"It's hard to say what will ultimately come out of this," says Jeffrey Bokor, a physicist at the University of California, Berkeley. "You never really know in advance. But this is very creative, thought-provoking work."

Bokor thinks that Nuss may be underestimating the potential applications of the technique. "Traditionally, this region of the electromagnetic spectrum has been difficult to work in, so people have avoided it. But now that we're seeing new technologies for handling this type of radiation, unanticipated applications will undoubtedly emerge," he says.

"This is an interesting example of science," Bokor muses. "Nuss starts out looking at pulse propagation in semiconductors, and the next thing you know, he's looking at slabs of bacon."

T rays pass through a sealed envelope (a), revealing an enclosed business card (b) and generating an image of the card (c).

Now that word has gotten around, colleagues are wandering into Nuss's laboratory with all kinds of ideas for applications of T-ray imaging. Thoughts range from searching skin or tissue samples for cancer cells to looking for chocolate chips inside cookies. Because T-ray imaging excels at finding objects just below dry, nonmetallic surfaces, at locating hidden water deposits, and at distinguishing gaseous emissions, potential practical uses crop up in arenas as diverse as screening computer circuits and chimney flues to checking out fruits and vegetables for freshness or fat content.

The military might find uses for it in radar or remote-sensing systems. In quality control, one could, in theory, scan fabrics, car parts, or building materials for manufacturing flaws. A homeowner might scan dry walls for wet insulation, structural beams, or perhaps water dripping from a hidden plumbing leak. Peering into sealed packages poses other opportunities. Presumably, a company could check a product's integrity before shipping, while mail handlers could search letters for explosives.

"We're still trying to get a feeling for this technology's strengths and weaknesses," says Nuss. "We're asking the question: What can this technique do that other imaging techniques can't do? That's the most important work to do at the moment, before worrying about commercializing it."

Puzzling over spin-off technologies that T-ray systems might spawn, Miller recalls the startled reaction of a colleague at the Baltimore conference when Nuss displayed an image of the contents of a sealed envelope.

"He turned to me and said, 'There may a new market out there for foil-lined envelopes.' " □

Technology

A silicon chip with a lot of nerve

The science fantasy of computers that send signals straight to a brain has taken a small step toward reality.

Peter Fromherz and Alfred Stett, physicists at the Max Planck Institute of Biochemistry in Munich, have made a silicon chip that can directly stimulate a nerve cell. Their so-called silicon-to-neuron junction, reported in the Aug. 21 Physical Review Letters, triggers a single nerve cell in a leech without killing the cell.

"It is possible now to interface individual neurons with silicon microstructures in both directions," they say, "from silicon to neuron, by stimulation of a [membrane] spot, and from neuron to silicon, using a metalfree field effect transistor."

In previous artificial nerve stimulators, metal leads tended to corrode and shed toxic by-products. In contrast, the silicon chip propagates a voltage pulse from a tiny spot on the cell membrane. This causes a buildup of positive charge that trips a neuronal impulse.

The new chip complements "neuron transistors" that receive ionic nerve impulses, transforming them into an electric impulse on a silicon chip. Together, the two microstructures offer the possibility of direct, two-way communication between a nervous system and machinery.

Still, employing the device for medical purposes—to control an artificial limb, for example—lies far in the distance, the scientists conclude. Exactly how practical it will prove, they say, "remains to be seen."

Stealth surgery on brain tissue

A robotic arm, guided by a computer programmed with missile-tracking software, can now deliver pinpoint doses of radiation to tumors in highly sensitive areas of the body, such as the brain and spinal cord.

The extreme accuracy of the system may make it possible to treat on an outpatient basis some cancers that are not amenable to surgery, says John Adler, a neurosurgeon at Stanford University Medical Center.

Called computer-mediated stereotaxic radiosurgery (CMSR), the new technique combines software adapted from Cruise missile guidance systems with robotic manipulators and a high-powered X-ray machine.

Before surgery, a CAT scan generates a detailed three-dimensional map of the target. The robotic arm then compares its own X-ray images with the mapped target, tracks and locks onto a tumor, and delivers a dose of radiation without harming surrounding tissues, says Stanford physicist Richard Cox.

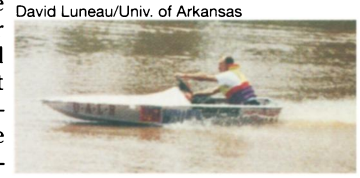
As a result, physicians may be able to kill off some types of cancers without opening a patient's skull or spine, Adler says.

Solar splash

An electric boat powered only by the sun sped across water recently at a record 25 miles per hour.

The Trojan Warrior, designed and built by engineering students at the University of Arkansas in Little Rock, sports an aluminum hull and an engine adapted from an industrial forklift. In last month's regatta on Lake Michigan, the craft, powered by solar cells and sun-charged batteries, raced 300 meters in 26.38 seconds. In a test of endurance, Golden Eagle, a hydrofoil built by Japan's Kanazawa Institute of Technology, traversed 30 kilometers in 2 hours.

David Luneau/Univ. of Arkansas


Solar-powered boat.