RESEARCH NEWS

Stopping flu globally by acting locally

Transmission electron micrograph of Avian influenza A H5N1 (orange) in cell culture (green)

(Image: CDC)

Human health on a worldwide scale may hinge on whether poultry workers in West India get treated for flu symptoms.

Chicken coops are breeding grounds for new varieties of influenza, which can sometimes jump from birds to humans. When this does occur, poultry workers will be the first to get sick.

As part of a grant from the National Science Foundation, SFI Postdoctoral Fellow Dan Hruschka and collaborators at Emory University will study how and when poultry workers in the West Indian city of Surat go to doctors or healers for treatment of flu-like symptoms.

So far, the avian flu can’t efficiently pass from human to human. But many scientists believe the virus is bound to evolve that capability eventually. Preventing a pandemic could depend on how early scientists realize a flu strain has developed the ability to travel from human to human.

Dan’s role in the Surat study will be to gather and analyze social network data showing how people refer one another to health care providers. That data could help the researchers suggest ways to recognize human-to-human spread of a flu strain at the earliest possible moment.

In the next 25 years, the world will need to better protect itself from emerging diseases, according to an SFI panel of experts.

Climate change and globalized trade have increased the potential for new diseases to emerge and for existing ones to spread. The panel noted the need for new research that encourages collaboration and combines expertise in fields ranging from biology to economics.


Participants in an SFI workshop October 15-17, “Modern Malware III: Fighting Modern Malware,” took a hard look at the range of threats lurking in today’s hyperconnected electronic world.

The three-day meeting was the third in an SFI “Modern Malware” series designed to apply SFI-style cross-disciplinary thought to one of modern society’s most pressing problems. Its organizers included Matt Williamson of Sana Security, Eric Davis of Google, and Ayn Romanov of Cisco. Google and Cisco are SFI Business Network members.

Nearly two-dozen participants brought a variety of perspectives to the table, together they represented computer security software developers, internet service providers, domain name registrants, electronic commerce, federal law enforcement, and other players in the online community.

Society’s dependence on electronic communication and commerce makes the Internet an attractive medium for bad actors, says Institute Vice President Chris Wood, and workshop participants noted that the victims of malware are not necessarily rewarded for combating it.

“Identity theft is merely aggravating. State-sponsored electronic warfare is potentially catastrophic,” he says.

Nearly sold out at the $500 and $1,000 level. Tickets are necessary year by exploring the future.

“Open Questions,” a two-day Business Network and Board of Trustees Symposium November 7 and 8 at the Eldorado Hotel in Santa Fe, will focus on the scientific, technological, and organizational challenges facing society in the next 25 years. (See “SFI turns 25” on page 3.)

Morning sessions will address significant questions in various scientific disciplines. Afternoon sessions are designed to provoke discussions on issues that will shape the evolution of business and society.

On Friday morning, November 7, Lee Smolin of the Perimeter Institute for Theoretical Physics will be the keynote speaker during a session on “Open Questions in Science.” The afternoon is dedicated to a roundtable discussion of challenges in science education for the next generation.

On Saturday morning, November 8, SFI External Professor Mark Newman of the University of Michigan will address the promises and challenges of network theory as a methodology for integrating science.

On Saturday afternoon, November 8, the Institute will host a gala dinner with the theme “The Road Less Traveled” at the hotel to inaugurate SFI’s 25th anniversary. Tickets are nearly sold out at the $500 and $1,000 level.

“The relationship between an individual’s or organization’s ability to do something about malware and their incentive to do so is absolutely out of whack,” he says.

“Identity theft is merely aggravating. State-sponsored electronic warfare is potentially catastrophic,” he says.

Nearly sold out at the $500 and $1,000 level. Tickets are necessary year by exploring the future.

“Open Questions,” a two-day Business Network and Board of Trustees Symposium November 7 and 8 at the Eldorado Hotel in Santa Fe, will focus on the scientific, technological, and organizational challenges facing society in the next 25 years. (See “SFI turns 25” on page 3.)

Morning sessions will address significant questions in various scientific disciplines. Afternoon sessions are designed to provoke discussions on issues that will shape the evolution of business and society.

