The history of life on Earth has often been likened to a four-billion-year-old torch relay. One flame, lit at the beginning of the chain, continues to pass on life in the same form all the way down. But what if life is better understood on the analogy of the eye, a convergent organ that evolved from independent origins? What if life evolved not just once, but multiple times independently?

In a new paper, published in the Journal of Molecular Evolution, SFI researchers Chris Kempes and David Krakauer argue that in order to recognize life’s full range of forms, we must develop a new theoretical frame. In their three-layered frame, Kempes and Krakauer call for researchers to consider, first, the full space of materials in which life could be possible; second, the constraints that limit the universe of possible life; and, third, the optimization processes that drive adaptation. In general, the framework considers life as adaptive information and adopts the analogy of computation to capture the processes central to life.

Several significant possibilities emerge when we consider life within the new framework. First, life originates multiple times — some apparent adaptations are actually “a new form of life, not just an adaptation,” explains Krakauer — and it takes a far broader range of forms than conventional definitions allow. Culture, computation, and forests are all forms of life in this frame. As Kempes explains, “human culture lives on the material of minds, much like multicellular organisms live on the material of single-celled organisms.” When researchers focus on the life traits of single organisms, they often neglect the extent to which organisms’ lives depend upon entire ecosystems as their fundamental material, and also ignore the ways that a life system may be more or less living. Within the new framework, by contrast, another implication appears. Life becomes a continuum rather than a binary phenomenon. In this vein, the authors point to a variety of recent efforts that quantitatively place life on a spectrum.

By taking a broader view of life’s principles, Kempes and Krakauer hope to generate more fertile theories for studying life. With clearer principles for finding life forms, and a new range of possible life forms that emerges from new principles, we’ll not only clarify what life is, but also better equipped to build devices to find life; to create it in labs, and to recognize to what degree the life we see is living.

Virtual workshop takes a hard think about thinking

Brains are a lot like computers. Both transmit information, transform information (i.e., “solve problems”), store memories, and use circuits that require energy to achieve their functions. Unfortunately, unlike your desktop computer, we don’t have detailed schematics for the brain, and its “algorithms” — the step-by-step logical processes underlying its large scale functions — are largely a black box. Simply put, we don’t know how the brain computes.

In July, “Dynamics of the Off Equilibrium Brain,” a virtual workshop led by SFI Professor David Wolpert and University of Pennsylvania Professor Vijay Balasubramanian, began to investigate new ways of understanding how the brain computes using newly developed ideas in thermodynamics and information theory.

Why thermodynamics and information theory? Brains must process tremendous amounts of information and do so while consuming resources like energy efficiently. “Your brain is amazingly more thermodynamically efficient than computers,” Wolpert says. Unlocking the relationship between energy and information in the brain could help researchers figure out how computation actually works. In particular, the workshop focused on the fact that the brain is not a static system, as classical theoretical frameworks often assume. Instead, it is an inherently dynamic system.

The workshop was held over two weeks with a daily talk and freeform discussions by Zoom. Attendees and speakers logged in from around the world to spend about three and a half hours each day talking about brains. Participants had backgrounds in neuroscience and physics, and spanned many career stages — their ages ranged from 18 to 80. Participants presented some new research, but dedicated much of their time to figuring out how to even formulate questions for future inquiry.

“Normal workshops and conferences just don’t fit the bill — you come and report stuff you’ve presented some new research, but dedicated much of their time to figuring out how to even formulate questions for future inquiry.”

The fix is in for archeology’s ‘dating problem’

Archaeologists have long had a dating problem. The radiocarbon analysis typically used to reconstruct past human demographic changes relies on a method easily skewed by radiocarbon calibration curves and measurement uncertainty. And there’s never been a statistical fix that works — until now.

“Nobody has systematically explored the problem, or shown how you can statistically deal with it,” says SFI Applied Complexity Fellow Michael Price, lead author on a paper in the Journal of Archaeological Science about a new method he developed for summarizing sets of radiocarbon dates. “It’s really exciting how this work came together. We identified a fundamental problem and fixed it.”

