Biomedicine

Hot spots may signal heart attacks

In people with atherosclerosis, fatty deposits narrow blood vessels and slow blood flow to the heart. Most heart attacks occur after fibrous caps covering these fatty deposits rupture. Blood clots can then form around the rupture and block off blood flow to the heart: a heart attack.

According to researchers in Greece, tiny changes in temperature along artery walls—measured through a small device inserted into the arteries—might indicate both the presence of atherosclerotic plaques and which plaques are most likely to rupture. Among 45 people without atherosclerosis, the researchers found that temperatures were essentially the same all along the artery wall. In 45 people with atherosclerosis, however, blood vessel temperatures taken in areas of plaques ranged from 0.1°C to 1.5°C higher than temperatures taken along healthy artery walls.

The more severe the person's underlying disease, the higher the temperatures measured at the plaques, the researchers report in the April 20 CIRCULATION. Temperature variations among the plaques at a single site were largest in the 15 patients who had recently suffered a heart attack.

"It's not clear whether the inflammatory response and increased temperature causes the plaque to rupture or whether the increased temperature is a response to such rupture," says David A. Meyerson, a cardiologist at Johns Hopkins University in Baltimore. "Either way, the technique may be valuable in monitoring which plaques are unstable and might trigger a heart attack."

Since the technique entails inserting a tiny thermometer inside the heart, it will probably be most useful when a patient with chest pain or other heart problems is already undergoing a procedure to look inside the arteries, he says. Temperature differences might then lead cardiologists to treat the more unstable plaques first. *—D.C.*

Bone marrow boosts transplant success

The idea behind organ transplants is simple: If you can't fix the part, replace it. This solution, however, is less than acceptable to the human immune system, which will attack transplanted organs as readily as it does invading bacteria. Although drugs that suppress the immune system help, many donated organs are rejected or fail over time.

However, if recipients are given infusions of donor bone marrow cells along with the donated organ, rejection occurs less often and is less severe, reports Abdul S. Rao of the University of Pittsburgh. The procedure seems to benefit patients receiving hearts, lungs, livers, and combined transplants of the kidney and pancreas, he reported at the Experimental Biology '99 meeting in Washington, D.C., last month.

Among 270 patients given bone marrow and organ transplants, 52 percent experienced rejection, compared with 67 percent of the patients given donated organs but not bone marrow, Rao says. More importantly, the rejection episodes were generally milder in the bone-marrow group.

Bone-marrow transplants promote the production of white blood cells of the donor's type, Rao says. These immune-system cells apparently encourage the body to regard the donated organ as part of itself. *—D.C.*

The straight dope

Long-term marijuana use does not seem to adversely affect mental function, according to a study of 1,318 Baltimore residents. Twelve years after they were first given a standard test of mental ability, volunteers' average scores had declined only slightly. Those who admitted to having smoked marijuana, even heavily, were no more likely to show signs of impaired mental function than people who had never tried the drug, researchers report in the May 1 AMERICAN JOURNAL OF EPIDEMIOLOGY. *—D.C.*

Physics

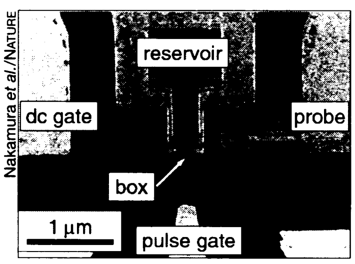
A quantum bit comes to life on a chip

Scientists jest about making so-called quantum computers from cups of coffee (SN: 1/18/97, p. 37). Their jokes allude to extraordinary experiments that use liquids to perform simple quantum calculations (SN: 9/12/98, p. 165). Experimenters have also had some success with photons, trapped ions, and other exotic components—but not with the materials and methods used to make conventional computing devices.

Japanese researchers now report that they have built a key quantum component on silicon with a method that manufacturers already use to make some specialized microcircuits. "The reason why people are so excited is that we can make it with a very standard lithographic technique," says Yasunobu Nakamura of NEC Fundamental Research Laboratories in Tsukuba.

Quantum computers don't exist yet, but, in theory, they would perform certain calculations billions of times faster than conventional computers do. They would use quantum bits, or qubits, made from tiny particles obedient to the odd rules of quantum mechanics (SN: 4/3/99, p. 220). Whereas an ordinary bit represents either 0 or 1, a qubit represents both at once.

In the April 29 NATURE, Nakamura and his colleagues describe creating a qubit in patches of aluminum on the surface of a coated piece of silicon. At 30 millikelvins, the metal allows electrons to flow without resistance. Juxtaposing two such superconducting patches allows a pair of vibrating electrons to simultaneously occupy both patches—that is, to represent states 0 and 1 at the same time. In the prototype, however, this mixed state sparked by a voltage pulse dies out too quickly for practical computing, Nakamura says. *—P.W.*



Nakamura et al./NATURE

An electron pair simultaneously occupies the metal box and reservoir on this chip, encoding the values 0 and 1.

Laser may twirl molecules to pieces

Physicists often picture the bonds between atoms as springs. Researchers in Canada are developing a new way to exploit that springiness to stretch selected bonds inside molecules until they break.

The method, proposed in the April 26 PHYSICAL REVIEW LETTERS, would use a whirling electric field created by a laser to spin molecules at up to 10 trillion revolutions per second. At that rate, centrifugal forces should tear pairs of atoms apart.

Because the force on heftier atoms would exceed that on lighter neighbors, the bonds connecting more-massive atoms would break sooner, the developers argue. If the method works, chemists may gain a long-sought ability to tailor molecules and reactions with unprecedented precision.

"We hope to have excellent control over how these molecules are spinning and so to have excellent control over this chemistry," says Misha Ivanov of the National Research Council of Canada in Ottawa.

Computer simulations indicate that such an optical twister should work. By inducing a slight electric polarity in the molecule, the laser's oscillating electric field aligns the molecule. As the field then rotates, slowly at first and then rapidly, its electric force makes the molecule spin along with it.

An equipment glitch has so far foiled laboratory tests, Ivanov says. When polarities are aligned, the laser field should hold a spinning molecule in place, as one's palm cups a marble. However, the field intensity jiggles around. For now, says Ivanov, "the twister is like the hand of a person with a hangover. It shakes like hell" and drops the marble. *—P.W.*