RANDOM SAMPLES

edited by CONSTANCE HOLDEN

Substitute for Shock Therapy?

For serious, drug-resistant cases of depression, electroconvulsive therapy (ECT) has been the only effective treatment. But ECT entails general anesthesia, the inducement of seizures, and some memory loss. Now some researchers think there's a potential alternative: transcranial magnetic stimulation (TMS).

TMS entails holding a metal coil against a patient's left temple—imaging studies have shown metabolism in the left prefrontal cortex to be low in depressed people—and sending a series of short electromagnetic pulses into the brain. Clinical studies on the technique are just starting to come out. A team headed by psychiatrist Mark George, now at the Medical University of South Carolina in Charleston, reports in the 2 October issue of *Neuroreport* giving daily doses of TMS to 6 patients for a week. One went into "remission," and one showed "significant" but temporary improvement. An unpublished study just completed by neurobiologist Pasqual Leone of the University of Valencia, Spain, involved 17 badly depressed patients. Leone says TMS and a sham procedure were administered in a "crossover" design, using patients as their own controls. TMS alleviated the symptoms in 11 of them, he says, while the sham was ineffective.

"If this turns out to be something that really works, it would be a major advance," says psychiatrist Frank Guerra of the University of Colorado Health Sciences Center. It might also lead psychiatrists to rethink the notion that a generalized brain seizure is essential for ECT to work. Researchers surmise that TMS is changing the chemistry in deep brain structures—just as ECT apparently does—but that because magnetism, unlike electricity, easily passes through body tissues, it can do the job without the need to trigger a seizure.

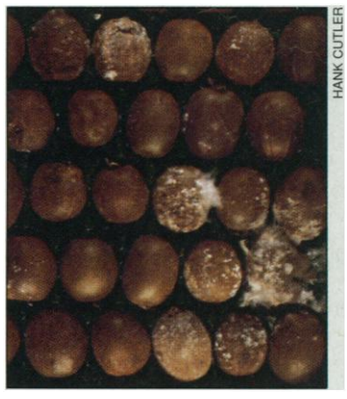
Some psychiatrists are still skeptical. Longtime ECT researcher Max Fink of the State University of New York, Stony Brook, is not impressed with the George study and says optimism about TMS is at best premature. People have tried both electricity and magnetism throughout this century to try to treat depression without inducing seizures, he says, and it never works. But TMS researchers are optimistic. "Our feeling is that ECT responders will respond to [TMS] and that this could potentially replace ECT," says neurologist Eric Wassermann of the National Institute of Neurological Disorders and Stroke. And the hope is that further research will cast more light on how both ECT and TMS actually work.

Biocontrol for Kiwi Mold

Consumers who delight in the kiwifruit have a serious competitor—a fungus called *Botrytis*, which preys on the fruit while it is in storage. Last year, according to Robert Hill of the Horticulture and Food Research Institute of New Zealand, *Botrytis* destroyed about $10 million of New Zealand's $400 million kiwi crop, and it takes only a slightly lesser toll in dry California. But scientists in New Zealand have now found something that can keep the greedy fungus at bay: a dab of 6-pentyl-alpha-pyrone (6-PAP)—an aromatic extract of another fungus.

After the success of a pilot experiment in which 3000 kiwifruits treated with the extract survived 12 months of refrigerated storage, scientists are monitoring the fate of 26,000 kiwis stored in sites around New Zealand. After 5 months they are still free of *Botrytis*, says Hill. The 6-PAP, which smells like a combination of coconut and celery, apparently acts as a natural fungicide, stopping the *Botrytis* at its entry point: the wound created when the fruit is picked.

6-PAP has waited a long time to be put to work. The active ingredient of a mold called *Trichoderma*, it was isolated in the 1970s by chemist Hank Cutler of the U.S. Department of Agriculture's Agricultural Research Service (ARS), who found that it could destroy other fungi. But according to ARS spokesperson Jim DeQuattro, 6-PAP lay on the shelf until 1991, when kiwifruit orchards in New Zealand were being destroyed by the fungus *Armillaria*. Hill observed that vines harboring *Trichoderma* seemed resistant to *Armillaria*, and he sought out Cutler. The two developed a treatment that proved successful in fighting the fungus.