In recent decades, archaeologists have increasingly relied on sets of radiocarbon dates to reconstruct past population size through an approach called “dates as data.” The core assumption is that the number of radiocarbon samples from a given period is proportional to the region’s population size at that time. Archaeologists have traditionally used “summed probability densities,” or SPDs, to summarize these sets of radiocarbon dates.

“But there are a lot of inherent issues with SPDs,” says Julie Hoggarth, Baylor University archaeologist and a co-author on the paper. Radiocarbon dating measures the decay of carbon-14 in organic matter. But the amount of carbon-14 in the atmosphere fluctuates through time; it’s not a constant baseline. So researchers create radiocarbon calibration curves that map the carbon-14 values to dates. Yet a single carbon-14 value can correspond to different dates — a problem known as “equivariance,” which can naturally bias the SPD curves. “That’s been a major issue,” and a hurdle for demographic analyses, says Hoggarth. “How do you know that the change you’re looking at is an actual change in population size, and it isn’t a change in the shape of the calibration curve?”

FALL 2021

The newsletter of the Santa Fe Institute

What if life is better understood on the analogy of the eye, a convergent organ that evolved from independent origins? (Image: CGAxis/Depositphotos)
The period of the late eighteenth century to the mid-nineteenth century from Marx in the mid-nineteenth century from distinguishing these types of fact... articulated a positive, or anti-narrative — a sequence of limited and dominant cause/effect relations required to explain the simple facts, and the best historian, one “capable of standing the artificial supports, the stupendous fabric yielded to the pressure of its own weight.”

In 1992 Francis Fukuyama wrote a long book... that Fukuyama had foreseen was disrupted by the unbroken desire for recognition. So, the authors factored in an adjustment for... its current framework on complexity, which many scientists... that maps the tragic impact of the exchange of ideas and interactions. Using data from municipal areas across the world, civilization is undergoing rapid urbanization. More than half the world’s humans currently live in urban settings, and in the coming decade, researchers predict the number of megacities — those with 10 million or more — will quadruple. “There is an urgent need for a quantitative and predictive approaches to studying political polarization. It was written by Mitch Waldrop, the author of the book “Complexity.”

As cities grow in size, the ‘rich get richer and the poor get poorer’

Cities are hubs of human activity, supercharging the exchange of ideas and interactions. Scaling theory has established that, as cities grow larger, they produce more... and their mobility. According to the theory, the richest of all society’s strata — the top decile income earners — gain a per-capita increase in wealth as cities grow. But we know from otherliterature, especially in economics, that many societies... said... lives... housing prices. With that adjustment, their research that says, that’s not necessarily true... or what’s going on... through cities... Biography. The book makes the point again and again that... a comprehensive guide to the properties of urban areas, from diversity, economic productivity and infrastructure to geography, growth, and institutions, and how they’re connected. Bettencourt says he hopes anyone who studies cities or teaches urban science will find this book, which draws on decades of research and a course he teaches at the University of Chicago, useful. It provides readers with a solid understanding of the classical models of cities and complex networks before delving into key features of urban areas, from diversity, economic productivity and infrastructure to geography, growth, and institutions, and how they’re connected. Bettencourt says the book makes the point again and again that cities are not just the things you see when you look out the window, Bettencourt says. “Cities are people in action, change, network...
The neuroscientist Stuart Firestein can’t point to a single moment when his quest to understand science’s long history and uncertain future began, but the fall of 2008 is as good a place to start as any. At the time, Firestein, a Columbia University neuroscientist with a Brooklynite’s love of colorful language, was facing a crisis of scientific confidence. He was on stage in an auditorium, teaching “Intro to the Brain” to 200 glazed-eye undergraduates. “Essentially asking them to memorize a 1,414-page, seven-pound textbook,” recalls Firestein, laughing at the ridiculousness of the idea. “We don’t practice science deterministically, but we sure as hell teach it that way.” That disconnect, Firestein realized, goes a long way toward explaining why in America climate change is doubted and vaccine hesitancy reigns. The public has lost faith in science. “We’re facing a crisis,” Firestein says. People distrust the very thing modern society is built upon.

