CARL DETORRES

Ten people who mattered this year.

365 DAYS:
the year in science

RELATIVITY CHALLENGER

The shy experimentalist whose team claims to have found faster-than-light neutrinos is happy for the work to stand or fall.

BY NICOLA NOSENGO

DARIO AUTIERO

M. TREZZINI/EPA/CORBIS

Dario Autiero can hardly keep track of his e-mails any more: hundreds keep pouring in from the media and his fellow physicists across the globe. "But the real problem is science amateurs," says Autiero, who works at the Institute of Nuclear Physics in Lyons, France. "They send e-mail upon e-mail saying that they had predicted it all."

Autiero has been at the centre of this media storm, scientific scepticism and amateur theorizing since 23 September, when he and his colleagues at the international Oscillation Project with Emulsion-Tracking Apparatus (OPERA) experiment announced results that seemed to remove a cornerstone of modern physics. At a seminar at CERN, the particle-physics laboratory near Geneva, Switzerland, and in a paper posted on the arXiv.org website (http://lanl.arxiv.org/abs/1109.4897), the OPERA team described how neutrinos — fundamental particles with no electrical charge and very low mass — seemed to make the 730-kilometre journey from CERN to an underground laboratory at Gran Sasso in Italy some 60 nanoseconds faster than the speed of light would allow. If true, the result will challenge Albert Einstein's theory of special relativity and force theoretical physicists to rewrite their textbooks.

Autiero was caught off guard by the frenzy that ensued. "The media have a completely different timescale," says Autiero, a quiet, shy man who is clearly uncomfortable in the spotlight. "They want answers right away, whereas as a scientist I am used to spending years looking for them."

The experiment's day job is to study how the three known types of neutrino 'oscillate', or switch between different identities, as they travel between Geneva and Gran Sasso. But Autiero realized that it also offered a chance to measure the particles' speed with unprecedented precision. This would require complicated statistics to match the neutrinos detected in Italy to the proton collisions that generated them in Switzerland, as well as extreme accuracy in measuring the distance between the particles' points of departure and arrival. In March, the team thought it had finally solved these problems — but that left them facing a much bigger one.

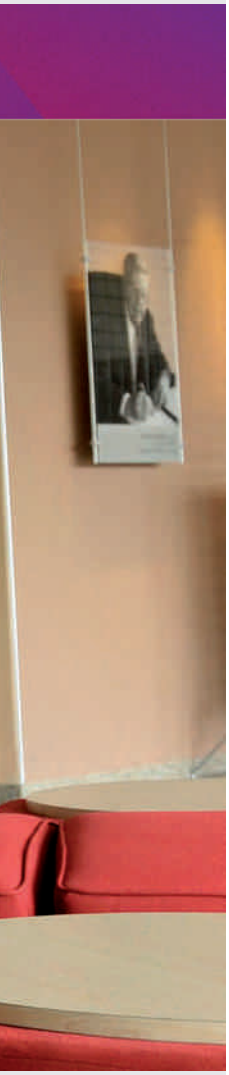
"When I first saw the data I was sure there was some mistake," Autiero recalls. The team spent the following months reanalysing the statistics, recalibrating the instruments and having them checked by independent institutes. The 60-nanosecond discrepancy refused to go away. "At that point, we had done all we could do with the data," Autiero says. "It was our duty to release them, so that others could look into them."

The experiment's advisory board felt the same. Still, a few OPERA members refused to sign the paper, and some scientists have criticized the team for telling reporters that the non-refereed preprint would be posted on arXiv.org. Astrophysicist Martin Rees of the University of Cambridge, UK, called the OPERA result an "embarrassment" and quoted the late astronomer Carl Sagan's remark that "extraordinary claims require extraordinary evidence".