HANK CUTLER

Storage rot. This doesn't happen when picking wounds are treated with 6-PAP.

Now that 6-PAP is showing promise at protecting kiwis in storage as well as on the vine, it may permit growers to sell the fruit year-round. Growers in the Northern and Southern hemispheres have opposite growing seasons. To break into each others' markets, they would have to provide fruit that could keep its fresh flavor even in long storage, as the 6-PAP–treated kiwis seem to do.

Mark Houston of the California Kiwifruit Commission says he hadn't heard about 6-PAP. But if it is a natural fungicide, he adds, "we're very interested in it. We don't really have anything to fight *Botrytis* right now."

EDWARD WOLFE

Trouble brewing? Mountain's dome and crater during last series of outbursts in February 1991.

Subterranean Rumbling At Mount St. Helens

After 4 years of calm, Mount St. Helens is getting indigestion again. Since the giant eruption in 1980, the mountain has periodically given off explosive bursts of gas, the last of them in 1991. Now a gradual resurgence of tiny earthquakes deep under the volcano is hinting to researchers that the mountain could be on the verge of belching again. The National Forest Service has closed the likely blast zone indefinitely, keeping tourists and scientists out of the crater. Similar explosions at two South American volcanoes have killed 10 volcanologists and tourists in recent years (*Science*, 16 April 1993, p. 289).

Since last January, volcanologists at the U.S. Geological Survey's Cascades Volcano Observatory (CVO) in Vancouver, Washington, have recorded a steady increase in the frequency of small, deep earthquakes—to 100 in September. The crescendo suggests a pressure buildup of gas as magma lingering from the big eruptions of the 1980s continues to crystallize and force gases out of solution, like a warming bottle of soda.

The result could be a gas explosion like the six that ripped the 280-meter-high lava dome within the crater between 1989 and 1991, tossing soccer-ball–size blocks almost a kilometer and sending ash-laden plumes as high as 6 kilometers. Those explosions struck without warning, so, says Daniel Dzurisin, CVO's scientist-

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in-charge, the earthquake build-up may be the only sign that another outburst is coming.

Even if that happens, though, says Dzurisin, it's all probably part of the hangover from the big blowout. There is nothing, he says, "that indicates the mountain is doing anything but continuing to go to sleep."

Tunable Sensors

People known for their precision usually aren't very flexible, and the same goes for industrial sensors. Sensor arrays that could measure tiny changes in concentrations of many different gases at once, including ethanol, carbon monoxide, and water vapor, would be a boon to industry. The precision sensors available today are not nearly versatile enough to do the job, however. But tomorrow's may be. Researchers at Purdue University have figured out how to make "tunable" sensors that can be adjusted to detect an array of different molecules.

In the 11 October issue of the *Journal of the American Chemical Society*, Purdue chemist Thomas Bein and his colleague Yongan Yan report that they have developed a way to tailor the sensitivity of devices that rely on porous crystalline compounds known as zeolites. The zeolites, which have molecule-size holes, act as filters that allow only one kind of molecule to reach a detector. Currently, if researchers wanted to make an array of zeolite-based sensors for different compounds, they would have to cast thin films of zeolites with different pore sizes—a tricky task. But Bein and Yan have devised a way to alter pore sizes in a single type of zeolite film.

The technique uses what Bein calls "embarrassingly simple" chemistry. Zeolites are made up of a negatively charged framework of atoms (such as silicon, aluminum, and oxygen) to which positively charged atoms, or ions, (such as sodium) are added to create an overall neutral charge. The positive ions occupy sites in and around the crystal's openings, thereby helping to determine the size of the pores. To change this pore size, the researchers replaced one set of positively charged ions with another by dipping a sodium-containing zeolite film in a bath containing potassium, calcium, or rubidium ions. When the other, different-sized ions diffused into the zeolite crystal, they took the place of the sodium ions, changing the zeolite's pore size. Switching from sodium to potassium, for example, narrowed the pore size from about 4 to 3 angstroms and made the potassium zeolite porous only to water vapor.