Firestein is an esteemed neuroscientist who specializes in the olfactory system, why and how our brains and noses sense smell. But it’s his obsession with the history, evolution, and future of science that brought him to SFI as its newest fractal faculty member. He has already authored two popular books, “Ignorance” and “Failure,” that cast science as an unending quest to illuminate ignorance and failure as an essential component in that process. He’s now begun a third book he plans to call “Optimism.” In it, Firestein will make the case that modern society’s optimism, oversimplified as the sense that our future will be brighter than our present, is a dire product of the scientific process.

“Science helps us act on the belief that ‘it could be otherwise,’” he says, invoking that old phrase to sum up his book’s thesis. But he also wants “Optimism” to sound an alarm. Science is precarious. Unless scientists get better at communicating with the public, it could one day stop marching humanity toward a better version of itself.

When considering how science arrived at this precarious moment, Firestein takes the long view. He starts in the 1600s with the likes of Copernicus, Galileo, Kepler, and the first scientific revolution. Before science, each generation lived essentially the same life as the generation before. Change was so slow as to be imperceptible. After this cognitive revolution, change became palpable and the idea of change accepted as normal. But powerful as this engine of progress was, Firestein notes that it developed into a kind of creeping determinism, a dogmatic certainty about how the world is governed. Science’s optimism suffered as determinism eliminates possibility. It closes the world. Science was in danger of losing its optimism.

This changed when Darwin’s “On the Origin of Species,” appeared in 1859. “That was the most revolutionary idea since Copernicus,” Firestein says. “Darwin showed us that life is nondeterministic—it’s random at its base yet also predictable.” In Firestein’s view, Darwin’s ideas changed the very essence of the questions that science sought to answer. Instead of extracting immutable laws from nature, trying to fit our understanding into a clockwork universe, science had to embrace uncertainty and randomness as fundamental forces. It had to embrace the very idea that the parts of the universe are unknowable. Firestein thinks of this seismic and ongoing shift as the second scientific revolution. Among its discoveries he counts Ludwig Boltzmann’s statistical approach to the second law of thermodynamics, Quantum mechanics, and nuclear energy (and yes, the bomb). Plate tectonics. iPhones. Climate models and mRNAs vaccines. But for all the whirlpool progress that the second scientific revolution has delivered, it is critically and maybe even suicidally flawed. “The early scientists of the late Renaissance and Enlightenment—Galileo, Hooke, Voltaire—wrote in common vernacular or had their works translated into vernacular languages. Voltaire, for example, translated Newton into French making his revolutionary work available to a wider public,” Firestein says. Egalitarianism was chief among science’s appeals. Post-Darwin, science became more niche and its vernacular so hyper-specific that a Ph.D. in one field can no longer comprehend a Ph.D. in another. One result of this trend is that scientists talk publicly about their work deterministically. Why? It’s easier. But it’s dangerous. “We have left the public far behind,” Firestein says. “People now think that unsettled science is unmoved science when exactly the opposite is true.”

After finishing his “Intro to the Brain” course back in 2008, Firestein launched a sort of rebellion against determinism. He started a new course where he invited top scientists to speak about the questions that animated their work. The idea was weirdly profound: a class about what nobody knew. Firestein realized it was the first time he was teaching science as a process rather than an outcome that could be labeled right or wrong. Twelve years later, he’s still teaching the course but the stakes now feel higher. 21st century, and much of the world, been more hostile to science. And never has it been so important for science, an institution that helped make the world modern, to bring its optimism back to that world.