But Autiero finds the criticism baffling. "If you think your experiment is done properly," he says, "you should treat unexpected results as you would treat expected ones." Even more puzzling to him was the flood of papers about the experiment posted on arXiv in the following weeks. Some of them "made valuable critiques and forced us to refine our work", he says. "But mostly they pointed at trivial problems we had solved months ago." A hardline experimentalist who admits to being "religious" when it comes to the scientific method, he felt offended by some of those papers.

Autiero thinks that the matter will be settled by the end of 2012. His team is repeating the experiment with a variation in how the neutrinos are generated at CERN, to rule out that process as a possible source of errors. On 17 November, the group released an updated arXiv preprint that included an analysis of 20 neutrinos from the repeated experiment, and simultaneously submitted the paper for publication in the *Journal of High Energy Physics*. This new version confirmed the initial result, and won back many of the collaborators who had refused to sign the initial paper.

But the true test, Autiero says, will come from two neutrino experiments that are attempting to replicate the results: the Main Injector Neutrino Oscillation Search, in which neutrinos fired from Fermilab near Chicago, Illinois, travel 720 kilometres to a detector in a mine in Minnesota; and T2K, which sends a beam from Tokai on the east coast of Japan to a detector in Kamioka, 300 kilometres to the north. Even if they prove the OPERA result wrong, Autiero says that he would not consider the experiment a failure. "Whatever happens, our most important contribution is not the result — it's the way we did the measuring," he insists. "We have refined a method others can now use, and this is what science is about." ■



PLANET SEEKER

In a year of exoplanet excitement, one astronomer is already asking what comes next.

BY ERIC HAND

Hundreds of years from now, says Sara Seager, "people will look back at us, and they won't remember me or you. They'll remember us as the generation of people who first found the Earth-like worlds" outside our Solar System.

This year, scientists have come tantalizingly close, says Seager, an astronomer at the Massachusetts Institute of Technology (MIT) in Cambridge. NASA's Kepler space telescope, which monitors thousands of stars for dimming caused by an orbiting planet, has found 28 confirmed exoplanets this year, including one that is slightly bigger than Earth and in its star's habitable zone. More than 2,000 await verification.

But Seager, a member of the Kepler science team, wants to do better. Kepler can reveal a planet's size and orbital radius, she explains. But to find out whether such a planet is Earth-like — with free oxygen or other signs of biological activity in its atmosphere — astronomers need a spectrum of the parent star's light reflected from or transmitted through the atmosphere. Because the stars in Kepler's field of view are up to 920 parsecs (3,000 light years) away, they are too dim for that.

Seager wants to search for Earth-like planets no more than 30 parsecs away, close enough that their atmospheres could be studied. Her tool would be a $10 \times 10 \times 30$-centimetre space telescope designed to watch a single star for a planetary transit. Such an 'ExoplanetSat' would not be able to analyse spectra by itself. For that, Seager will need an orbiting telescope such as the Terrestrial Planet Finder, an ambitious concept that NASA put on ice in 2006. But a fleet of ExoplanetSats could provide a resurrected planet finder with a map of where to look. Each ExoplanetSat would cost less than US$1 million. Rather than a telescope mirror, it would rely on a modified, $1,300 commercial lens. And dozens could be launched very cheaply, piggybacking on rockets carrying other missions.

"I'm trying to do new things," says Seager, who is teaching herself the necessary engineering and is aiming for a 2013 launch. Her group has received roughly $3 million in funding from MIT, Draper Laboratory in Cambridge and elsewhere.

Geoff Marcy, an astronomer at the University of California, Berkeley, and one of the first exoplanet seekers, lauds Seager's creativity in unfamiliar fields. "There are thousands of scientists working on exoplanets," he says. "She's looking for something different." ■

J. KNIGHT

SARA SEAGER

C. DHARAPAK/AP

POLLUTION COP

The top US environment official has faced relentless attacks on the country's pollution regulations.

