RESEARCH NEWS

Modeling ways to beat the next flu outbreak

Three SFI External Professors are modeling patterns of flu outbreak and response to help health officials manage the next pandemic.

Soon after H1N1’s initial emergence last year, mathematical epidemiologist Lauren Ancel Meyers at UT Austin and colleagues used Facebook to gauge initial perceptions about and behaviors toward the flu, then conducted a national poll. As news media attention tapered, they noted that “people’s perception of the risk of flu increased, but their willingness to adopt prevention measures declined,” she says. Now they are surveying New York City and Milwaukee, which had large summer outbreaks, and L.A. and D.C., which did not, to see how local infection levels affect residents’ behaviors.

Regardless of perceptions, optimizing the public health response to the pandemic could affect millions of lives. The U.S. stockpile has 50 million anti-viral drug treatments for national distribution. (Though not vaccines, anti-virals can treat symptoms and reduce transmission.)

In modeling millions of scenarios, according to Lauren, the politically tractable option of distributing five million anti-virals a month distributed proportionally to states’ populations consistently emerged among the better choices. She is currently looking at how best to distribute vaccines to reduce hospitalizations and deaths.

Carlos Castillo-Chavez, a theoretical epidemiologist at Arizona State University, weaves practical and theoretical elements into what he calls “the big question: How do you weigh interests with risk?” Mexico, for example, implemented social measures at tremendous economic cost, whereas the U.S. and Canada adopted less stringent measures. Now, people’s cross-immunity may protect sub-populations from later rounds by changing the entire immunological landscape.

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RESEARCH NEWS

Can rewards backfire? Behavioral research says yes

As a homegrown economic experiment, SFI Professor Sam Bowles once offered, in lieu of an allowance and clothing money, to pay his teenage children to do household tasks, complete with a price list.

“The prices were pretty good, but not a stitch of work was done,” he recalls. Sam, Director of SFI’s Behavioral Sciences Program, has been focusing much of his research on people’s responses to economic incentives.

“We looked at a vast number of cases in which people were given incentives to do simple things,” he says. “All but a few of these experiments backfired to one degree or another.”

For example, children who were told they’d be given a reward for drawing pictures all but stopped drawing. Paying potential blood donors to in the hopes of increasing donations made people less likely to do so. Daycare centers that began fining parents for picking up their children after hours did not see an increase in parental punctuality; in fact, their tardiness increased.

Sam believes rewards may diminish intrinsic motivations; in other words, being paid for an altruistic act may seem to cheapen the deed in the mind of the deed doer.

This notion extends to the workplace. The employer who adopts what economists would term “optimal” incentive system may simply appear

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BUSINESS NETWORK NEWS

Understanding systemic risk in markets

Can financial market phenomena such as bubbles, runs, and crashes be understood through the lens of complexity science?

An SFI Business Network meeting in New York on October 15 explored the role of systemic risk in financial markets. The gathering drew a dozen experts from the financial sector and another dozen scientists.

Systemic risk occurs when a system – a market, an ecosystem, or society as whole, for example – bears underlying interdependencies whose disturbances might, in certain situations, cause the entire system to collapse, says SFI Professor Fabrizio Lillo (University of Palermo), one of the Institute’s organizers of the event.

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INSIDE SFI

Evening event combines science, music, and drama

A public event in Santa Fe on November 14 weaved science and music into a unique SFI evening program, says SFI Special Projects Coordinator Valerie Plame Wilson.


The music was interspersed with commentary from SFI Faculty Chair David Krakauer on Darwin’s historic significance in biology, evolution, and scientific discovery in general. Actors in period costumes performed dramatic readings from the correspondences of Darwin and Mendelssohn.

The concert was underwritten by Andrew and Sydney Davis.
Looking to technology to win the race against climate change

Researchers working to transform sunlight and other resources into inexpensive, near-zero-carbon energy find themselves in a race against a formidable opponent: rapidly advancing climate change.

“There’s limited time to find an answer,” says SFI Omidyar Fellow Jessika Trancik, whose research focuses on the evolution of technologies related to low-carbon energy conversion.

“To prevent the most damaging effects of climate change, our global energy infrastructure will need to reach very close to zero carbon dioxide emissions in the second half of this century,” she says.