So what can be done? That’s the question Firestein is coming to SFI to answer. While here, he wants to understand how optimism figures in the working process of scientists working on complexity and uncertainty. And he is interested in hearing their ideas about how their work can be better communicated to the public. “Our forebears did it. ‘We owe it to future scientists and ourselves to do it too,’” he says. Put another way, Firestein wants science to be talked about in common vernacular. Because, in this scary moment, he believes that it could be otherwise.

In the Summer 2021 issue of Parallax, we introduced Frances Mittelstadt and Callum McManus, the first two “fractal” members of SFI’s faculty. Now, we welcome Stuart Firestein as our third.
New tutorial teaches open science

The best possible science is science that is open, reproducible, replicable, transparent, and inclusive,” says Open Science advocate and SFI Complexity Postdoctoral Fellow Helenscausal

To that end, Miton’s course outlines a “buffet” approach throughout the research cycle, from preregistering research questions to publishing final results. Miton hopes her course will be useful as a teaching tool to educate the next generation of scientists about the applications and advantages of Open Science.

At that moment, Miton’s course outlines a “buffet” of techniques — including open methods, open code, open materials and data, preprints, and open access. I constructed the course with the goal of providing one entry to the whole spectrum of practices in the same place, rather than in a piecemeal fashion, which is how I had to learn them, she says. After watching the videos, you will have a good foundation in the different Open Science methods and resources for learning how to apply them.

Miton sees Open Science as one of many ways to improve science, and she applies the principles in her own work. A lot of people agree on Open Science in theory but are reluctant to put it into practice because they believe it requires extra effort. As a researcher, I find that Open Science approaches have many advantages and provide a different way to organize my workflow that isn’t any costlier. These approaches give structure and robustness to my research process.

In addition to enhancing her own research, Miton appreciates the collective benefits of Open Science. Open Science contributes to diversity in science, in part, she says, by shifting away from traditional economic incentives, like the power of publishers, and rethinking how researchers are evaluated. The goal is to make sure that scientific knowledge is accessible to all.

The course on ComplexityExplorer.org is free and open to all.

RADIOCARBON DATING (cont. from page 3)

When she discussed the problem with Price several years ago, he told her he wasn’t a fan of SPDs, either. She asked what archæologists should do instead. “I basically said, ‘Well, there is no alternative.’” That realization led to a years-long quest. Price has developed an approach to estimating prehistoric populations that uses Bayesian reasoning and a flexible probability model that allows researchers to overcome the problem of equifinality. The approach also allows them to combine additional archaeological information with radiocarbon analyses to get a more accurate population estimate. He and his team applied the approach to existing radiocarbon dates from the Maya city of Tikal, which has extensive prior archaeological research. “It serves as a gold standard, a benchmark case,” he says, “for any Mayan scholar. For a long time, archaeologists debated two demographic reconstructions: Tikal’s population spiked in the Early Classic period and then plateaued, or it spiked in the Late Classic period. When the team applied the new Bayesian algorithm, it showed that a really steep population increase associated with the Late Classic, she says, “so that was really wonderful confirmation for us.”

The authors produced an open-source package that implements the new approach, and websites and links are included in their paper. “The reason I’m excited for this,” Price says.

A new model for group decision-making shows how ‘followers’ influence outcomes

From small committees to national elections, group decision-making can be complicated and it may not always settle on the best choice. That’s partly because some members of the group do not research on their own, and others take their cues from the people around them. That distinction is readily observed around election time. “Many voters couldn’t tell you the policy platforms for the candidates they were voting for,” says Vicky Chuqian Yang, an SFI Omidyar Fellow and Peters-Hurst Scholar. “Many individu- als are uninformed, and you’re most likely to rely on information they get from others.”

Social scientists have long sought ways to study the phenomenon of group decision-making, but until recently, understanding the influences of diverse disciplines has tried to tackle the problem, with parallel efforts often leading to conflicting conclusions. Most existing models examine the effect of a single variable, which means they don’t capture the whole picture.