"It's beautiful work," says Geoffrey Ozin, an inorganic chemist at the University of Toronto, and he thinks manufacturers of everything from semiconductors to food may end up agreeing.

Virtual Course on Protein Structure

NEWS FROM THE NET

Cyberspace pioneers have chalked up another one: a course on protein structure that its creators, a multinational team of scientists, call "the first international multimedia science education course to be taught entirely via the Internet."

The course, "Principles of Protein Structure," was conceived by Peter Murray-Rust, a crystallographer at Glaxo-Wellcome and honorary professor at Birkbeck College, University of London, which is the physical headquarters for the course. Murray-Rust says he got the idea from a course on the programming language C++, which he says was the first totally Internet-based course.

This is "not a Mickey Mouse course," says Murray-Rust. Rather, it's been "created by volunteers from some of the world's top-class laboratories." Seventy graduate students and researchers from around the world have already "graduated" from a pilot course. Each student is assigned a particular protein to study. Students get weekly assignments, participate in tutorials, do dissertations, and display their work and hold real-time discussions in virtual meeting spaces or "MOOs" (*Science*, 13 May 1994, p. 900).

The next course—which the college credits as an advanced-level course—starts in January and will cover three 11-week terms ending next October. The cost is £163 for citizens of the European Union; £500 for others. The URL is **http://www.cryst.bbk.ac.uk/PPS2/**. A "complete mirroring of much of the [course] material," which obviates time-consuming waits to download graphics and animation from across the Atlantic, is available from Brookhaven National Laboratory (**http://www.pdb.bnl.gov/**).

FIVE BIGGEST FOREIGN R&D INVESTORS IN THE UNITED STATES, 1993

Country	Expenditures ($billions)	R&D employees	No. of companies
Switzerland	2.524	14,700	16
Germany	2.321	19,200	32
United Kingdom	2.295	20,000	61
Japan	1.781	11,800	107
France	1.204	9,300	22

Fertile U.S. soil. R&D expenditures by foreign companies in the United States have quadrupled in the past decade and now amount to about 15% of U.S. industrial R&D spending, according to a new report from the Department of Commerce.* Major acquisitions by foreign pharmaceutical companies of U.S. corporations such as Genentech, Chiron, and Smith-Kline have helped swell the numbers, which grew from $3.7 billion in 1982 to $14.6 billion in 1993. Foreign biotechnology companies set up R&D shops in the United States to acquire technology and take advantage of a favorable research environment, notes the report, while electronics and automotive companies do so to help their parent companies increase sales and, for automakers, to meet U.S. environmental regulations. The report also includes data on R&D spending abroad by U.S. companies, which has tripled since 1982 to $9.8 billion in 1993. The most popular site for U.S. R&D investment is Germany, followed by the United Kingdom, Canada, France, and Japan.

* Globalizing Industrial R&D, Office of Technology Policy, U.S. Department of Commerce, October 1995.

Fuzzy Athletic Vegetarian ISO ...

For Romeo, a diademed sifaka—a member of the lemur family—finding that special someone is a little more complicated than placing a singles ad. He's the only such animal in captivity, residing at the Duke Primate Center. Now Duke wants him to have a family, with the ultimate hope of repopulating the wild community in Madagascar. Fund raising is under way for an expedition to Madagascar next spring, led by center director Kenneth Glander, where scientists hope to locate the already-named Juliet. Because of rapid depletion of Madagascar habitat, "this is a salvage operation" as much as a mating foray, says Glander. Interestingly, while the diademed sifakas (which the locals eat) are almost extinct, a close relative, the indri, is still common. That's because they have an "eerie, almost human-like call," says Glander, so Malagasies regard them as sacred and don't kill them.

DAVID HARING