In Khayelitsha, a shanty town in Cape Town, South Africa, over 500 structures are crowded into a 5.5-acre area, abutting a school with its own 0.8-acre soccer field, emphasizing the heterogeneity of the developing city. The slum’s high density and poor road access make providing urban services, such as fire protection and sanitation, challenging and expensive. The data overlay provides a topological measure of how difficult it is to reach each structure from a road. (Image: Christa Brelsford)

Better cities from locally gathered data

Cities give rise to socioeconomic processes that have led to spectacular economic growth and human development in now-rich parts of the world. Such changes, however, were relatively slow to emerge, typically spanning several generations.

Today, the rapid urbanization of the “developing” world demands that problems of sustainable human development are solved faster, “really in the next few decades,” says SFI Professor Luis Bettencourt. “But we still lack critical theoretical and practical knowledge about cities and their role in the processes of human development,” he says.

Addressing this information crisis through better cities from locally gathered data.

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Symposium revisits economies as complex systems

To mark the Institute’s 30th anniversary, SFI’s Annual Trustees and Business Network Symposium focuses on an important component of SFI’s research portfolio: the investigation of economies, firms, and individual decision-making from a complex adaptive systems perspective.

Chris Wood, SFI VP for Administration and Director of the Business Network, says some of the critical elements of this perspective—or, as some would emphasize, the most notable departures from mainstream economics—include the realizations that:

- Economies are rarely, if ever, in equilibrium;
- Economies reflect the aggregate of decisions and actions of organizations and individuals at many different scales, from the individual consumer to the giant bank that’s “too big to fail” to the actions of federal, state, and local governments to international pressures and opportunities; and
- Human decision-makers are rarely the rational, primarily self-interested, utility maximizing “Homo economicus” that mainstream economic theories assume us to be.

SFI External Professor W. Brian Arthur summarized this view in a recent SFI working paper: “[T]he economy is not necessarily in equilibrium: economic agents (firms, consumers, investors) constantly change their actions and strategies in response to the outcome they mutually create. This further changes the outcome, which requires them to adjust again. Agents thus live in a world where their beliefs and strategies are constantly being ‘tested’ for survival within an outcome or ‘ecology’ these beliefs and strategies together create. Economics has largely avoided this nonequilibrium view in

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Weaving new ecological theory

On the heels of a manifesto on the nature of ecological theory, SFI researchers and their collaborators met in Chile in October to discuss its future.

Co-organized by SFI External Professor Pablo Marquet and VP for Science Jennifer Dunne, the working group was the first formal meeting of NEAT, the Network for Ecological Theory Integration.

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Workshop explores commonalities in network dynamics

A quiet forest scene, where sunlight filters through old-growth evergreens to thick underbrush, belies the system’s bustling interconnections. Energy captured by plants, mushrooms, and microbes is directed through insects to songbirds and up to the occasional passing carnivore, and ultimately returns to the forest floor as detritus.

Such a food web is a network exhibiting two kinds of dynamics. Its nutrient flow, where biomass and energy course through a set of feeding relations between organisms, is an example of dynamics on a network. Dynamics of a network is when the structure itself changes, for example, when species and their feeding links blink in and out of existence.

Both types of dynamics can operate within a single system and often influence each other. Environmental stresses may
Geometry and programmed cell death might have helped along the evolution of multicellular life, according to research led by SFI President Jerry Sabloff’s 2014 Stanislav Ulam Memorial Lecture Series, during which he showed how lessons today’s archaeologists are learning about the past offer insights that could shed light on present and future human societies.

In an October 27 “Science in a Complex World” piece in the Santa Fe New Mexican, SFI External Professor Andreas Wagner addresses a question that has confounded theoretical biologists: how do evolutionary innovations arise in the first place?

In an interview with SFI Miller Scholar Sam Shepard in the September 7 issue of The Guardian, Shepard acknowledges SFI’s Cowan Campus as a place where he is surprisingly productive.