“The outcome of collective decision making is the result of complex interactions of many vari- ables,” says Yang, “and those interactions are rarely taken into account” in previous work. To overcome that challenge, Yang recently led the development of a mathematical framework that allows the influence of multiple factors to be taken into account in the same time, she explains. Those effects include the influence of social learners. The model predicted, for example, that decision-making groups have a critical threshold of people who get their information from others. Below that threshold, the group chooses the

Radiocarbon dating is the process of determining the age of a specimen containing organic material by using the properties of radiocarbon, a radioactive isotope of carbon. It is based on the fact that every living organism contains a constant amount of carbon-14 in their tissues. When an organism dies, it stops incorporating carbon-14 into its tissues, and the amount of carbon-14 in its remains decreases at a predictable rate due to radioactive decay.

The age of an object can be calculated by comparing the amount of radioactive carbon-14 remaining in the object to the amount of carbon-14 in the atmosphere at the time of its death. This ratio is then used to calculate the age of the object.

The primary sources for radiocarbon dating are organic materials such as wood, charred bones, and human remains. The accuracy of radiocarbon dating depends on several factors, including the age of the specimen, the type of material, and the amount of carbon-14 remaining.

Therefore, radiocarbon dating is a valuable tool for historical and archaeological research, allowing scientists to determine the age of objects and artifacts and gain insights into the past.
Researchers look to human social sensors to better predict trends

Election outcomes are notoriously difficult to predict. In 2016, for example, most polls suggested that Hillary Clinton would win the presidency, but Donald Trump defeated her. Researchers cite multiple explanations for the unreliability in election forecasts—some voters are difficult to reach, and some may wish to remain hidden. Among those who do respond to surveys, some may change their minds after being polled, while others may be embarrassed or afraid to report their true intentions.

In a new perspective piece for Nature, in a special issue devoted to computational social science, SF researchers Werta Galesic, Jonas Dalege, Henrik Olsson, Daniel Stein, Tamara van der Does, and their collaborators propose a surprising way to get around these shortcomings in survey design—not just in the world of politics, but in other types of research as well. While it’s widely assumed that cognitive bias hinders our assessment of the people around us, their research and that of others suggests that, in fact, our estimations of what our friends and family believe are often accurate.

“We realized that if we ask a national sample of people about this claim is not limited to criminologists. As Stefani Crabtree

...MERRITT RUHLEN

In Memoriam

MERITT RUHLEN

Stanford linguist Merritt Ruhlen, a long-time Santa Fe Institute collaborator who authored the Evolution of Human Language project (EHL), passed away on January 29, 2021.

Ruhlen was well known for his work tracing lexical similarities across all the major language families of the world—so called “global etymologies.” Drawing on these similarities, he made the case that these language families can be traced back to a single “mother tongue” — a claim that built on the legacy of Ruhlen’s mentor, Joseph Greenberg, and other comparatist linguists before him.

In 2005, Ruhlen worked closely with SF co-founder Murray Gell-Mann and renowned linguist Sergi Starostin (George Starostin’s father) to co-found EHL, hosting its foundational meetings at SF. The project’s primary purpose is to trace the historical relationships between the world’s ~1,600 spoken languages, and to “organize[them] into a genealogical tree similar to the accepted classification of biological species,” according to the project website.

RICHARD LEWONTIN

Richard Lewontin, 92, a revolutionary geneticist, evolutionary biologist, and longtime member of the SFI Science Board, passed away in his home in Massachusetts on July 4, 2021.

Lewontin delivered a critical jolt of complexity to the field of population genetics. Through fieldwork, new laboratory techniques, computation, and statistical methods, his work pushed genetics past the simplistic assumption that all phenotypic variations are driven by isolated mutations on single genes.

Throughout his scientific career, Lewontin was an outspoken critic of popular accounts of racial differences, which he condemned as scientific racism. Instead, he believed that variation in human social development is the result of environmental forces. Lewontin was a key player in the naturalistic tradition of evolutionary biology that he helped to establish as a social science.