Jessika is working on the problem from three angles designed to develop a fundamental understanding of how technologies change over time. One focuses on developing a data-driven framework for comparing energy technologies. She and her colleagues collect information to better understand how technologies evolve and how to compare them based on a variety of attributes, such as cost, carbon emissions, and resource size.

She also explores how the design features of a technology can lead to faster rates of improvement — for example, unit scale, how the components of a technology are interconnected, and how these may affect the rate of change. She believes the work may reveal design features that can be incorporated into a technology to allow for rapid improvement. This, in turn, could help policymakers decide which technologies to support and invest in.

In a third area of research, she looks at a subset of candidates for low-carbon energy conversion. She says nanostructured energy technologies are perfect examples of the difficulty of achieving an optimal combination of components at the outset, but where there is great potential for high performance in the future — in this case in reaching very low cost and low carbon intensity. She is exploring ways to simultaneously realize practical solutions more quickly and tailor the design of technologies to allow for future improvement.

“These and other technologies don’t just show up in optimal form,” Jessika says. “The challenge is to balance curiosity-driven research and how to compare them based on a variety of attributes, such as cost, carbon emissions, and resource size.

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greedy, leading not to enough employee compliance but angry retaliation.

As part of Sam’s ongoing working group on the co-evolution of institutions and behaviors, he examined the results of group cooperation games in which the rewards were greatest for all if its players cooperated. More often than not, the subjects worked together. In fact, from American students to Zimbabwean villagers, cooperators would band together to punish players who behaved selfishly, even if it was at the punishers’ own expense.

“Fines imposed by peers who do not stand to benefit personally invariably induce shirkers to shape up,” he says, “most likely because they induce shirkers rather than angels.”

Sam will deliver a series of lectures on related topics at Yale University in January as its Castle Lecturer in Ethics, Politics, and Economics. The lectures will be published as a book by Yale University Press. He also will hold the next meeting of this co-evolution working group in January.

PEOPLE

Dan Schrag on President’s S&T council

Dan Schrag, an SFI External Professor and Science Board member, was named recently to President Barack Obama’s 18-member council on science and technology.

Dan is professor of Earth and Planetary Sciences at Harvard University, as well as director of Harvard’s Center for the Environment. His research has focused on climate and climate change over the broadest range of Earth history.

Dan was at SFI in September to deliver one of the Ulan lectures in honor of SFI Distinguished Professor Murray Gell-Mann.

> Can rewards backfire?

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CAROLINE BUCKEE accepts Harvard appointment

Caroline Buckee has accepted an appointment as an assistant professor in the Department of Epidemiology at Harvard School of Public Health. Her Harvard appointment begins July 1, 2010.

Caroline is an SFI Omidyar Fellow and a Sir Henry Wellcome Research Fellow in Zoology at the University of Oxford. Her SFI research has focused on combining experimental and theoretical techniques to understand the evolution of genetically diverse pathogen species.

SFI Science Board Co-Chair David Campbell has been recognized by the American Physical Society for his outstanding contributions to physics. He will be awarded the 2010 Julius Edgar Lilienfeld Prize during the annual APS meeting in March in Portland, Oregon.

David is being honored “for pioneering new approaches to the study of complex systems, using the complementary approaches of nonlinear dynamics and statistical physics, and for communicating the excitement of this new field to diverse audiences,” according to the APS citation.

He shares a $10,000 prize with Shlomo Havlin, a professor of physics at Israel’s Bar-Ilan University. The prize was established in 1999 by Beatrice Lilienfeld in memory of her husband, Austro-Hungarian physicist Julius Edgar Lilienfeld.

David is Provost of Boston University and the former director of the Center for Nonlinear Studies at Los Alamos National Laboratory.
Adapting food production to a changing world climate

A recent meeting in Washington, D.C., on climate change and agriculture raised questions that were both sobering for planet Earth and interesting for SFI, says Institute President Jerry Saltzoff.

The conference explored ways to counter the effects of climate change on food production worldwide. It brought together experts from many disciplines to begin to define the public policies and investments needed to ensure that useful scientific advances reach farmers in both the developed and developing regions.