On September 4, the Santa Fe New Mexican reported on the McKinnon Family’s generous donation of $2.5 million to endow and provide administrative support for SFI’s education and outreach programs.

In a September 1 New York Times article, SFI Professor Luis Bettencourt comments on the need for further research before implementing a ride-sharing system for New York City taxis.

Both Science and NBCNews.com reported on an analysis of animal depictions on Egyptian artifacts by SFI Omidyar Postdoctoral Fellow Justin Yeakel and colleagues suggesting that the Nile Valley ecosystem has grown progressively less stable over the last 6,000 years.

The Ebola outbreak in West Africa is a sobering spectacle. It’s also becoming clear there is still too much we don’t know about Ebola, and more generally about how diseases spread and how to stop them. If there is a good case for vigorous science and science funding, here it is.

The team took inspiration for their results from a recent experiment on yeast. In that study, researchers repeatedly grew the yeast Saccharomyces cerevisiae in test tubes and selected whatever sank to the bottom for more growth. Because the yeast cells that stuck together tended to sink, larger clusters survived this artificial selection.

So too rudimentary reproduction: when one cluster got too big, it would simply break apart, forming two distinct organisms. But a more counterintuitive trait evolved as well: individual cells that were programmed to die sooner than their unicellular ancestors.

One reason for this, Libby says, is space. In the multicellular yeast creatures, each cell can split genetically-programmed cell death likely evolved along with multicellularity, laying the foundations for the reproduction of multicellular organisms.

The meeting will focus on understanding how biological innovations arise in nature, and whether “man-made” synthetic biology has shown that artificial tissues and organs can be constructed,” Solé says.

Three decades ago, it seemed crazy that a character in the film Blade Runner, a genetic engineer named Chew, would specialize in making eyes, but researchers today are starting to do precisely that, Solé says. Meanwhile, robots can develop simple grammars, lie to each other, and identify themselves in the mirror.

Such research, she says, opens up new possibilities and new questions about the nature of evolution: Is there a unique kind of design principle for living cells? Or might there be alternative evolutionary principles that can be applied to artificial systems but are absent in nature? Is complex language a rare accident, only arising in human societies, or instead might there be other kinds of complex language that become a reality in the future as computers are becoming more complex?

By looking at life’s human-made counterparts, we hope to better understand some fundamental questions concerning the possibility and actuality of robots.

Soles says he hopes the working group will create new ties between SFI researchers and bring new researchers into the SFI circle—and lay some foundations for a new area of research.

Geometry-enabled multicellularity

Geometry and programmed cell death might have helped along the evolution of multicellular life, according to research led by SFI President Jerry Sabloff’s 2014 Stanislav Ulam Memorial Lecture Series, during which he showed how lessons today’s archaeologists are learning about the past offer insights that could shed light on present and future human societies.

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The Earth and the Moon are next-door neighbors in the universe, both receiving plenty of light from the nearby sun. So why has the Moon stayed simple, ignoring all that energy, while the Earth exploits it to such fabulous effect? What general principles underlie the differences in how they have evolved?

Erwin Schrödinger, one of the titans of quantum mechanics, considered this question in posing what is now known as Schrödinger’s Paradox. SFI Professor David Wolpert thinks the answer to his paradox might lie in the way biological systems store and transmit information— and information is something one can analyze with well-established theoretical machinery, he says.

So why has the Moon stayed simple, ignoring all that energy, while the Earth exploits it to such fabulous effect?

“When physicists talk about information, what we mean is how much we can infer about the state of one thing by looking at the state of another thing,” he explains. A simple example is how much we can infer about the total biomass of predators in an ecosystem from what we know about the total biomass of prey. The more we can infer, the more information connects those two things.

“So by studying how information is stored in a biological system, how it flows within the system, and the dynamics of how this flow changes in time,” he says, “we can start to uncover the tapestry of information in such systems—and, just maybe, start to understand what processes cause that tapestry to grow ever more complex.”