DOUGLAS WHITE

UC Irvine anthropologist Douglas White, a former SFI External Professor, passed away on August 32, 2021.

White was widely regarded for his research into human relationships, communities, and cultural roles as dynamic, complex networks. He was the co-author or editor of five books; founded and co-chaired the Social Networks Ph.D. at UC Irvine and chaired the Social Dynamics and Complexity research group, and was president of the Social Science Computing Association. Committed to making scientific research open and accessible, White founded two open-access e-journals: World Cultures in 1981, and Structure and Dynamics in 2005.

Using rigorous mathematical modeling to approach classic anthropological questions of human interactions—particularly regarding kinship, marriage, and divisions of labor—White helped advance the practice of network analysis in anthropology. In addition to his innovative approaches to human networks, White was admired for the spirit with which he approached his work and colleagues.

Read the full obituaries for Ruhlen, Lewontin, and White at www.santafe.edu/news.

CITIES (cont. from page 2)

theory for how larger urban areas affect a wide variety of city features, dynamics, and outcomes,” wrote the authors.

The questions in this study were initially raised by co-authors Cate Heine, Elisa Heinrich Mora, and Jacob J. Jackson, who together spanned two cohorts of Undergraduate Complexity Researchers at SFI.

According to Weer, the next step is to explore whether the urban phenomenon is primarily an urban phenomenon, arising from underlying social dynamics ‘that desperately need to be addressed’. He speculates that poorer city dwellers are missing out on the increased social interactions that are credited with driving innovation and creation in large metropolises.

“...What was a huge surprise in this research was that, as the city grows, there’s no advantage to people in the bottom 10-20th percentiles.”

“What was a huge surprise in this research was that, as the city grows, there’s no advantage to people in the bottom 10-20th percentiles.”

“When you go down the income deciles, the value-added for city-dwellers get less and less in a systematic way... so much so that, in the bottom decile you get nothing at all. There’s even evidence that you’re losing quality of life,” says West. “Here we found that rich are getting even richer than we thought and the poor are getting even poorer than we thought.”
ATLANTIS series traverses space, science, and art

Space has always been the place where the imagination reaches beyond the world as we know it. What happens when we stretch deep into space and set our imaginations adrift?

The Complex Systems Society will award a 2021 Junior Scientist Award to SFI External Professor Ori Pellag, an assistant professor within the University of Colorado’s Department of Computer Science and Bio-Robotics Institute. Pellag’s research aims to understanding how biological communication signals are generated and interpreted. Pellag uses insect swarms as a model system to identify how organisms harness the dynamics of communication signals.

Welcome to ATLANTIS, a new creative editorial series released by the Santa Fe Institute’s InterPlanetary Project, which sails through space and engages with the scientific and philosophical questions that emerge on the voyage. The series is co-created by science writer Natalie Elliot and SFI’s Caitlin McShea, who pose under the pseudonym “ATLANTIS” – a (fictional) space-faring ship named after the lost city, which was said to be drowned for its habits, and then rose again to champion the humane use of science,” the creators write.

ATLANTIS sets sail to explore the theories and technologies that drive the hunt for extraterrestrial life, the complex challenges of interplanetary recycling, and the ways that the narratives of space exploration are constructed — to name but a few subjects it traverses. Traveling with Shakespeare and David Bowie, to Mars’ Jezero Crater and Jupiter’s moons, the inquiring authors hoist the Jolly Roger of their imaginative ship, which reads, “If this be science, there is art in’t.” In other words, they show the many ways that the playful voice of art can sound in the most fascinating insights of science. New dispatches are released about every three weeks. The series is hosted on Aliencrashsite.org.

Virtual topical meeting takes stock of market risk and social media

In an age where it’s easier to get on social media than off of it, we still know shockingly little about how the scope, speed, and structure of online communication forums impacts beliefs about stock market investing.

