# Biomedicine

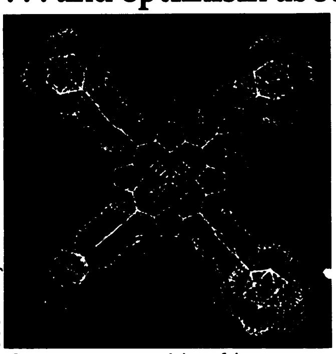
## Good news for early cancer diagnosis . . .

Scientists have developed an extremely sensitive urine test that can identify patients with bladder cancer, raising hopes the painful and invasive techniques currently in use may become unnecessary within the next few years. The test detects a protein discovered only two years ago — autocrine motility factor (AMF) — which is secreted by cancer cells and helps them spread to other sites in the body. In a study reported in the Oct. 5 JOURNAL OF THE NATIONAL CANCER INSTITUTE, the test detected all 22 patients with bladder cancer. It wrongly indicated a positive result in two of 27 patients without cancer. The researchers, led by Raouf Guirguis of the National Cancer Institute, say the test holds promise for detecting bladder cancer at stages early enough to allow successful treatment.

Using a urine sample added to tumor cells, the test measures the cells' ability to pass through an artificial membrane. The researchers used a newly developed immunological assay for AMF to confirm the test results.

They estimate it may take two years to fine-tune the test before large-scale clinical trials can begin. Each year, more than 46,000 people in the United States develop bladder cancer, which causes 10,000 deaths annually.

## . . . and optimism about a novel therapy


UCSF/Wiley Jarvis

*Computer graphic of boron bomb's atomic structure.*

A custom-designed, boron-containing compound that tumor cells absorb and retain preferentially has potential as a cancer therapy, scientists report. When the compound is irradiated with a beam of "slow neutrons" — a form of low-energy radiation that does not by itself cause tissue damage — the boron atoms split and "explode" like tiny atomic bombs, killing the cancer cell. Researchers say experiments on cultured hamster cells and in mice with cancer indicate the treatment is one of the more promising new applications of "neutron capture therapy." Scientists have experimented with similar treatments since the 1950s, but with poor results.

Stephen B. Kahl and his colleagues at the University of California, San Francisco, developed the molecular "package bomb" as a 20-sided solid with one atom of boron-10 — a neutron-absorbing isotope of boron — at each of the molecule's 12 corners. Four or more of these icosahedrons are bound together to a molecule of porphyrin, an iron-containing molecule that remains preferentially in cancer cells.

The advantages of this approach are many, Ralph Fairchild of the Brookhaven National Laboratory in Upton, N.Y., told SCIENCE NEWS. Since neutron beams can penetrate far into the body, even deep-seated tumors can be targeted, he says. And because the boronated compound actually enters the tumor cells — rather than simply binding to the outside membranes as is the case with similar experimental therapies — the approach is effective with only one-tenth the amount of boron that would otherwise be required. Boron is normally nontoxic but becomes radioactive when exposed to slow neutrons. Fairchild notes that Kahn's boron compound is the most effective of a half-dozen target compounds his team has looked at so far.

Within one to two years, the San Francisco researchers say, clinical tests may begin on patients with a deadly form of brain tumor called glioma. Preliminary experimental results were presented recently at the American Chemical Society's national meeting in Los Angeles.

# Physics

## Electron excitement in three dimensions

Just as light waves can be thought of as streams of particles (photons), particles such as electrons can be thought of as waves. And, like overlapping waves in which crests and troughs cancel or reinforce one another, waves associated with electrons create interference patterns.

That wave-like property of electrons is the basis for a recently proposed technique for determining the three-dimensional atomic structure of surfaces. The technique, called photoelectron holography, produces the electron-generated equivalent of the visible-light holograms now seen so often as a security feature on credit cards and in three-dimensional displays.

In photoelectron holography, a burst of finely tuned X-rays illuminates a small patch on a crystal surface. The X-rays excite atoms in the illuminated area, forcing them to release electrons. Some electrons travel directly to a nearby detector while others first rebound from neighboring atoms before completing their journey. Because the direct-flight and scattered electrons travel slightly different distances to reach the detector, the waves associated with the electrons produce an interference pattern. In the Sept. 19 PHYSICAL REVIEW LETTERS, John J. Barton of the IBM Thomas J. Watson Research Center in Yorktown Heights, N.Y., shows theoretically that if such a hologram can be obtained and measured, then this two-dimensional interference pattern can be mathematically converted into a three-dimensional image showing the locations of atoms on the crystal surface.

Unlike the scanning tunneling microscope, a widely used tool for tracing a surface's atomic bumps and hollows, photoelectron holography offers the possibility of not only showing atomic locations but also identifying the atoms. By tuning the illuminating X-rays to a particular wavelength, researchers force only atoms of a certain element to respond, producing a characteristic "signature" that identifies the emitting atoms and possibly the scattering atoms.

Because individual atoms yield only one electron, a photoelectron hologram is actually the sum of many events. "Because it takes many thousands of photoelectron events to create the hologram, we're really looking at the average [atomic position] over the illuminated area of the crystal," Barton says. The technique would work best with a single-crystal sample or a composite sample made up of a thin film laid down on a crystal surface. If the material is too disordered, then no clear picture of the surface can be reconstructed from the hologram.

Although photoelectron interference is a fairly well-known phenomenon, until Barton's work no one had thought it useful to measure the full interference pattern in two dimensions. No one understood that the pattern was actually a hologram. "My paper shows that if you can make the measurements, then you can determine the structure," Barton says. "The real question comes down to: Is it feasible to make these measurements?" Barton and his colleagues are now attempting to build a suitable detector to test the idea.

## Steps on the road to the SSC

With the decision on where to build the $5.3 billion Superconducting Super Collider (SSC) less than two months away, delegations from the seven contending states (SN: 1/30/88, p.68) met last week with Energy Secretary John S. Herrington to plead their cases. Later this month, Herrington will receive a confidential report from a departmental task force outlining in more detail the strengths and weaknesses of the various state proposals. Drafts of environmental impact statements for each site were released last August. The task force will receive public comment on the evaluations this month and issue a final report in December.