With former SFI Omidyar Fellow James O’Deacy and SFI VP for Science Jennifer Dunne, Wolpert is co-coordinating a two-day, invitation-only working group, “Information Theory, Ecosystems, and Schrödinger’s Paradox,” in mid-November. Scientists specializing in ecosystem modeling, phylogenetic tree reconstruction, cell biology, algorithmic information theory, computation, and statistical physics will gather at SFI to look closely at how life orders itself, and then try to reconcile biology’s underlying order with thermodynamics.

“We want to know what processes, potentially information-theoretic in nature, drive the apparent rise in complexity of many systems, ranging from early life through ecosystems through social systems and up to the biosphere as a whole,” he says. “Armed with that knowledge, we can gain insight into how stable the biosphere might be as humanity changes it so drastically. More speculatively, we might learn what caused a biosphere—life—to evolve in the first place.”

The outcome of the meeting, Wolpert expects, will be new approaches to understanding information tapestries, what drives their change, and how such changes might provide the key to Schrödinger’s Paradox.
RESEARCH NEWS

Modeling pilots behaving strategically

It’s a jungle up there. More than 87,000 commercial flights take off and land in the U.S. every day. Add to that countless flights by military and private aircraft, all piloted by human beings relying on limited information and a mind-boggling array of technology. Despite all that traffic, the national airspace is remarkably safe. But what happens when thousands of unmanned aerial systems (a.k.a. drones) join the mix? In particular, what rules and procedures should govern drones, controlled by human operators on the ground through noisy communication links (links that sometimes drop out entirely), to ensure that current safety standards are met?

The FAA has these questions and more on its plate as it prepares to issue new rules. The goal is to investigate what procedures would be best for using drones to help fight forest fires.

“More generally, we think we can contribute to the assessment of potential air safety issues of the entire national airspace as it gets more crowded and starts to include drones,” he says. “Our new approach could be of interest in a number of other areas as well, from cyber security to regulations of financial markets.”

“When you become sensitized to it, it’s hard not to see randomness in the sequence of human actions in almost all scenarios where people interact,” he adds.

SFI Professor David Wolpert is leading a three-year, NASA-funded project to develop new computational models that offer quantitative predictions of air safety as the national airspace gets increasingly congested with planes, onboard pilots, remote drone pilots, automated technologies – and a great deal of new uncertainty.

In the past, regulations governing air traffic have typically relied on subjective expert opinion or on the anecdotal results of crash investigations. What’s missing, says Wolpert, is a quantitative, predictive framework that acknowledges that aircraft are controlled by human beings interacting with one another. This suggests a role for game theory, he says. “A near-miss in the sky is the quintessential game of chicken. Do I swerve left or right? I have to guess what the other pilot is thinking, and the other pilot makes guesses about what I am thinking.”

But modeling airborne events presents a challenge traditional game theory can’t address: airborne events take place not in a series of discrete time steps, with lockstep stages of which human moves when. Rather they occur in continuous time, with events, actions, delays, and reactions occurring in a partially random sequence, at random times.

According to Wolpert, such randomness in the sequence and timing of events is best modeled with techniques from a different field, stochastic process theory. “We need to merge game theory and stochastic process theory, creating a completely new field,” he says.

To begin, Wolpert and colleagues from Stanford and Los Alamos National Laboratory are working with the U.S. Forest Service. The goal is to investigate what procedures would be best for using drones to help fight forest fires.

Mergers lead to business ecosystem imbalances

Business mergers and acquisitions bring about significant imbalances in the functioning of economic systems, and the threat of monopoly looms large, according to an analysis of economic data published in Proceedings of the Royal Society A.

Drawing on approaches from complexity and evolutionary biology – and analyzing historical business data from a variety of industries and geographies and from the 1830s to the present – SFI Distinguished Professor Geoffrey West and colleagues from Imperial College London and PricewaterhouseCoopers show that the cumulative history of mergers and acquisitions of companies (i.e., ancestry) is a key characteristic underpinning the dynamics of business ecosystems.