This October, SFI partners with UBS to host a virtual topical meeting titled “Technology and Risk: Will Speedier and Deliberate Communication Bring Higher Levels of Risk?” Members of SFI’s Applied Complexity Network can continue a discussion that began in 2020 on “Beliefs, Narratives, and Market Structure,” now in year that’s seen a sensational “meme-stock” rally of GameStop (January 2021), a surge in uranium mining company shares (September 2021), and the preliminary outing of a major Amazon merger (August 2021), all fueled by online exchanges over social media.

Attendees will learn from three scientists researching belief dynamics, communication technology, and market risk. SFI Professor Mirta Galesic, an expert in the emerging field of belief dynamics, will discuss how her team is using quantitative and computational techniques to predict social trends. Filippo Menczer, a distinguished professor of informatics and computer science at Indiana University who develops tools for combating social media manipulation, will explore how community structure impacts the spread of ideas. Finally, Valentina Sernova, a doctoral mathematician working with SFI External Professor Doyne Farmer at the University of Oxford, will present her preliminary analysis of how social contagion, or “hype,” on Reddit’s WallStreetBets forum drives large fluctuations in stock trading. “Belief dynamics is one of the most exciting areas of research we’re developing at SFI right now,” says Will Tracy, SFI’s Vice President for Applied Complex Systems who is co-hosting the event with Juan-Luis Perez, the Global Head of Research at UBS. “Because meme stocks had such an outsized impact on market behavior this year, it seemed important to revisit last year’s topic, and continue this conversation.”

Following the presentations and Q&A sessions, the researchers will set for a panel discussion on the implications of technology-driven communication on asset valuation and risk.

The researchers will set for a panel discussion on the implications of technology-driven communication on asset valuation and risk.

A NEW TOOL FOR COMPARING RESEARCHERS

A new study co-authored by ASU-SFI Biosocial Complex Systems Fellow Stefani Crabtree, led by Corey Bradshaw at Flinders University, presents a tool to assess research performance more fairly than the pervasive H-index score, which is commonly used to make hiring decisions in academia. Called the Epsilon Index, named for the Greek letter used to symbolize residuals in statistics, the new metric takes into account the many differences in the research space to deliver a fairer comparison. The tool is freely available as a ready-made app — simply punch in a few data for a sample of researchers from open-source databases like Google Scholar, and it does the heavy lifting to produce the result, enabling comparison of researchers at any stage of their career and from any discipline on the same scale.

Read the paper at doi.org/10.15384/02.223741

STUDY SHOWS IMPACTS OF DEFORESTATION AND FOREST BURNING ON AMAZON BIODIVERSITY

A new study in Nature, co-authored by SFI External Professor Brian Enquist and others at the University of Arizona, provides the first quantitative assessment of how environmental policies on deforestation, along with forest fires and drought, have impacted the diversity of plants and animals in the Amazon.

Researchers created biodiversity maps of the Amazon region representing more than 14,500 plant and vertebrate species, then used observations of forest fires and deforestation from the last two to quantify the cumulative impacts on the region’s species. Since 2001, they found, up to 73,400 square miles of Amazon rainforest have been impacted by fires, affecting up to 14,800 Amazonian species, including many threatened species.

Read the paper at doi.org/10.1038/s41586-021-03876-7

GETTING IN SYNC ON A BUDGET

Synchronization is critical for the function of many distributed systems — whether it’s computers or power grids or neuronal populations — but doing it using the least amount of energy and resources possible can be a daunting task. In a paper published in Nature Communications in June 2021, SFI Postdoctoral Fellow Yuanhuan Zhang and former SFI External Professor Steve Strogatz report using temporal network models to show that allowing connection patterns to change over time makes it possible to synchronize a system more efficiently.

The researchers’ temporal network design is “open loop,” so it’s versatile and expected to work for a wide range of systems.

Read the paper at doi.org/10.1038/s41467-021-23446-9

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