Depression proves risky for ill hearts

Despair and sadness weigh heavy on the heart. If such feelings attain the status of clinical depression, they literally drag down one's chances of living out the year after weathering a heart attack, a new study finds.

Both women and men who exhibit mild to moderate depression while hospitalized for a heart attack are more likely to die over the subsequent year, report psychologist Nancy Frasure-Smith of the Montreal Heart Institute in Quebec and her colleagues.

Previous research on mortality among depressed heart-attack victims has focused largely on men (SN: 10/23/93, p. 263).

"With current cardiac treatment regimens, the prognosis after [a heart attack] is quite good, even for depressed patients," the researchers assert. "[B]eyond its impact on prognosis, depression results in considerable suffering for patients and families."

Frasure-Smith's group studied 283 women and 613 men who completed psychiatric interviews in the hospital while undergoing treatment for a heart attack. Most participants had not experienced more than one heart attack.

A total of 133 women and 157 men cited symptoms of at least mild depression while hospitalized. Most weren't treated for their depression.

Although women were twice as likely to report signs of depression as men, the depressed members of each sex displayed roughly equal 1-year mortality rates, the scientists note in the January/February PSYCHOSOMATIC MEDICINE. About 8 percent of depressed women and 7 percent of depressed men died of heart-related causes in that time, compared with slightly more than 2 percent of their nondepressed counterparts.

The researchers statistically controlled for many other influences on mortality, including age, cigarette smoking, social isolation, and medical problems.

Men most often reported being depressed if they lived alone and were unmarried, Frasure-Smith's group says. In contrast, women who were unmarried and lived by themselves had the lowest risk of depression.

Men may experience a unique closeness with their spouses, the researchers suggest. Women maintain a wider variety of close relationships, although from a single study it's unclear whether living alone really benefits them after a heart attack.

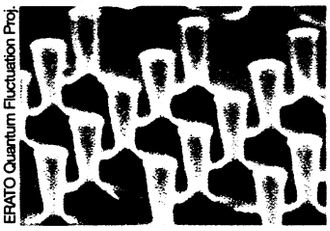
In prior studies, depression raised the risk of death from heart-related causes. Future work needs to pin down the size and source of this effect, add psychiatrist Lawson R. Wulsin of the University of Cincinnati and his coworkers in the same journal. *—B. Bower*

Tiny turnstile spits out solo photons

Photons are party animals, compelled by quantum mechanics to roam in crowds. The gregarious habits of these fundamental particles of light have hindered attempts to use them one at a time for tasks such as computing or sending secrets. The challenge has been to guarantee that only one photon arrives on the scene at any given moment.

A new device made from the semiconductor gallium arsenide, however, forces photons to sally forth one by one. The pillar-shaped component—an exotic light-emitting diode—acts as a turnstile with electrons as tokens, say its inventors at Stanford University, Hamamatsu (Japan) Photonics, and NTT Basic Research Laboratories in Atsugi, Japan.

Ideally, each electron that enters the component chucks out one photon from the top of the device. The turnstile, described in the Feb. 11 NATURE, approaches that goal when operated at a frigid 55 millikelvins. It ejects a photon for at least a third of the electrons, timed to a precision of tens of billionths of a second. Unfortunately, the device's builders note, the photons go off in all directions, making them difficult to capture in an optical fiber and to pipe to downstream circuits.



ERATO Quantum Fluctuation Proj.

Each of these microscopic pillars spouts photons one by one, if electrons enter its base.

"If they're up to 33 percent, that's a significant breakthrough and improvement," comments Michael G. Raymer of the University of Oregon in Eugene. If they can further boost that percentage and steer the photons to a useful destination, "then the device would have very important applications in quantum information processing," he adds.

Quantum computing, for example, attempts to exploit the quantum mechanical nature of tiny particles, such as photons or atoms, to surpass conventional computers in certain tasks (SN: 3/1/97, p. 135). After researchers first used photons as bits four years ago, further progress using photons has stalled. One reason is the difficulty of guaranteeing that a photon would be present when needed.

Because the new device provides timed release of lone photons, it may overcome that limitation, says Oliver J. Benson, one of the Stanford researchers. Adds Jungsang Kim, also of the Stanford team, the device may also aid the use of photons in secure communications. It would help eliminate unintended, redundant photons carrying copies of a message. Those copies may allow a spy to pilfer information from extra photons without being detected.

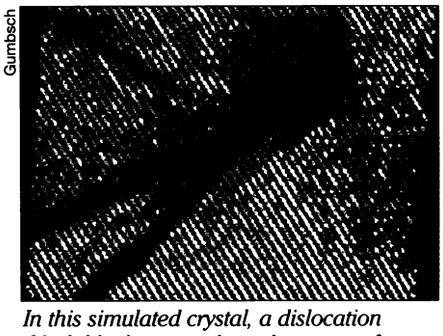
The researchers are making a new version of the turnstile in a tiny cluster of semiconductor atoms, or quantum dot, hoping to boost photon output and operating temperature. *—P. Weiss*

Supersonic defects have the right stuff

You don't need to be in a jet or rocket to break the sound barrier. Striking a hard blow on a piece of metal can do the same thing.

Using computer simulations, researchers have found that a structural defect can spread through a material faster than the speed of sound, which is several thousand meters per second in a typical metal. These defects, known as dislocations, arise when deformation of a material forces perfectly aligned planes of atoms to slip past each other. Hitting the family car with a shopping cart, for example, sends dislocations running through the fender, forming a broad dent.

Previously, theorists thought that these dislocations couldn't break the sound barrier, says Huajian Gao of Stanford University. However, he and Peter Gumbsch of the Max Planck Institute for Metallurgy in Stuttgart, Germany, found that under certain conditions, materials can violate this rule.



Gumbsch

In this simulated crystal, a dislocation (dark blue) moves through tungsten faster than the speed of sound. It creates the equivalent of a sonic boom, indicated by the feathery trails left in its wake.

The researchers simulated the behavior of atoms in a thin strip of tungsten at temperatures between 10 and 70 kelvins. A sharp blow to the virtual metal initiates a supersonic dislocation, indicated by telltale shock waves left behind. The waves are produced when atoms trailing the dislocation get squeezed togeth-