

tory as it selects a new director.”

McTague, through a spokesperson, declined to comment on the selection process, although he praised Anastasio as “extremely impressive.” The appointment appears to have mollified Tauscher and other Livermore supporters. UC “made the right choice with Anastasio,” Tauscher said last week, adding that he “has always been the best choice for lab director.”

Anastasio will have his work cut out for him. One key issue involves the allocation of time on the National Ignition Facility (NIF)—a \$3.5 billion laser facility. NIF is being built to conduct tests to ensure the efficacy of existing nuclear weapons, but it also offers a platform for basic researchers. The new director must also deal with several suits charging the lab with racial discrimination in hiring and promotion. But the president’s homeland security proposals no doubt will be on the front burner as Livermore charts an uncertain new course in protecting the United States from terrorists wielding chemical, biological, or nuclear weapons.

—ANDREW LAWLER

SPINTRONICS

Magnetic Gate Opens New Computing Path

A tiny device that answers “no” when it’s told “yes” and vice versa could mark the first step toward microchips that calculate magnetically, a team of physicists reports. The “NOT gate,” described on page 2003, uses a trick of geometry to manipulate magnetism as conventional devices do electric charge. “It’s just very clever,” says Craig Lent, an electrical engineer at the University of Notre Dame in Indiana. “They’re on the road to nanomagnetics.”

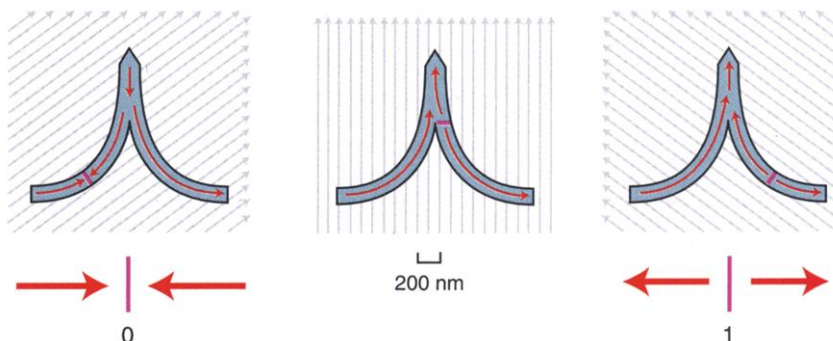
Electronic microchips crunch numbers by shuffling dollops of charge. But physicists and electrical engineers are striving to harness a more subtle property of electrons: the fact that the particles behave like spinning tops and are magnetized along their spin axes. Burgeoning “spintronics” technologies aim to use magnetic materials and magnetically polarized currents to store bits of information and perform calculations more efficiently (*Science*, 16 November 2001, p. 1488). So far researchers have developed devices that use layers of magnetic materials to read data from densely encoded disk drives or to store data in memory chips even when they’re turned off (*Science*, 12 April, p. 246). They’ve also begun to manipulate magnetically polarized electrical currents flowing within nonmagnetic semiconductors, an approach that might lead to more efficient calculations and even to superfast “quantum computing.”

But researchers have yet to perform calculations with just changes in magnetization

and no flow of electric charge. The new device, developed by Russell Cowburn and colleagues at the University of Durham, U.K., is a step in that direction.

The gate consists of a simple track of naturally magnetic nickel-iron wire, shaped like an upside-down Y. The magnetism of the alloy naturally runs parallel to the track, but it can be made to flip direction within a short length of the wire. In that case, the two opposing magnetizations meet at a region called a “domain wall.” There they either both point toward the domain wall (head to head) or both point away from it (toe to toe). Those two magnetic configurations can be used to encode 0 and 1 values for bits of information.