They conclude that a universal mechanism leads to imbalanced business ecosystems in which a few very large but sluggish “too big to fail” entities, and very small niche entities, prevail.

To study Ebola’s spread, understand human mobility

In a letter in Science on October 24, SFI Omicur Fellow Sam Scarpino and co-authors stress the importance of human mobility patterns in understanding the spread of Ebola. The authors write that “modeling efforts are limited in the absence of good mobility data.”

Analyses of existing mobile phone data and air travel data have produced initial maps of Ebola’s movement, but more data are required to inform transmission models, which are necessary for planning appropriate interventions as the outbreak evolves.

When humans bred with Neanderthals

A Nature paper co-authored by SFI Professor Michael Lachmann decodes the genome of a 45,000-year-old human from Siberia. The researchers analyzed DNA from a fossilized femur found on the banks of the Irtysh river near the settlement of Ust’-Ishim. It is the oldest modern human bone found outside of Africa and the Middle East. The man it belonged to possessed a quantity of Neanderthal DNA similar to that of present-day Europeans and east Asians, though in larger segments along the genome.

The analysis indicates that the two groups interbred 7,000 to 13,000 years before the man lived, or 50,000 and 60,000 years ago.

Trade relations offer stability against war

In a paper published on arXiv.org on October 5, SFI External Professor Matthew Jackson and co-author Stephen Nei model military and trade networks since 1820 in the first game-theoretical study of international alliances. The model combines network theory with game theory to ask whether countries’ military and trade alliances provide stability against armed conflict. The model shows that the rapid increase in trade alliances since the 1960s increased the stability of international networks. The study also suggests that while modern networks are far more stable due to the increased number of trade alliances, no network of interconnected nations can be wholly immune to war.
improved data and data collection is the focus of three-day workshop at SFI in November, “Acting Locally. Understanding Locally: Scaling Up Community Collected Data in Developing Cities.”

Co-organized by Bettencourt, ASU’s Jose Lobo, and SFI’s Joe Hand, the meeting brings together researchers, community and nongovernmental organizations, open-source software developers, and representatives from the United Nations, World Bank, and various philanthropic foundations.

The need for data is particularly critical – and lacking – at the local level inside cities, says Bettencourt, where strong heterogeneity and inequality necessarily underlie urban planning and human development.

“The technology to collect, organize, and share local urban data is getting really good and it will only get better,” he says.

“But the organization is lacking. We want to create a vision for acquiring data easily and learning from it fast.”

Born out of the SFI researchers’ interactions with local community organizations as part of the Neighborhood, Slums, & Human Development project, the workshop seeks ways to build an international community dedicated to collaborative local data collection, especially in poor neighborhoods in developing cities.

“We want to create information bases and tools for large-scale collaboration, and create free open platforms for people to collect the data, upload it, and share it with others,” says Bettencourt. “We want to create an infrastructure that’s light and easy to use, and have the means to share knowledge about people’s local conditions – sort of like Wikipedia for neighborhoods, but with a strong data and scientific foundation.”

How to know whether brute-force computation is the best we can do

The connection between the complexity of mathematical proofs and the complexity of algorithms is deeper than previously thought, according to SFIExternal Professor Joshua Grochow and his collaborator, University of Toronto computer scientist Toniann Pitassi.

Their recent work, presented by Pitassi at the IEEE Symposium on Foundations of Computer Science on October 20, could help researchers better understand a central problem in computer science, known as P versus NP.

“Prior to our paper, the proof system approach to proving that P 6= NP was an infinite endeavor,” Grochow says.

For decades, the fundamental issue computers face hasn’t just been how to make algorithms run faster, but whether it’s always possible to improve on brute-force algorithms.