On Friday morning, November 7, Lee Smolin of the Perimeter Institute for Theoretical Physics will be the keynote speaker during a session on “Open Questions in Science.” The afternoon is dedicated to a roundtable discussion of challenges in science education for the next generation.

On Saturday morning, November 8, SFI External Professor Mark Newman of the University of Michigan will address the promises and challenges of network theory as a methodology for integrating science.

On Saturday afternoon, November 8, the Institute will host a gala dinner with the theme “The Road Less Traveled” at the hotel to inaugurate SFI’s 25th anniversary. Tickets are nearly sold out at the $500 and $1,000 level.

“The relationship between an individual’s or organization’s ability to do something about malware and their incentive to do so is absolutely out of whack,” he says.

> more on page 2

> more on page 4
Past work by SFI External Professor Mark Newman and SFI Postdoctoral Fellow Michael Gastner was referenced in a September 18 Nature article about national science indicators. Nature created a series of cartograms to illustrate disparities among states in federal science funding per capita and other indices. The maps were made using 2008 data from the NSF. “Perhaps the best-known use of cartograms is the 2004 analysis of U.S. presidential election results by [Mark and Michael] of the Santa Fe Institute in New Mexico, who are experts in social and information networks. Whereas standard maps showed the United States awash in red Republican votes, cartograms that adjusted state and county areas on the basis of their population gave a more accurate picture, with roughly equal areas of red and blue.”

A September 10 Nature article about the future of evolutionary theory and the synthesis of thought from genetics and developmental biology quoted SFI Professor David Krakauer: “It’s a matter of finally unify[ng] two areas that haven’t spoken to one another,” he says. To tackle any modern problem in evolutionary biology, you’ll have to use development and the dynamics of the genus that underlie it. He’s quite enthusiastic about the possibility of bringing together mathematical theories of pattern formation… and the large body of theory on genetic change between generations used by population geneticists. "But at the same time, he can see forces beyond the content of the theories that may keep them apart: “It’s not about totally incompatible world views. It’s about who holds the torch—who are the legitimate heirs to the Darwinian intellectual estate.”

An October 1 post in the New York Times by theoretical physicist and author Mark Buchanan cited the work of three SFI-affiliated researchers to better understand financial market fluctuation through agent-based modeling. The article blames day-to-day uncertainty about stock market fluctuation on economists’ over-reliance on classical market-equilibrium theory. “Really understanding what’s going on means going beyond equilibrium thinking and getting some insight into the underlying ecology of beliefs and expectations, perceptions, and misconceptions that drive market swings. Surprisingly, very few economists have actually tried to do this, although that’s now changing – if slowly – through the efforts of pioneers who are building computer models able to mimic market dynamics by simulating their workforce from the bottom up…” For example, an agent model being developed by the Yale economist John Geanakoplos [SFI Science Board and Science Steering Committee Member, and SFI External Professor], along with two physicists, [SFI Professor] Dovey Farmer and [SFI External Professor] Stefan Thurner, looks at how the level of credit in a market can influence its overall stability. The model also shows something that is not at all obvious. The instability doesn’t grow in the market gradually, but arises suddenly. Beyond a certain threshold the virtual market abruptly loses its stability in a ‘phase transition’ akin to the way ice abruptly melts into liquid water. Beyond this point, collective financial math breaks down very violently. This is the kind of possibility that equilibrium thinking cannot even entertain.”

The October 2 Christian Science Monitor featured a study by SFI External Professor Jim Crutchfield (UC Davis) and Santa Fe area sound artist David Orell

AWARDS

Arthur wins Lagrange Prize

SFI External Professor W. Brian Arthur is one of two inaugural recipients of the Lagrange Prize for research in the science of complexity. Princeton mathematician Yakov Sinai also received the inaugural prize.

Awarded by the Institute for Scientific Interchange Foundation (http://www.isif.it) and CRT Foundation (http://www.tondoincorti.it) of Turin, Italy, the 75,000 Euro prize is given for “outstanding scientific contributions to the field of complexity and complex systems in all disciplines.”

In addition to his SFI External Professorship, Arthur is a past member of SFI’s Board of Trustees and Sciences Board. He currently is a visiting researcher at the Palo Alto Research Center’s Intelligent Systems Lab.