John Holdren, White House science advisor and director of the Office of Science and Technology Policy, gave the keynote address. Jerry attended the September 14 meeting via an invitation from conference organizer Nina Fedoroff, Science and Technology Advisor to the Secretary of State. Nina is an SFI External Professor and Science Steering Committee member.

“Jerry says the topic is a good one for SFI, and he is discussing the issues raised at the conference with resident faculty members. "There may be some real opportunities for SFI to contribute down the road," he says."

Jerry says the topic is a good one for SFI, and he is discussing the issues raised at the conference with resident faculty members. “There may be some real opportunities for SFI to contribute down the road,” he says.

“as the discussion indicated, in many cases it is not so much a matter of mitigating the effects of climate change as it is adapting to its effects,” he notes.

The meeting was a chance for economists and other scholars to begin a discussion of market characteristics that might be appropriate indicators for measuring systemic risk. Among those they discussed were connectivity, adaptability, and homogeneity.

The day after the meeting a smaller group met to discuss plans for future study of systemic risk, to include a meeting at SFI with a broader range of disciplines represented.

John and Nancy and her husband Ron have maintained a vacation home in Santa Fe since the early 1980s. They have an adult daughter and three grandchildren and enjoy travel and golf.
INSIDE SFI
Institute science blog accessible at www.santafe.edu

Discussion of just about any subject in the SFI research portfolio can be found on the Institute’s science blog “Simplicity & Complexity.” The blog includes contributions from SFI faculty as well as follow-up discussion. A recent entry, for example, asks “Did Krugman Get It Wrong?”, a reference to economics Nobel laureate Paul Krugman’s article in the New York Times Magazine on September 6, 2009. Suggested readings from SFI’s “Foundations of Complexity” reading group are posted as well. “Simplicity & Complexity” is accessible from the upper right corner of the Institute’s home page at www.santafe.edu.

PEOPLE
Former Institute International Fellow wins prestigious Colombian award

Former SFI International Fellow Juan-Camilo Cárdenas Campo has received a 2009 Science Award from the Fundación Alejandro Ángel Escobar, recognized by many as the most prestigious scientific award in Colombia. The award in the Environment and Sustainable Development category recognizes research that contributes to the conservation and sustainable use of natural resources and the environment. Juan-Camilo’s award commends his work on institutions, poverty, and cooperation in the local handling of common resources. Juan-Camilo is Professor in the Department of Economics at the Universidad de los Andes, Bogotá.

SFI IN THE NEWS

A September 12 Wall Street Journal article, “Wall Street’s Math Wizards Forgot a Few Variables,” says some finance experts and economists blame the failure of too-simple financial risk models for the 2008 market meltdown. SFI Professor Doyne Farmer is quoted: “You don’t need a model of human psychology to see that there was a danger of impending disaster…But economists have failed to make models that accurately model such phenomena and adequately address their couplings.” His work to model complex financial interactions is mentioned.

Excerpts from an address by SFI Distinguished Professor and Nobel laureate Murray Gell-Mann were reprinted in Science News online on September 12. In his address to 150 15- to 18-year-olds gathered for an Adventures of the Mind summit, he described the origins of and philosophy behind SFI’s approach to science: “The way we operate is to be completely transdisciplinary. Problems are worked on without any regard for what field they originally come from…That’s quite different from what happens at most universities, where you have departments and textbooks and professional societies and sections of granting agencies all dividing people up into special compartments…It’s so exciting to watch these ideas bubbling up from the bottom, not being imposed from the top.”

An October 14 book review in The Globe and Mail gives high marks to SFI Professor W. Brian Arthur’s new book, The Nature of Technology: What It Is and How It Evolves (Free Press, 2009). The book explores the ways innovation occurs and posits that technological innovation is never new but rather results from creative combinations of existing ideas. “His book is an accessible meditation on technology, however, and this is worth reading if you want to understand how that world evolves.”

PEOPLE
Bette Korber recognized by SAGE magazine

SFI External Professor Bette Korber is among 20 New Mexicans being recognized with 2009 Women Making a Difference awards by SAGE magazine, the Albuquerque Journal’s monthly magazine about women. Bette’s award, one of two in the Science category, recognizes her work on a global HIV database and an AIDS vaccine.

In addition to her SFI appointment, Bette is an immunologist in the Theoretical Division at Los Alamos National Laboratory.