Take the traveling-salesperson problem, which calls for finding the shortest route connecting several cities. The brute-force method is to compute all possible routes and see which is shortest, but as you add cities, the problem grows exponentially: with 5, 10, or 15 cities, there are 120, 3.6 million, and 1.3 trillion different routes to check, respectively.

The P versus NP question asks whether there are fundamentally faster solutions, not just to the traveling-salesperson problem, but to any of thousands of important computational problems. If P doesn’t equal NP, then for many problems brute force is essentially the best we can do.

A related problem is whether there are relatively short – meaning not exponentially long – proofs of mathematical statements. If there aren’t, then P doesn’t equal NP, answering a million-dollar question, says Grochow. Because there are many different mathematical proof systems, or dialects, proving that claim is a tall order.

The pair developed an algebraic proof system and showed that if that system doesn’t have short proofs, then the algebraic versions of P and NP, known as VP and VNP, are not equal. But, says Grochow, the result is “significantly stronger than that,” and should help researchers learn more about the P versus NP problem.

Are quarantines confounding Ebola containment?

A study published in PLoS Currents: Outbreaks by SFI External Professor Carlos Castillo-Chavez and co-authors models the rapid evolution of the Ebola virus and efforts to contain it. By applying a time-series analysis and other statistical methods to World Health Organization data for Ebola in West Africa, they found that in Liberia and Guinea, the transmission rate accelerated when military-forced quarantines were imposed – suggesting a rethinking of the nuances of mitigation strategies.

Ecologists need ‘efficient theory’ to make sense of all the data

Ecologists are awash with data and have the tools to find patterns in it. But understanding those patterns requires simple, mathematical approaches. The 16 co-authors of a July 16 report in BioScience term such approaches “efficient theory,” which builds on first principles and a small number of assumptions. SFI-affiliated authors include lead author Pablo Marquet, Jim Brown, Jennifer Dunne, Brian Enquist, Jessica Green, John Harte, James O’Dwyer, and Geoffrey West.

How hosts and parasites co-evolve

In a paper in PNAS, SFI External Professor Michael Hochberg and collaborators examined co-evolution patterns among the host bacterium Pseudomonas aeruginosa and a panel of bacteriophages (viruses that infect and replicate within a bacterium). Their study finds that pathogen identity affected co-evolutionary dynamics and suggests that these dynamics are associated with the nature of the receptor used by the viruses for infection.

When microbes join forces, useful new compounds emerge

In a paper in PLoS Computational Biology, SFI External Professor Elhanen Borenstein and co-authors show that when living together, communities of microbial species commonly produce novel, potentially useful compounds that single species growing alone do not. They begin to define the mechanisms and time signatures of such “emergent biosynthetic capacities” and present a computational framework for modeling, exploring, tracking, and predicting this phenomenon in simple two-species communities.

Weighing the pros and cons of fracking for oil and gas

In Physics Today, SFI External Professor John Rundle and co-authors review the practice of fracking – injecting large volumes of low-viscosity water into shale to extract oil and gas – and consider the pros and cons. Although the relatively new technique of superfracking has dramatically increased natural gas recovery, the authors note, it also raises significant technical and environmental concerns.

Modern forests shaped by extinction event

In PLDS, SFI External Professor Brian Enquist and colleagues suggest that the asteroid that probably spelled extinction for the dinosaurs could be responsible for modern forest landscapes favoring deciduous trees over evergreens. The team analyzed more than 1,000 fossilized plant leaves and classified their survival strategies. They found that slow-growing plants such as evergreens prevailed before the extinction event, while fast-growing, fast-flowering deciduous plants displaced them after the collision.

What influenced the prevalence of violence in ancient societies?

In a July 2014 paper in American Antiquity, SFI External Professor Tim Kohler and co-authors plot eight centuries of violence in two pre-Hispanic societies in the American Southwest, finding that violence generally declined (even as population increased markedly) in one region, and that violence increased (as population increased and maize production fluctuated) in another region. Scott Ortman, a former SFI Omidyar Fellow, is a study co-author.

