Biomedicine

Vitamin E's bloody role

Among the vitamin cognoscenti, vitamin E has built a solid reputation as a free radical fighter, ridding the body of the highly reactive molecules that may cause cancer and other woes (SN: 4/22/95, p.248). Indeed, vitamin E's recently reported ability to help prevent strokes and heart attacks has usually been attributed to its skill at mopping up reactive forms of oxygen molecules and other free radicals (SN: 8/1/92, p.76).

But when taken in megadoses, vitamin E also "makes you prone to bleed," notes Paul Dowd of the University of Pittsburgh. This anticoagulant effect, he suspects, might also help prevent clots that can generate heart attacks and strokes.

In the Aug. 29 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, he and colleague Zhizhen Barbara Zheng report that the usual commercial form of vitamin E is relatively ineffective at thinning blood. But vitamin E quinone, a molecule that forms naturally when the vitamin reacts with oxygen in the body, proved a potent anticoagulant.

Vitamin E quinone apparently inhibits carboxylase, an enzyme that must modify a variety of proteins in order for blood clots to form. "This is a busy enzyme," says Dowd. He and Zheng propose that vitamin E quinone inhibits carboxylase by binding to the site on the enzyme where vitamin K—which activates the blood clotting cascade—normally attaches.

"It's a chemical explanation for what we saw," says Robert E. Olson of the University of South Florida College of Medicine in Tampa, who led a group which had shown that megadoses of vitamin E inhibited carboxylase enzymes in mice. Indeed, he says, they've "gone a step further than we did to show a reasonable mechanism."

Dowd believes that investigators should explore whether vitamin E quinone may offer a safe alternative to anticoagulant drugs, such as warfarin, which are sometimes slow to act.

Hormone helps elderly sleep

Old people who have trouble sleeping may get relief from their insomnia by taking a hormone that regulates the body's internal clock. Researchers from Israel have found that a time-released formulation of the hormone melatonin substantially increases sleep quality among elderly insomniacs. And unlike other sleep aids, it produces no side effects.

"The major effect we found with melatonin was in sleep maintenance," says study leader Nava Zisapel of Tel Aviv University. "People could fall back asleep much more easily after waking in the middle of the night."

Melatonin is a nocturnally produced hormone originating in the pineal gland in the center of the brain. Its purported roles range from regulating the body's biological clock and reproductive hormone cycles to quashing free radicals (SN: 5/13/95, p.300). Though many health food stores already stock the hormone as a sleep aid, evidence to justify such self-medication remains merely suggestive.

Zisapel and her colleagues tested the hormone's activity in 12 insomniacs. All participants, men and women around 75 years old, had lost their ability to produce melatonin. Every evening for 3 weeks, the researchers gave half the participants 2 milligrams of melatonin and the other half a placebo. Then, after a week's hiatus, the groups switched treatments for another 3 weeks. Throughout, the volunteers wore a wrist device that recorded sleep patterns.

As the Israeli researchers report in the Aug. 26 LANCET, the volunteers fell asleep more quickly and slept about 10 percent longer when taking the melatonin than they did while taking the placebo.

Zisapel now suspects that melatonin could be very helpful for the 25 percent of elderly insomnia patients who fail to produce adequate amounts of melatonin. And, she points out, "it is a natural mechanism that you are working on."

Physics

A magnetic trampoline for cold atoms

It's just a strip of ordinary magnetic audio tape, recorded not with the sounds of Bruce Springsteen or Hootie & the Blowfish but with a pure, high-frequency tone. Yet researchers can use it as a mirror for reflecting superchilled atoms.

This represents "the first demonstration of atomic retroreflection from a surface with microscopic magnetic structure, opening the way to a simple new technique for atom manipulation without the use of laser light," Edward A. Hinds and his coworkers at Yale University report in the July 24 PHYSICAL REVIEW LETTERS.

To observe these atomic bounces, the researchers cool rubidium atoms in a trap created by a combination of magnetic fields and intersecting laser beams. After the atoms reach 30 microkelvins (a temperature approaching absolute zero), the trap is briefly turned off, releasing some of the atoms, which then begin to fall because of gravity.

These atoms behave like little bar magnets. Passing through a weak magnetic field, they align themselves in a particular direction. When the falling atoms reach the specially prepared audio tape, the intense magnetic field created by oriented domains at its surface repels the atoms, forcing them back upward to be recaptured by the trap.

Using strips of audio tape, the researchers can keep atoms bouncing up and down for about half a second before the atoms spread out and start missing the mirror. But by using a computer floppy disk, deformed to create a concave surface, they can focus the atoms to keep them rebounding longer.

Suitably magnetized surfaces may prove useful in the storage and manipulation of cold atoms, Hinds and his colleagues conclude. For example, magnetic mirrors may eventually serve to bounce moving atoms into narrow beams or to keep them safely in cold storage.

Magnetic monopoles in matter

Physicists have expended a great deal of effort searching for magnetic monopoles—fundamental particles that have only one magnetic pole. So-called grand unified theories, which mathematically tie together the electromagnetic, weak, and strong forces of nature, predict that magnetic monopoles—if they exist—would be extremely heavy and move much more slowly than other subatomic particles.

So far, searches for magnetic monopoles have largely focused on their detection among cosmic rays (SN: 10/5/91, p.219), and these efforts have turned up nothing. But a few monopoles, originally created in the early moments of the Big Bang, may have survived and become trapped in matter, particularly the material at the cores of stars.

Now, Hunmoo Jeon and Michael J. Longo of the University of Michigan in Ann Arbor report in the Aug. 21 PHYSICAL REVIEW LETTERS that they have found no evidence of the presence of magnetic monopoles in recycled star matter that's ended up here on Earth. Using a sensitive monopole detector, the researchers examined more than 331 kilograms of material, including iron ores, ferromanganese nodules, and 112 kg of meteorites, before coming to their conclusion.

An ultraminiature atomic clock

Neither gaining nor losing as much as a millionth of a second in a year, the NIST-7 atomic clock sets the standard for timekeeping (SN: 5/1/93, p.276). But it's an expensive, bulky clock, ill-suited for everyday use in navigation or telecommunications. Sacrificing a little accuracy, researchers at Westinghouse Electric Corp. in Pittsburgh have now developed a compact atomic clock that can easily fit into radio receivers and other types of electronic equipment, greatly improving their ability to track time and to synchronize signals.