His research interests include technological evolution, nonequilibrium models of economics, and theoretical frameworks for economic allocation. He has authored three books and is a noted speaker.

PEOPLE

Ladua leaves SFI for UCSF

SFI Postdoctoral Fellow Josh Ladua’s last day at the Institute was October 10. He is now a Postdoctoral Fellow with the Gladstone Institutes at the University of California, San Francisco, where he is working on iSEM, a metagenomics project funded by the Moore Foundation.

CREDITS

Editorial staff
Julie Gerber
Ginger Richardson
Della Ulbarri

Contributors
Pat Lowe
Howard Karchevel
Julie Rahmayer
Krista Zala

Design and production
Michael Vittow

The SFI Update is published monthly by the Institute to keep our community informed about current work and activities. Please send comments to Ginger Richardson at grr@santeafe.edu.

RESEARCH NEWS

Model citizens: Preventing flu by understanding behavior

Influenza spreads as people travel. Vaccines can work only if people choose to take them. Sexually transmitted diseases can be stopped only if people adopt safe sex practices.

In a September 19 Nature article titled “Model citizens: Preventing flu by understanding behavior,” the researchers have used a global version of the model to study how travel restrictions affect a flu's spread. As they expected, restricting air travel between large cities tended to delay its spread from country to country.

Surprisingly, though, the researchers found that in some situations such restrictions could make a flu epidemic worse in particular areas. For instance, delaying the spread of a new flu virus that originates in Asia could cause it to hit the U.S. during winter instead of summer, greatly increasing its wallop.

One way to protect people from emerging flu viruses is to develop techniques to quickly create new vaccines.

“…”A laudable and important goal,” he says, “but the assumption is that if you produce a vaccine, people will take it. That’s what’s actually preventable.”

He points to a study that showed that more than half the surveyed residents of Washington, D.C., and New York wouldn’t accept a smallpox vaccine even during a confirmed smallpox outbreak.

These and other examples convince Josh that “behavior is a central frontier in epidemic modeling.”

JOSH AND HIS COLLEAGUES HAVE DEVELOPED AN AGENT-BASED MODEL OF THE U.S. POPULATION SO THEY CAN WATCH HOW INFLUENZA SPREADS ACROSS THE U.S. BLACK DOTS INDICATE PEOPLE WHO ARE HEALTHY AND SUSCEPTIBLE. RED DOTS SHOW PEOPLE WITH ACTIVE CASES. BLUE DOTS SHOW THOSE WHO HAVE HAD IT.

Simulations show how a flu virus can spread across the U.S. Black dots indicate people who are healthy and susceptible. Red dots show people with active cases. Blue dots show those who have had it.

Influenza spread can be accelerated or slowed – through the efforts of pioneers who are bringing together mathematical theories of pattern formation and the large body of theory on genetic change between generations used by population geneticists. "But at the same time, he can see forces beyond the content of the theories that may keep them apart: “It’s not about totally incompatible world views. It’s about who holds the torch—who are the legitimate heirs to the Darwinian intellectual estate.”

What the candidates say about science

The U.S. presidential candidates’ positions on climate change and 13 other issues in science are detailed at Science Debate 2008 (www.sciencedebate2008.com), an online compilation of the candidates’ answers to questions posed by the nation’s science community.

Leading researchers initially submitted more than 3,400 questions they wanted the candidates to answer. The questions were pared down to the top 14 by groups representing the AAAS, the National Academies, and other organizations. The final list of questions covers issues from energy and health care to scientific integrity and government interference. More than 38,000 leading scientists and engineers have signed on in support of Science Debate 2008, including several researchers affiliated with SFI.

Another site sponsored by Science & Engineers for America tallies congressional delegates’ voting history on and, candidates’ responses to, key scientific issues (http://sharp.sefora.org/).
SFI in the News

Due to “to listen to the ultrasonic complaints of drought-stricken, beetle-infested ponderosa pines, yielding new insights into the trees’ plight...” The two found that trees stressed by drought emit sounds pitched too high for human hearing. The researchers suspect that bark beetles detect these sounds and thus locate weakened trees to attack. The beetles also emit ultrasonic with which they communicate among themselves. This, too, may attract more beetles to a tree under attack... If so, it may be possible to use ultrasonic to divert and confuse the beetles and thus protect vulnerable trees.