BY JEFF TOLLEFSON

Lisa Jackson knew from the start of 2011 that she would face a rough year as head of the US Environmental Protection Agency (EPA). Republican conservatives had just swept the board at the 2010 congressional elections, and they took over the House of Representatives vowing to handcuff the EPA, which they viewed as a prime example of big government run amok. One hostile lawmaker advised Jackson to get her own parking space on Capitol Hill because Congress would be calling her in regularly to defend her agency and the environmental agenda of President Barack Obama. Jackson has testified before Congress 11 times this year.

The Republican hostility has its roots in one of Jackson's first major decisions after taking the helm of the EPA in 2009. A chemical engineer turned public servant, Jackson issued a scientific assessment formally declaring that greenhouse gases pose a threat to human health and welfare. That ruling set the stage for the EPA to regulate greenhouse-gas emissions under the Clean Air Act, and Jackson immediately went to work. Looking back, she says the ruling represents a long-awaited triumph of science after years of delay and obfuscation about climate research under the previous administration. "Restoring that science I hope will be among the hallmarks of the Obama EPA," she says.

The ruling has led to a series of decisions that have provoked

SCIENCE REVOLUTIONARY

An engineer was catapulted from Tahrir Square to Egypt's parliament and fought to rebuild science.

BY MOHAMMED YAHIA

As academics joined the millions protesting in Egypt's streets this spring, the voice of one engineer soon began leading chants. Essam Sharaf was in the thick of demonstrations in January, and he became the first prime minister of a post-revolution cabinet in March — promoting science as a solution to the country's woes. But by November, he had resigned amid a second surge of popular protest.

The 59-year-old Sharaf was born in Egypt and earned degrees in engineering from Cairo University and Purdue University in West Lafayette, Indiana. By 2010, he was an academic engineer at Cairo University and a fierce critic of Egyptian President Hosni Mubarak's regime.

Sharaf's stance during the uprising made him popular with the young revolutionaries. He was high on their list of candidates to lead the new transition government, along with Nobel laureate Ahmed Zewail, a chemist from the California Institute of Technology in Pasadena. When Sharaf was chosen, hundreds of thousands of revolutionaries gathered to greet him in Tahrir Square. "If I can't bring the change you want, then I will return to the lines with you," he told them.

Once in office, Sharaf said that science could solve many of Egypt's dire developmental problems, ranging from water security to energy. His cabinet began drafting plans to improve the education system and, in June, he approved a long-standing proposal by Zewail to build a university of basic and applied research. "Countries do not move forward except with scientific research," said Sharaf at the launch of the project, to be called the Zewail City for Science and Technology. "Without question, he has been a visionary engineer," says Kumares Sinha, a professor of civil engineering at Purdue University who once supervised Sharaf. "Over the years he has been a strong advocate for science and engineering in the Arab world as a way to advance and reform the society."

But that success in advocating for science did not carry over to politics. Critics accused Sharaf's cabinet of weakness, believing that all real power lay in the hands of the military junta. When this discontent erupted into violent protests in November, Sharaf and his cabinet resigned. Elections took place in November for a new parliament, which should be in place early next year, and a presidential election will be held in June. For now, the future of science in Egypt is as uncertain as that of the reinvented country itself. ■

Republican ire. The Obama administration has worked with automobile makers over the past three years to establish fuel-efficiency and greenhouse-gas-emissions standards, the president's signature environmental achievement thus far. The EPA has also begun rolling out requirements for major industrial facilities and, despite delays, is preparing to issue the first-ever greenhouse-gas standard for US power plants and refineries.

