes from Complex People, a cook- book produced by SFI, is now available at the SFI bookstore and other stores in Santa Fe.

Twenty-five middle and high school teachers from all over the country will participate in an intensive two-week summer workshop at SFI designed to prepare them to introduce their students to complexity science.

The workshop is supported in part by Project GUTS. Scientists tell students to look for "things that fit in anyone's luggage," "something that will fit in anyone's luggage."

Paige says books typically available to science teachers are decades old in terms of their science content, and most teachers have not been trained in complexity concepts and so they have a difficult time teaching them to students.

"They are in need of current informa- tion," she says. "The workshop helps teachers revitalize their lesson plans and helps keep them inspired."

Project GUTS facilitators worked directly with SFI researchers to inter- pret and distill scientific concepts to the professional development material that will be used in the course. Paige says scientific collaborations of this sort present a provocative tem- plate for teacher professional develop- ment and student engagement.

The workshop is supported in part by the SFI Science Board Chair Emeritus, Harold Morowitz through a National Sci- ence Foundation Frontiers in Integrative Biological Research (FIBIR) grant.

Summer workshop to train teachers to teach network science

Summer programs

continued from page 1

and social systems. Fifty-one students were selected from nearly 400 applicants. This year’s CSSS is June 9-26 in Santa Fe, with partial support from the National Science Foundation.

School director and SFI External Professor Dan Rockmore (Dartmouth) says the program is “packed with all sorts of great lectures, with a large component devoted to mathemat- ical statistics and calculus. The big reason for having huge datasets, something that is definitely crucial to the understanding of systems,” he says.

The 2010 Research Experiences for Under- graduates program, June 6 through August 14 at SFI, is supported by NSF’s Directorate of Social, Behavioral, and Economic Sci- ences. Also new this year, five of this year’s 13 REU students are return participants from last year’s program, says Ginger; the returning students will spend the summer in resi- dence at SFI, pair up with an Institute faculty to continue their research, and serve as alumni mentors to the new students. REU students live at nearby St. John’s College and spend their days at SFI.

The 16th annual Graduate Workshop on Com- putational Social Science Modeling and Complexity takes place June 20 through June 24. The workshop provides an intensive two-week study of computational social science modeling and complexity for about 40 graduate students. It features individual projects by the students and includes lec- tures and topical seminars by SFI research- ers and presentations of work in progress by the participants. Its primary goal is to assist graduate students pursuing research that includes computational modeling at SFI Professor John Miller (Carnegie Mellon University), who co-directs the workshop with SFI External Professor Scott Page (University of Michigan).

“I always view this workshop as what gradu- ate school should be: a group of highly moti- vated and creative friends and collaborators, exploring the frontiers of science,” John says.

The Global Sustainability Summer School, July 11-24 in Santa Fe, brings together experts in climate change, economics, technological forecasting, and other topics for a two-week course focusing on the interactions among and within complex systems approaches to understanding these problems. Participants come from numer- ous countries and dozens of disciplines and include graduate students, postdocs, faculty from colleges and universities, and individuals from government and the private sector. The program is sponsored by the SFI, Department of Energy’s National Renew- able Energy Lab, and the National Science Foundation.

This year SFI is offering a new three-day course on complexity for professionals, university faculty and students, and others interested in how the methods and results of this interdisciplinary field can be applied in their own or work or studies. The course is called “Exploring Complexity in Science and Engineering from a Santa Fe Institute Perspective,” organized by SFI External Professor Melanie Mitchell, will provide an intensive tour of the major ideas of complex systems science. It will be taught in Portland, Oregon, by a group of SFI faculty and as- sociates.

As part of its year-round educational out- reach offerings, the Institute supports addi- tional schools, residential internships and fel- lowships through the postdoctoral level, and additional schools, residential internships and fel- lowships through the postdoctoral level, and other outreach activities. The Summer programs are one of these initiatives.

The workshop is supported in part by the SFI Science Board Chair Emeritus, Harold Morowitz through a National Sci- ence Foundation Frontiers in Integrative Biological Research (FIBIR) grant.

BOOK NEWS

Simple SFI recipes compiled

Simple Recipes from Complex People, a cook- book produced by SFI, is now available at the Institute’s bookstore and at a handful of Santa Fe-area retail stores.

Laura Ware, SFI Coordinator of Publications, Facilities, and Personnel, conceived of the idea in 2005 when former President Elon Goldberg retired. Inspired by a recipe called “four things in a blender,” Laura wanted to give busy Ellen a collection of simple recipes from her friends. She collected recipes with four or fewer primary ingredients from researchers and staff. The idea languished until last December, when Laura and her daughter Ana June, a cuisine photographer and graphic designer, decided to finish the project. When it was completed, SFI VP for Development Nancy Deutsch thought it could be made available to Institute visitors.

Paige says textbooks typically available to science teachers are decades old in terms of their science content, and most teachers have not been trained in complexity concepts and so they have a difficult time teaching them to students.

“They are in need of current informa- tion,” she says. “The workshop helps teachers revitalize their lesson plans and helps keep them inspired."

Project GUTS facilitators worked directly with SFI researchers to inter- pret and distill scientific concepts to the professional development material that will be used in the course. Paige says scientific collaborations of this sort present a provocative tem- plate for teacher professional develop- ment and student engagement.

The workshop is supported in part by SFI Science Board Chair Emeritus, Harold Morowitz through a National Sci- ence Foundation Frontiers in Integrative Biological Research (FIBIR) grant.
When the 9th International Symposium on Intelligent Data Analysis begins May 19 at Biosphere 2 north of Tucson, Arizona, SFI Faculty Chair David Krakauer will give the plenary remarks. And for the first time SFI is Faculty Chair David Krakauer will give the

Intelligent Data Analysis begins May 19 at analyzing complex, dynamical systems such as Liz says the 2010 symposium will focus on a computer engineering departments.

Liz Bradley, a professor with the University of with data mining algorithms, says co-organizer in 1995, it has gradually become associated symposium has evolved since its inception What kind of conference would inspire the SFI has been engaged in data mining since its beginning, as one approach to examining highly complex data sets common in complex adaptive systems. David says, His own remarks will focus on "Intelligent Data Analysis of Intelligent Sys-

SFI’s mission is to bring together great minds, and communicate the common fundamental principles in complex physical, computational, biological, and social systems that underlie many of the most profound problems facing science and society today.

To remain on the cutting edge, she believes, SFI must continually renew itself by exploring new directions, such as the highly connected nature of current-day crises – financial meltdown, nuclear proliferation, terrorism, political upheaval, and climate change, to name a few – and their impact on national and global security. Another possible direction is the relationship between mathematics, science, and the arts, she says. This renewal, she says, will foster SFI’s contin-
ued scientific preeminence and have important consequences. It will help SFI retain present benefits and cultivate new ones, which is essen-
tial to development efforts; to continue to recruit world-class minds to an already distinguished faculty; and to attract promising postdocs through the Omidyar Fellows program, which has brought focus and vitality to SFI.

Diana made a generous gift to support the development program. This year’s "The future of any organization is does its young people, mentored by more experi-
enced people, and their fresh ideas," she says. "I’m very glad to be part of SFI," she adds. "Finding new ways of thinking about things, and finding new things to think about, match my own curiosity and intellect."