Cowburn and colleagues found a way to switch between the two arrangements by us-



Why not? In spintronic NOT gate, a rotating magnetic field (gray arrows) changes the value of a bit by moving and then flipping the boundary between regions of magnetized wire.

ing a magnetic field to force the domain wall through a kink—the stem of the inverted Y. When a magnetic field points along a branch of the device, it pushes the domain wall along the track so that more of the wire is magnetized in the same direction as the field (see figure). If the track made a smooth curve, a rotating magnetic field would simply ease the domain wall around the bend. In the Y-shaped device, however, something else happens. As the domain wall moves up into the stem of the Y and down again, it flips from the head-to-head configuration to the tail-to-tail configuration or vice versa, something like a car backing into a driveway to turn around. By swapping domain-wall configurations, the device exchanges 0 for 1 and 1 for 0—the hallmark of a logical NOT gate.

Cowburn and colleagues have strung as many as 11 NOT gates together in a closed loop. The devices kept flipping bits faithfully while a domain wall went around as many as 100,000 times. Unlike some other budding technologies, the device also works at room temperature. Arrays of NOT gates can do little by themselves, the researchers acknowledge, but they hope to develop other devices, such as an “AND gate” that can compare two inputs, that will enable them to perform full-scale calculations. “We think we’ll have a fully functioning logic [system]

within a year,” Cowburn says.

Chips that manipulate magnetism should resist damage from radiation and retain information if they inadvertently lose power, so they might be useful in spacecraft and other harsh environments, says Russell Beech, an electrical engineer at NVE Corp. in Eden Prairie, Minnesota. However, Cowburn and colleagues must address some basic questions if they’re to turn their promising idea into a useful technology, Beech says. For example, they must find ways to reliably feed domain walls into a circuit and to generate the rotating magnetic field from wires embedded in the chip itself.

But even if the new device does not blossom into a new technology, it could give researchers an important tool for probing the

basic physics of magnetic materials, says David Awschalom, a physicist at the University of California, Santa Barbara: “It’s a wonderful laboratory for studying domain wall motion.” Such studies should prove fruitful however the story of spintronics unwinds.

—ADRIAN CHO

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GENETICALLY MODIFIED FOOD

TV Drama Sparks Scientific Backlash

Intending to discredit a biotech company, a farmer opposed to genetically modified (GM) foods slips a gene conferring resistance to the powerful antibiotic vancomycin into wheat. The protest goes horribly wrong, however, when the resistance gene moves from the wheat into the bacterium *Staphylococcus aureus*, provoking a deadly and uncontrollable outbreak of staph infections.

Sounds incredible? The plot of the BBC thriller “Fields of Gold,” which aired 8 and 9 June in the United Kingdom, is indeed far-fetched, many experts say. Some scientists, concerned that the alarming story line will erode already low public confidence over the safety of GM crops, mounted a high-

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Field of nightmares? A British TV thriller has stirred up the controversy over GM crops.

profile attack last week. Leading the charge was Robert May, president of the Royal Society, the U.K.'s preeminent scientific body. "Fields of Gold," he said in a statement, is "ludicrous" and "hysterically inaccurate" and is "propaganda."

The vehement protests included calls for BBC to pull the program before it aired. BBC did not comply, although it posted on one of its Web science pages what could be construed as a disclaimer about the show's premise, noting that "most scientists think that the risk to our health from this is remote."

The program was scripted by Ronan Bennett, known for his politically charged fiction about Northern Ireland, and Alan Rusbridger, an editor at *The Guardian*, a highly respected left-leaning U.K. newspaper. Last summer, the two asked University of Cambridge geneticist Mark Tester to vet their script. Tester provided suggestions to make the script more plausible, including a possible means for mixing GM wheat with the bacteria. But he harshly criticizes the accuracy of the final product, especially the ease with which the fictional farmer transfers the gene into the plant and the highly improbable transfer of the resistance gene from the wheat into bacteria. The program, he told *Science*, "raises concerns that have no scientific basis."