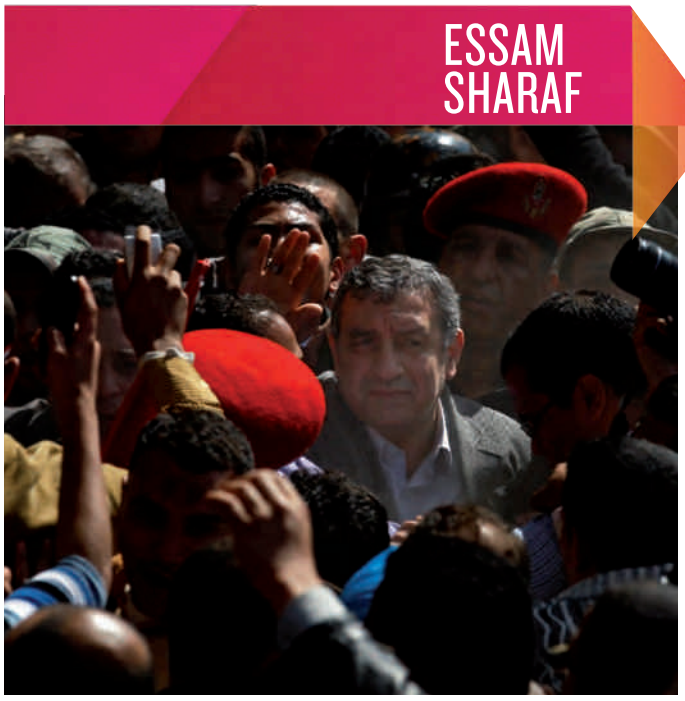
Jackson's EPA has also targeted smog-forming pollutants as well as mercury and other toxic chemicals from industrial facilities and power plants. In October, the agency announced plans to regulate the waste water generated by shale-gas development, which involves injecting water and chemicals at high pressure into gas-bearing rocks, an activity that many fear could pollute groundwater resources.

The Republican Congress has fought these efforts, arguing that pollution regulations cost jobs and resources at a time when the country is short of both. As of November, by Jackson's count, Republicans had brought more than 170 attacks on basic environmental protections up for vote this year, although none of their efforts to weaken existing regulations was successful.

Even Jackson's critics acknowledge that she holds up well under fire and has succeeded in pushing through some significant environmental regulations. "She's been very effective," says Jeff Holmstead, an attorney at Bracewell and Giuliani in Washington DC, who headed the EPA's air-quality programme under former president George W. Bush.

Environmentalists, however, were hoping for much more from the Obama administration. Already angry about the slow pace of greenhouse-gas regulations, they were incensed when Obama overruled Jackson and quashed the EPA's proposed standards for ozone pollution. But most realize that an EPA chief has limited power, says Frank O'Donnell, who heads the advocacy group Clean Air Watch in Washington DC. He adds, "Jackson herself has done as strong a job as anybody possibly could under the circumstances". ■

K. HAMRA/AP



J. BUUS/PERSBUREAU VAN EIJNDHOVEN

FALLEN STAR

A psychologist's spectacular fraud became an example in open investigation.

BY EWEN CALLAWAY

Dutch social psychologist Diederik Stapel had been called one of the 'bright thrusting young stars' of the field before his career imploded this autumn over fraudulent research. In prominent studies that explored prejudices and stereotypes, Stapel didn't just fudge data, he fabricated entire experiments — seemingly for much of his career, according to a preliminary report issued on 31 October by the three university committees investigating his work. They are still sifting through data from approximately 150 published papers to catalogue Stapel's misdeeds for a final report to be issued next year.

Stapel's case is unusual not only for its scale, but also for the speed and transparency of the investigation. Officials at Tilburg University in the Netherlands, where Stapel was dean of the School of Social and Behavioural Sciences, announced his suspension and their plans to investigate in early September, just days after students alerted them to irregularities in his published data. Pim Levelt, director emeritus of the Max Planck Institute for Psycholinguistics in Nijmegen, the Netherlands, headed the Tilburg investigation and says that the committee acted rapidly and openly in the interests of Stapel's former students and collaborators. "There are co-authors who are losing most of their publications, and that is really a disaster when you are starting a science career," he says.