Culture influences strategy in online coordination game

People strategize better with those from their own culture and they are poor at predicting the behavior of those from different cultures, suggests a new study led by SFI External Professor Matthew O. Jackson and published in PNAS. Subjects in India and the United States using an online strategy game had fundamentally different strategies and different expectations of the other players, the study found.
Under our feet, bacteria influence the microstructure of soil, tipping advantage toward their offspring. Beneath the waves, a coral reef's story adds life to architecture for other species to call home. On the human side, recent studies suggest that a pregnant woman's food choices can affect her child's food preferences. The child's consequent ecological niche (in terms of diet) triggers gene regulation, ultimately creating epigenetic effects.

Niche construction, in both ecology and culture, is the focus of a growing number of recent research and theoretical developments, according to SFI External Professor Marcus Feldman. “Fifteen years ago there were not many papers,” he says. “Now there are hundreds, and [niche construction] is poised to explode as a subfield within ecology. It’s a very good time for us to stand back and look at the whole field and how it’s been going over the last few years.”

To explore the current landscape, Feldman, Kevin Laland, Lucy Odling-Smee, and Doug Ervin are convening a workshop, “Frontiers in Niche Construction: From Theory to Application in the Biological and Social Sciences,” at SFI November 10-12. The meeting involves some two-dozen researchers whose fields relate to, or are impacted by, the biological sciences.

Evolutionary theory’s modern synthesis will be among the topics of discussion. It was developed in the middle of last century, says Feldman, before we knew about epigenetics, microbiology, or developmental biology – and pertinent mathematical theory was in its early days – which raises the question of how to fold these new and complex fields into the synthesis, and whether it’s worth doing, he says. Another question is whether the field “is sufficiently complex that it could serve the purpose of a program at SFI,” he says. “We’ll discuss it with resident faculty and postdocs at SFI to see whether it tickles their fancy enough to make it a regular thing.”

For the last decade she has worked as a correspondent, editor, and producer for the world’s largest Spanish-language news organization, EFE, covering climate change, energy, biodiversity, and sustainable development. She plans to spend May 2015 at SFI.

Catalina Arevalo is a Madrid, Spain-based science writer and multimedia communicator. For the last decade she has worked as a correspondent, editor, and producer for the world’s largest Spanish-language news organization, EFE, covering climate change, energy, biodiversity, and sustainable development. She plans to spend January and June 2015 at SFI.

Christie Aschwanden is a science journalist whose work has appeared in Smithsonian, Popular Science, New Scientist, Discover, Science, and NPR.org. She writes a health column for the Washington Post and is a frequent contributor to the New York Times. She plans to spend May 2015 at SFI.

Rhitu ChATTERjee has worked as a public radio and science journalist for nearly a decade. She currently lives in New Delhi. You can hear her stories on PRI’s “The World” and NPR’s “All Things Considered” and “Morning Edition.” She plans to spend April and May 2015 at SFI.

New online forum connects SFI alumni

For the first time, alumni of SFI’s postdoctoral programs, summer schools, and graduate and undergraduate programs have an online forum for keeping up with fellow alums and maintaining their involvement with the Institute.

SFI’s new Alumni Community website was launched in October 2014. The new forum features an alumni map, notable alumni profiles, job opportunities in complex systems, SFI news, and upcoming SFI events. Most important, it allows users to find other alums and form complexity-focused collaborative research or social groups.

“Our former students and fellows are an enduring part of the Institute’s community,” says Ginger Richardson, McKinnon Family Vice President for Education and Outreach. “They make continuing contributions to our research, serve as ambassadors for the Institute, and often help teach and lead future programs. Our new site enables alums to engage more deeply with SFI and with each other.”

The forum’s goal, says its coordinator Hilary Skolnik, is “to help our alumni stay involved with, and informed about, SFI news, and upcoming SFI events. Most importantly, it is critically important to compare theory and real world data. This framework makes it easier to build unified theories of ecology. “We now want to get back to the ‘integration’ part of the equation,” Dunne says.