http://features.scmirror.org/innova-
tion/2008/10/02/can-we-save-forests-by-
listening-to-bees/

The October 6 Christian Science Monitor reviewed the conclusions of a research team that includes SFI Postdoctoral Fellow Michael Gastner showing that closing off certain streets can relieve traffic congestion. The researchers’ study of transportation patterns as networks has been widely cited. http://features.scmirror.com/environment/2009/10/06/doors-closing-roads-cut-
delays/

SFI Distinguished Fellow and Trustee Murray Gell-Mann was quoted in an October 7 Scientific American profile of Japan-born American physicist Yoichiro Nambu (University of Chicago). “Over the years, you could rely on Yoichiro to provide deep and penetrating insights on very many questions,” said Murray. Nambu was awarded the 2008 Nobel Prize in Physics for the discovery of the mechanism of spontaneous broken symmetry in particle physics. The article is a re-posting of a Scientific American article first published in February 1995. www.sci.am/cf/awards.cfm?aw=profile-yoichi-
ro-nambu&page=2

An October 10 New Scientist article mentioned the work of political scientist and SFI Postdoctoral Fellow Nathan Collins describing the tendency of people to misunderstand or misrepresent a politician’s stance or record based on how the person making the judgment categorizes that candidate—as Republican or Democrat, for example. “The categorizing process, which has been shown to help explain how we learn and remember things, has now been modeled for political beliefs by Nathan Collins, a political scientist at the Santa Fe Institute in New Mexico. In a paper being considered for publication by The Journal of Politics, he finds that voters are more likely to misremember a candidate’s position if it conflicts with the party labels. And that, says Collins, opens the door to deceptive campaigning.” www.newscientist.com/article/mg20003774.400-our-psychology-helps-politi-
cians-band-the-truth.html

SFI Professor Sam Bowles was quoted in an October 14 segment of PBS NewsHour with Jim Lehrer focused on inequality in New Mexico. The piece, which was shot at the lab cafeteria, first dreamt of a place where interdisciplinary thought could be nurtured, none could have predicted that the seeds they planted in those early days would sprout a dozen or so institutes and university research departments around the world similarly dedicated to the field. George Cowan, Lifetime Trustee Emeritus, Distin-
guished Fellow, and Founding President of the Institute, on the idea first enounced immediately after the idea of an interdisciplinary run by scientists. It was late 1982. The idea came together a few months later when Murray Gell-Mann, now SFI Distinguished Fellow and Trustee, came to the group to describe what he had in mind. “That’s when we decided we could do it,” says George.

By early 1984, two challenges stood in their way. The name “The Santa Fe Institute” was owned by a local drug and alcohol rehabilitation clinic. And they had no funding.

Problem one was solved when the clinic went out of business and the group registered the name. Problem two required more effort.

Philanthropist Art Spiegel (of the Spiegel catalog) who had just moved to Albu-
querque from Chicago, helped secure a handful of investors, while Murray eked a couple of grants from foundations such as the John D. and Catherine T. MacArthur Foundation. Some of the Institute’s principals were able to stay on the lab payroll while the fledging operation grew its wings.

*Former Los Alamos Director* Sig Hecker was instrumental in getting us off the ground,” George says.
PEOPLE

Smithsonian acquires portraits of SFI icons

The Smithsonian National Portrait Gallery has acquired the portraits of two Institute icons – SFI Distinguished Fellow, SFI Trustee, and Nobel laureate Murray Gell-Mann and Pulitzer Prize-winning author Cormac McCarthy – to add to its permanent collection of famous Americans.

The Smithsonian acquired the paintings, by acclaimed artist Andrew Tift, from Andreeva Portrait Commissions of Santa Fe (www.luxuryportraits.com).

The images are part of a series of 23 commissioned in 2003 by gallerist/owner Tatiana Andreeva as a millennial portrait collection of prominent scientists, activists, artists, musicians, flea market sellers, a Vietnam veteran, and a waitress, among others.

Tift, winner of the prestigious BP Portrait Award Best of Show 2006 at London’s National Portrait Gallery, visited the Institute to meet both men before painting them.

Murray Gell-Mann
Cormac McCarthy
(Images courtesy of Andreeva Portrait Commissions)