Levelt says that he drew lessons from other investigations, including the high-profile case of Marc Hauser, the former Harvard University psychologist who resigned this year after being found guilty of eight counts of research misconduct. The details of what Hauser did, however, are still unclear. "I was not very pleased by the Hauser case. It was a bit secretive, the final report was very short, and it took them three years," Levelt says.

But Daniele Fanelli at the University of Edinburgh, UK, who studies research misconduct, says that the committees investigating Stapel had much more freedom. Stapel quickly confessed and even identified papers that contained fabricated data. (He has since returned his PhD to the University of Amsterdam and reportedly sought mental-health care.) In cases in which accused scientists dispute the charges, Fanelli says, universities have to keep the investigations under wraps. ■

ROSIE REDFIELD

M. DEE/NATURE

CRITICAL ENQUIRER

A blogger's quest to replicate 'arsenic life' led to a remarkable experiment in open science.

BY ERIKA CHECK HAYDEN

She appeared like a shot out of the blogosphere: a wild-haired Canadian microbiologist with a propensity to say what was on her mind. And on 4 December 2010, what was on Rosie Redfield's mind was arsenic — specifically, a paper published two days earlier in *Science*, in which researchers funded by NASA claimed to have found bacteria that could incorporate arsenic into their DNA in place of phosphorus (F. Wolfe-Simon *et al. Science* **332,** 1163–1166; 2010). If true, the finding showed that life could be supported by a form of biochemistry radically different from the one we know. But Redfield's blog entry on the paper pulled no punches. "Basically, it doesn't present ANY convincing evidence that arsenic has been incorporated into DNA," she wrote.

Redfield kicked off a frenzy of criticism of the 'arsenic-life' paper in the blogosphere and the media. In June, *Science* published eight critiques of the paper. But that month, Redfield took matters into her own hands: she began attempting to replicate the work in her lab at the University of British Columbia in Vancouver, and documenting her progress on her blog (http://rrresearch.fieldofscience.com).

The result has been a fascinating story of open science unfolding over the year. Redfield's blog has become a virtual lab meeting, in which scientists from around the world help to troubleshoot her attempts to grow and study the GFAJ-1 bacteria — the strain isolated by Felisa Wolfe-Simon,

CHILD OF THE TIMES

The '7-billionth baby' was born into a world that is approaching a population plateau.

BY DECLAN BUTLER

On 31 October, the United Nations declared, the world's population reached 7 billion. Danica May Camacho, born on that day in the Philippines, was the first of several babies acclaimed for having nudged the population over the threshold. The choices were symbolic: the United Nations can at best only estimate that humanity will pass 7 billion sometime this year or next. But putting a face to the number drew attention to the challenges of absorbing a larger population and prompted a slew of Malthusian doomsayers to lament an overpopulated world.

Yet the underlying population story is not that there are now 7 billion people, nor that humanity's numbers will rise to somewhere around 10 billion by 2050. It is the dramatic slowing of population growth. The raw data reveal that the number of annual births, which had been growing for centuries, peaked around 1990 at roughly 135 million, and has declined since then. "The world reached peak child before peak oil," says Hans Rosling, an epidemiologist at the Karolinska Institute in Stockholm. That is mostly because family size in the majority of poorer nations has been shrinking for decades, thanks to economic growth, improved family planning and decreased child mortality. Much of the developing world is closing in on the population-replacement fertility rate, about two children per woman.

Annual population growth has already dropped from 1.8% around 1950 to 1.1% in 2010 and is expected to reach zero around 2060–80. This has knock-on effects: in Africa, where the population has been growing fastest of late, the median age is set to increase, bringing most of the population into working age. This demographic dividend is likely to spur economic growth.

Even if the population problem is abating, the sheer number poses challenges for humanity and the planet. The remedies needed in the next decades are much the same as those needed today: reduce poverty to tackle the root cause of hunger and to accelerate the fall in population growth; develop sustainable agricultural practices that increase food production without gobbling up extra land, water and other resources; develop renewable energy sources and boost energy efficiency to deliver the power that the world will need while avoiding more global warming.