A variety of efficient theories, such as metabolic scaling, neutral theory, and MaxEnt, address and predict overlapping ecological questions using various approaches. “The synthesis of these diverse lines of research, as well as other lines of inquiry pushing toward theory status, like work on ecological networks, hold the promise of a more general theory that can address a broader range of ecological questions and phenomena,” she says.

Marquet, Dunne, and colleagues have already planned two more meetings, one at SFI in 2015 or 2016, with a third to follow in Prague.

McKinnon Family’s $2.5M gift supports SFI’s Education programs

The McKinnon family in September made a generous gift of $2.5 million to support SFI’s Education & Outreach programs. The gift creates a permanently endowed fund to continue and expand SFI-sponsored educational activities and their administration. These programs include a variety of summer schools, internships, memberships, and online courses and resources that provide complexity training and engagement for students of all ages and stages of education.

With this gift we can bring our wide-ranging expertise to thousands of complexity enthusiasts and learners in New Mexico and beyond,” says SFI President Jerry Sabloff. “We are extremely grateful to the McKinnons for their confidence in and support for our science and education programs.”

“We are honored to partner with you in helping to take SFI to the next level,” says Ian McKinnon, an SFI Trustee and longtime Institute supporter.

In recognition of the gift, SFI has renamed the position of Vice President for Education and Outreach the “McKinnon Family Vice President for Education and Outreach.”

The gift is among the largest in the Institute’s history from a private donor.

Murray Gell-Mann accepts Germany’s prestigious Helmholtz Medal

In a special ceremony September 25 at the Institute, SFI Distinguished Fellow Murray Gell-Mann received Germany’s prestigious Helmholtz Medal for his achievements in physics and the sciences. The Medal is the highest honor of the Berlin Brandenburg Academy of Sciences and Humanities. The ceremony featured an introduction and welcome from SFI President Jerry Sabloff, followed by words of recognition from Gell-Mann’s SFI colleagues Jim Hartle and Geoffrey West. Here, Gell-Mann thanks friends, colleagues, and the Academy in a brief acceptance speech.
UPDATE

SFI Community Lecture, Wednesday, November 12, 7:30 p.m., James A. Little Theater (1060 Cerrillos Road) – Why we kill: The four stages by which almost any human being can be socialized into someone who will assault, rape, or murder. They looks at the history of violence, question the association of culture, genetics, and low self-esteem are often cited, but growing evidence points to brutalization experienced in childhood, often at the hands of parents or peers. Ginger Rhodes and Richard Rhodes explore the work of criminologist Lonnie Athens, whose “violentization” model identifies a four-stage process by which almost any human being can be socialized into someone who will assault, rape, or murder. They look at the history of violence, question the association of violence with mental illness, test Athens’ theory on real-life cases, and make a strong argument for early intervention. Richard Rhodes is the author of 25 books including The Making of the Atomic Bomb, which won a Pulitzer Prize in nonfiction. Ginger Rhodes is a licensed clinical psychologist in private practice in San Francisco specializing in trauma treatment. The two co-edited the 1996 book Trying To Get Some Dignity: Stories of Triumph Over Childhood Abuse.

SFI’s 2014 Community Lectures are made possible through the generous support of Thornburg Investment Management. Lectures are free and open to the public, but seating is limited. To watch a lecture as it happens, visit SFI’s YouTube page; participate in the discussion live on Twitter at #sfi_live.

Science On Screen, Tuesday, November 25, 7:00 p.m., CCA (1050 Old Pecos Trail) – “Alien” with Eric Libby. “In space, no one can hear you scream.” Ridley Scott’s unbeat- able 1979 sci-fi horror classic follows a spacecrafter invaded by a malignant creature bent on relentless parasitic reproduction. SFI Omidyar Postdoctoral Fellow Eric Libby, a biologist with a wicked wit and a fascination with how cells mutate and evolve into new organisms, delivers a wicked wit and a fascination with how cells mutate and evolve into new organisms, delivers the context.