Bennett says that he and Rusbridger rewrote some scenes according to Tester's advice. Moreover, he says it was Tester who brought the idea of horizontal gene transfer to their attention in the first place. When Tester reviewed the script, Bennett says, "he did not take objection to any of it, he just made suggestions." Indeed, in an e-mail to the BBC in July 2001, Tester said he remained "open-minded" about the gene transfer scenario. As for the demand for the show's cancellation, Bennett says, "it has a whiff of book burning about it." Rusbridger claims that many scientists gave positive feedback. He also points out that U.K. officials have expressed concern over horizontal transfer in government documents.

Despite the scant research on horizontal transfer of transgenes, several scientists who

saw the program agree that it is implausible. "If genes moved with any frequency from plants to bacteria, we'd find them in bacterial genomes. We don't," says Peter Lund, a molecular biologist at the University of Birmingham, U.K. An outbreak of vancomycin-resistant bugs, Lund and others say, is much more likely to come from existing resistant bacteria than from a plant.

But Lund adds that the show reflects real concerns among Britons: "We have no trust in politicians or big business, and very limited trust in or understanding of science." Even a critic from the conservative *Times* of London sympathized with the urge to confront the dangers of GM crops: "The public have been taught fear and skepticism not by radical agitators but by businessmen and their political allies, who were prepared to take irresponsible risks with our health."

The show's anti-GM message comes at a particularly inopportune time for the U.K. government, which announced last week that it would sponsor televised national debates on GM food safety this summer. Few, however, believe that television, whether in the form of public debate or a GM thriller, will reconcile such bitterly opposed viewpoints.

—BEN SHOUSE

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ECOLOGY

A Coral by Any Other Name ...

Although the undersea landscape is peppered with corals of many shapes and sizes, there's no consensus about whether the different configurations denote different species. Some researchers think so and call each by a different name. But others argue that because many corals interbreed, they do not qualify as distinct taxonomic entities. Now on page 2023, Harvard University researchers say they have set the record straight, at least for three species found in the Caribbean. By performing more extensive genetic studies than



All in the family. When elkhorn coral (right) eggs are fertilized by staghorn coral (middle) sperm, a bushy hybrid (left) results.

ScienceScope

One of Their Own An in-house geologist has taken the helm of the Smithsonian's troubled National Museum of Natural History in Washington, D.C.—at least temporarily. Until a permanent director is found, Douglas Erwin, an expert in ancient mass extinctions, will be in charge of the museum's research program, which some scientists say is threatened by changes proposed by Smithsonian chief Lawrence Small (*Science*, 14 September 2001, p. 1969).

Erwin, chair of the museum's paleontology department, steps in for Dennis O'Connor, who left last month for an academic post. O'Connor served just 7 months after replacing Robert Fri, who left last year in part because of disagreements with Small.

University of Pennsylvania anthropologist Jeremy Sabloff, who heads a committee evaluating Smithsonian science, is pleased with Erwin's appointment, as well as that of Irwin Shapiro—head of the Smithsonian Astrophysical Observatory—who last month became undersecretary for science. Given the turmoil, "having strong voices for science is absolutely necessary," Sabloff says. But he notes that a search committee is already writing a job description for Erwin's replacement.

MIT Reports on Secret Science After a 3-month study, a faculty committee at the Massachusetts Institute of Technology (MIT) this week recommended that the school retain rules that bar classified research from campus. But the panel said the university should establish a new committee to track evolving government rules on scientific secrecy and consider expanding off-campus laboratories to handle expected growth in classified work.

MIT leaders ordered the report last February, after some universities reported that federal funders were pressuring them to restrict some basic research in the wake of the 11 September terrorist attacks (*Science*, 22 February, p. 1438). Most schools ban secret work from campus and bar prior government review of basic science results.

In its 50-page report, the panel—led by engineering professor Sheila Widnall—reaffirmed MIT's commitment to "an open research environment" on campus. But it predicted that MIT's classified work—done at affiliated Lincoln Laboratory—will grow. In particular, the panel said "it is not too hard to imagine" a new lab for secret biological research. MIT officials say the report will help guide the use of such facilities.

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