We may have defused the population bomb, but 1 billion people remain hungry and the planet's resources are stretched thin. ■

lead author of the *Science* paper and a microbiologist who worked in the lab of Ronald Oremland at the US Geological Survey in Menlo Park, California. For months, Redfield could not get the GFAJ-1 bacteria to grow reproducibly on a medium containing arsenic. Finally, in November, the bacteria took off. Redfield now plans to check whether they have incorporated arsenic into their DNA, but it will take even more work to show that they can survive without any phosphorus.

To Redfield, the exercise has shown how social media tools are binding science into a community closer than it has been since the early twentieth century, when it was possible for scientists to personally know everyone in their field. "Scientists are much more able to communicate with people we don't know, and to learn from people we've never met," she says.

Before arsenic life, Redfield was known in the evolutionary-microbiology community for championing the relatively unpopular idea that bacteria evolved the ability to take up DNA from their environment for the purposes of nutrition, not sex. So although much has been made of Redfield's criticism of Wolfe-Simon — a blogger on Gizmodo.com, for instance, photoshopped a picture of the two glaring lightning bolts at each other — Redfield says that her lonely defence of her own unpopular hypothesis has made her sympathetic to Wolfe-Simon. "I'm in that position; it's not that people doubt my experiments; they doubt my interpretation," she says. Like Redfield, many scientists now believe that the conclusions of Wolfe-Simon and her team were incorrect because the researchers didn't rule out the possibility that their cultures were contaminated with phosphorus. Wolfe-Simon's team has argued that any background phosphorus was insufficient to support the bacterial growth it observed.

Ford Doolittle, a biochemist who hired Redfield for her first faculty job and is now at Dalhousie University in Halifax, Canada, says that Redfield's work has proved a point by showing how science is supposed to work. "Science is way too uncritical of itself," says Doolittle. "We need more Rosies out there." ■

B. MARQUEZ/AP

DANICA MAY COMACHO

M. BRICE/CERN

MIKE LAMONT

THE HIGGS MECHANIC

The engineer who keeps the Large Hadron Collider running brought physics closer than ever to completing the particle zoo.

BY EUGENIE SAMUEL REICH

It was standing room only in the auditorium at CERN on 13 December, when physicists at the Large Hadron Collider (LHC) presented the best indications yet that the long-sought-after Higgs boson might have been found. But the man who keeps the particles colliding was absent. Mike Lamont heads the LHC operations group, which was holding its own workshop on the machine's function. The group of about 80 engineers staffs the LHC control room in shifts and coordinates hundreds of others working on the superconducting magnets, accelerating chambers and other equipment arrayed around the LHC's 27-kilometre ring near Geneva, Switzerland, all to keep the data flowing without overtaxing the machine.

This year, the LHC produced 500 trillion proton–proton collisions, 100 times more than in 2010, generating a torrent of data that has allowed scientists to collect suggestive — but not definitive — indications of a Higgs boson with a mass of about 125 gigaelectronvolts. Lamont had spent the year carefully edging up the number of collisions by injecting more protons into each of the bunches speeding around the ring, packing the bunches more tightly and tightening the colliding beams to an ever-smaller focus. He also had to solve day-to-day problems, such as radiation damage to beam-line electronics and 'UFOs' — unidentified falling objects — that occasionally plummet into the path of the beam and interrupt experiments.

Lamont, a physicist who joined the LHC preparation team in 2001, was among those who worked frantically to restart the machine after an accident in 2008 shut it down. He insists that getting the collider back online was all down to teamwork. His goal for the next year is to deliver three times more data than in 2011 — hopefully enough either to confirm that the hint of the Higgs was real, or to rule it out. "The experiments are like hungry chicks. They always want more," he says. ■

S. SHINDO

FUKUSHIMA'S GADFLY

The emotional academic who challenged his government and took nuclear clean-up into his own hands.

