Biomedicine

Magnetic field attracts attention

"I sing the body electric," wrote Walt Whitman, but researchers at the Johns Hopkins University Applied Physics Laboratory in Laurel, Md., sing the body magnetic. The researchers have recently begun animal trials measuring the magnetic field of the brain to locate epileptic seizures and monitor brain swelling.

The whole body, says Hopkins researcher Steven Hansen, is a conductive medium filled with saline solution and pulsating with electricity. This is especially true of the brain, where electrical signals pass between nerve cells called neurons. "Epilepsy," explains Hansen, "is neural activity where neurons are misfiring, either singly or massively. When it's massive, you have a seizure."

Some types of seizures elude the usual medical efforts to pinpoint their location. In such cases, doctors try to locate the seizures by drilling holes in the patient's skull and running wires into the brain to pick up the associated electrical signals. The brain and skull tissue, however, can change the signals as they pass through, obscuring the location of the seizure. Says Hansen, "I've had doctors tell me it would be nice just to know which side of the brain to look at."

Magnetic fields have no such problems. "Any time you have an electric field, you have a magnetic field associated with it," says Hansen, and "tissue is transparent to magnetic fields." The magnetic field created by the brain's electricity passes unchanged through tissue, much as the field of a magnet passes through paint to stick to a refrigerator door. Using a device 10 billion times more sensitive than a compass, Hansen and his co-workers are scanning the magnetic fields produced by rat brains in which they have induced epileptic seizures, using them as models to perfect the technique for use in humans.

Related research in the same lab is using similar techniques to detect brain edema — swelling in the brain caused by injury. As fluid enters an injured brain, the conductivity of the brain changes. Like the airport metal detector that alerts guards to conductive objects such as keys and metal guns, the sensor, when developed for hospital use, should be able to alert medical personnel to increased conductivity — meaning increased fluid and chance of death — in the brains of injured patients. Current methods for continuous monitoring, says Hansen, call for pressure sensors implanted beneath the patient's skull. Scans using radiation, such as CAT or PET scans, cannot be used for continuous monitoring because of the risk of radiation exposure.

Development of the devices may take three to 10 years, he says.

For want of successful vaccination . . .

The war against measles isn't going according to plan. In 1978, a federal health official targeted 1982 as the year in which U.S. measles would be wiped out. But the disease is still around, and in the first half of 1986 there were 3,921 reported cases — more than twice as many as in the first half of 1985, according to a report by the Centers for Disease Control (CDC) in Atlanta in the Aug. 22 MORBIDITY AND MORTALITY WEEKLY REPORT.

Only about 3 percent of the cases could be pinned to virus brought in from outside the United States. About half the patients were unvaccinated (half of those were too young), but the other half had received vaccinations that apparently failed to "take," according to the CDC epidemiologists. While the number of reported cases is less than 1 percent of what it was before the advent of the measles vaccine, the total for the first half of 1986 is nearly four times that reported for January through June 1983.

Technology

Setting a sooty trap for arsonists

A fire set by an arsonist often destroys the evidence that connects the arsonist with the crime. Gone are the splashes of gasoline, kerosene or paint thinner used to start the fire. But all is not lost. Soot deposits sampled at the scene of a fire sometimes contain traces of by-products resulting from the burning of these combustible liquids. Researchers at the National Bureau of Standards (NBS) in Gaithersburg, Md., have now developed a chemical method for detecting these by-products.

The burning of liquid hydrocarbons such as gasoline generates, among other things, a group of compounds called polycyclic aromatic hydrocarbons. NBS scientists use a solvent to extract these compounds from soot particles. Then they run the extracts through a gas chromatograph to detect and identify specific components.

This chemical test is "a very simple one that could easily be used as a forensic device," says NBS chemist Stephen N. Chesler. The method, however, is still experimental, he adds, and needs further work.

In laboratory tests, the researchers burned household materials like wood, plastics and synthetic fibers under controlled conditions. With no gasoline present, they found that only small amounts of aromatic hydrocarbons show up in soot deposits. In contrast, when gasoline and other combustible liquids are added, the soot contains easily detectable quantities.

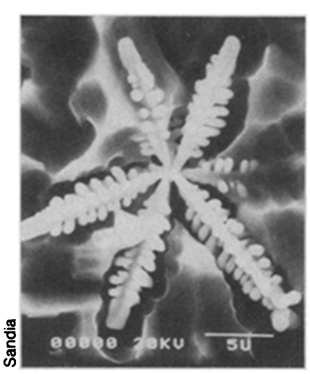
NBS researchers also obtained soot samples from test fires deliberately set in abandoned buildings by experts at the Treasury Department's Bureau of Alcohol, Tobacco and Firearms. They were able to identify which ones had been started using gasoline or some other hydrocarbon-based "accelerant." The test, however, would not work if such materials had been previously stored in a building.

Adding strength to glassy ceramics

A dose of zirconium oxide (zirconia) may be just the tonic for turning partially crystalline materials that are part glass and part ceramic into tougher, stronger substances. Glass-ceramics, which combine traits of both materials, are widely used in applications ranging from cookware and artificial teeth to large telescope mirrors and electrical switches.

In a recently patented process developed by Keith Keefer and Terry Michalske at the Sandia National Laboratories in Albuquerque, N.M., powdered noncrystalline zirconia is mixed with various glass-ceramic ingredients. The mixture is first heated to melt and dissolve all of the components and then carefully cooled to create tetragonal zirconia crystals within the glass.

These tetragonal crystals are unstable. If a crack happens to pass near such a crystal, the crystal spontaneously shifts into its larger, less symmetrical monoclinic form (shown in the photo). This essentially closes the crack, making it harder for the crack to grow. As a result, the material is tougher than it would be without the zirconia additive.


Sandia

The presence of noncrystalline zirconia in the glass-ceramic also makes the material more resistant to corrosion. Sandia researchers expect that fibers made from zirconia-toughened glass-ceramics could be used to reinforce concrete for explosion-resistant bunkers or nuclear power plant containment buildings.