Science On Screen, Wednesday, December 17, 7:00 p.m., CCA (1050 Old Pecos Trail) – Eternal Sunshine of the Spotless Mind with Chris Wood. The Making of the Atomic Bomb, which won a Pulitzer Prize in nonfiction. Ginger Rhodes is a licensed clinical psychologist in private practice in San Francisco specializing in trauma treatment. The two co-edited the 1996 book Trying To Get Some Dignity: Stories of Triumph Over Childhood Abuse.

Science On Screen, Tuesday, November 25, 7:30 p.m., James A. Little Theater (1060 Cerrillos Road) – Why we kill: Violence as socialization. Acts of serious violence – often committed by seemingly average people – leave us only to ask “why?” Culture, genetics, and low self-esteem are often cited, but growing evidence points to brutalization experienced in childhood, often at the hands of parents or peers. Ginger Rhodes and Richard Rhodes explore the work of criminologist Lonnie Athens, whose “violentization” model identifies a four-stage process by which almost any human being can be socialized into someone who will assault, rape, or murder. They look at the history of violence, question the association of violence with mental illness, test Athens’ theory on real-life cases, and make a strong argument for early intervention. Richard Rhodes is the author of 25 books including The Making of the Atomic Bomb, which won a Pulitzer Prize in nonfiction. Ginger Rhodes is a licensed clinical psychologist in private practice in San Francisco specializing in trauma treatment. The two co-edited the 1996 book Trying To Get Some Dignity: Stories of Triumph Over Childhood Abuse.

The end of the year is the perfect time to ask ourselves a critical question: Have I done all I can to support the causes I care about, set an example for others, and maybe even make a difference in the world? If the answer is “no,” consider the value of your contributions to SFI. Whether you’re passionate about SFI’s spirit of inquiry, fascinated by one of SFI’s Big Questions, or determined to build a legacy that benefits future generations, SFI offers you many opportunities to make a difference.

New Science. New Horizons. SFI’s 30th anniversary campaign, has raised more than $25 million toward our $30 million goal. Contributing now allows you to optimize your tax position this year while helping SFI build for the future. Make the most of your year-end charitable giving goals by donating cash or securities to any of these funds:

• President’s Circle Membership: $1,000 per year – Annual giving club with special programming for members.
• Education Scholarships: $1,500 will fully fund a deserving, young complexity scholar for 2015.
• The Murray Gell-Mann Fund: A special fund honoring Dr. Gell-Mann. The Fund supports the full breadth of SFI science to ensure that Gell-Mann’s work – and that of the Institute he helped build – continues for future generations.

Nancy Deutsch, Vice President for Advancement

Best regards,


YEAR-END GIVING

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New Science. New Horizons. SFI’s 30th anniversary campaign, has raised more than $25 million toward our $30 million goal. Contributing now allows you to optimize your tax position this year while helping SFI build for the future. Make the most of your year-end charitable giving goals by donating cash or securities to any of these funds:

• President’s Circle Membership: $1,000 per year – Annual giving club with special programming for members.
• The Murray Gell-Mann Fund: A special fund honoring Dr. Gell-Mann. The Fund supports the full breadth of SFI science to ensure that Gell-Mann’s work – and that of the Institute he helped build – continues for future generations.
• Education Scholarships: $1,500 will fully fund a deserving, young complexity scholar for 2015.

Nancy Deutsch, Vice President for Advancement

Best regards,

The end of the year is the perfect time to ask

ourselves a critical question: Have I done all I
can to support the causes I care about, set an
e xample for others, and maybe even make

a difference in the world? If the answer is "no,"
c onsider the value of your contributions to

SFI. Whether you’re passionate about SFI’s

spirit of inquiry, fascinated by one of SFI’s

Big Questions, or determined to build a legacy

that benefits future generations, SFI offers you

many opportunities to make a difference.

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