BY DAVID CYRANOSKI

Tatsuhiko Kodama began his testimony calmly. But a few minutes into his speech before the Japanese parliament's health and welfare committee on 27 July, the biologist's tone grew sharp — and then downright angry — as he blasted the Japanese government for not accurately reporting the amount of radiation that had leaked from the Fukushima Daiichi nuclear power plant after the earthquake on 11 March. "This is clear negligence on the part of the government," he shouted. "With 70,000 people wandering around, unable to go home, what is the government doing?"

The 16-minute rant has since been viewed around one million times on YouTube, and Kodama, who is head of the Radioisotope Center of the University of Tokyo, quickly became known as the 'emotional scientist' spokesman for the victims of the Fukushima disaster. Journalists and local governments sought his advice on how to deal with the ongoing nuclear crisis, and he helped local governments to initiate some evacuation and decontamination efforts — all while the central government dawdled.

"He's been a real driving force," says Kaname Tajima, a ruling-party politician in charge of nuclear-disaster measures, who was stationed in Fukushima from June to September.

Sitting in his office in October, Kodama quietly recounts what led to his impassioned rant. He says that the information breakdown started

TECH EXEC

From flexible circuitry to miniature solar cells, this engineer has a knack for turning physics into technology.

BY ERIC HAND

The bulky crate in the back of the delivery truck didn't look like much, remembers John Rogers, thinking back to 1996 and his time as a postdoctoral fellow in physical chemistry at Harvard University in Cambridge, Massachusetts. But inside was his first commercial product, the InSite 300. It was designed to shine laser light on thin films and listen for an acoustic echo that would reveal their thickness and elastic properties without touching them. Active Impulse Systems, the start-up company he had co-founded a year earlier, had just sold its first InSite 300 for US$400,000 to a California firm that made semiconductor tools. In that moment, as Rogers posed with his colleagues for a jubilant snapshot in the back of the truck, he knew what he wanted to do with his life. "Physics for physics' sake is great," he says. "But if you can do physics for the sake of technology, I think that might be the way to go."

That attitude goes a long way towards explaining how Rogers came to win this year's Lemelson–MIT award for innovation — not to mention a MacArthur Foundation 'genius' fellowship in 2009. Now the head of a 40-person lab at the University of Illinois at Urbana–Champaign, Rogers still freely combines techniques from physics, chemistry, materials science and even bioengineering — and continues to pile up patents and spin-off companies. "That transition from a scientific idea to an engineering prototype — he's unbelievably good at it," says George Whitesides, who mentored Rogers during his postdoc.

A case in point is Rogers's work on flexible electronics, a crowded field that he joined about five years ago. The goal is to make electronic devices that can be worn rather than held — woven into clothes, say, or moulded to the body. But whereas many of his materials-science colleagues were working with organic materials, Rogers gave brittle silicon another chance. He found that ultra-thin silicon circuits printed onto an elastic surface could be highly flexible — and retain the benefits of silicon's low cost and high performance.

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Ones to watch 2012

DIETER EGLI
NEW YORK STEM CELL FOUNDATION
This year he reprogrammed a human egg and derived embryonic stem cells — but with three sets of chromosomes. Tweaks could produce 'diploid' lines.

PAUL MAHAFFY
NASA GODDARD SPACE FLIGHT CENTER
When the Mars Science Laboratory lands, the instrument that he runs will sniff for traces of methane, a gas that could be a clue to life.

ELON MUSK
SPACEX
His SpaceX Dragon capsule is scheduled to dock with the International Space Station early next year — a milestone for commercial space flight.

OSCAR PISTORIUS
SOUTH AFRICAN SPRINTER
His efforts to qualify for the 2012 Summer Olympics on carbon-fibre artificial limbs are set to reignite debate about technology's impact on human performance.

ESKE WILLERSLEV
CENTER FOR GEOGENETICS, COPENHAGEN
This year, he tackled an Aboriginal Australian genome and extinct megafauna. Next year, his palaeogenetic sequencing ventures are bound to surprise.

in the first days after the disaster, when the government decided not to release data from an ¥11-billion (US$141-million) system created to forecast how radiation spreads after a nuclear accident. The government claimed that because data were sparse, the system might cause unwarranted panic. That suggestion angers Kodama, who says that the Nuclear Safety Commission "should not be worried about confusion or panic. The specialist committee's major mistake was trying to act as politicians rather than scientists." Without the simulation results, which turned out to match later reports of a plume of radiation stretching to the northwest of the plant, evacuees from one high-radiation area fled to another.

Then, the Nuclear Safety Commission and the parliament bickered over whether safety levels should be set at 20 millisieverts or 1 millisievert, delaying decontamination efforts and further confusing citizens. "While these committees were arguing, the situation was getting worse and worse. That's another thing that makes me mad," says Kodama.

The academic eventually got the government's ear. The week after his rant, Tajima visited him. The following week, Kodama met then prime minister Naoto Kan, and advised him to get more data from the worst-affected areas.

Kodama, who is responsible for the safe operation and maintenance of the University of Tokyo's 27 isotope facilities, was already advising local officials about contamination. In late May, he started working in Minamisoma, a coastal city with around 70,000 inhabitants that straddles the border of the 20-kilometre mandatory evacuation zone. On his counsel, the local government encouraged pregnant women and children, who face an increased risk from radiation exposure, to evacuate from those areas outside the exclusion zone that had elevated radiation. Later, such advisories became common in the wider affected region. Kodama also started emergency decontamination efforts in Minamisoma, teaching town administrators how to measure radiation and look for micro-hotspots.

"You can't just measure, you have to look for the source," says Yoshiaki Yokota, a member of the local school board whom Kodama taught. "Before he showed me, I knew nothing about radiation."

Kodama's frustration continues. He says that the government is still not doing enough to help the victims, and he opposes plans to build a state-of-the-art ¥100-billion hospital in Fukushima city, arguing that support should be spread out more widely.

He also says that the government is still not releasing enough information. A ban on entry to the exclusion zone has kept scientists from sizing up the true situation in the area and has hampered the work of journalists. Kodama calls it a "censorship that is quite unusual in democratic countries".

"The lesson from Chernobyl for the Japanese government is that there is so much psychological scarring, so we can never put too much information out there," he adds. ■

One result of this work is a spin-off company based in Cambridge, Massachusetts, called mc10, that is working with the sporting-goods giant Reebok to roll out a product in 2012 that, Rogers says, will measure an athlete's "kinetic health and well-being". He wants to get inside the body, as well — mc10 is in the process of developing membranes studded with electrodes that can wrap around the brain or heart to provide neurologists and cardiologists with vastly improved diagnostic maps (J. Viventi *et al. Nature Neurosci.* **14,** 1599–1605; 2011).

Another spin-off co-founded by Rogers — Semprius, based in Durham, North Carolina — aims to make photovoltaic arrays that produce solar energy for less than 10¢ per kilowatt-hour, which would make the arrays competitive with coal or gas technologies. The company relies on a transfer-printing technique developed by Rogers to peel tiny, high-efficiency solar cells off gallium arsenide wafers and put them onto arrays (J. Yoon *et al. Nature* **465,** 329–333; 2010).

For all the razzle-dazzle of his ideas, however, Rogers in person is laid-back, agreeable and modest. It is telling that he is spending his MacArthur and Lemelson–MIT prize money not on himself, but on supporting students whose ideas might be too risky for government grants. "Life is short," he says. "I want to be able to point to a few things where we were able to have an impact." ■

P. WYNN THOMPSON/*NEW YORK TIMES*/REDUX/EYEVINE