Biomedicine

Julie Ann Miller and Joan Arehart-Treichel report from Washington at the 12th International Symposium on Neuroradiology

Brain scanning for the common man

Successful surgery to abate severe epilepsy requires removal of the brain tissue that initiates seizures. This focal site differs from one patient to the next. Positron emission tomography (PET) has been successful in identifying focal sites and is used routinely at the University of California's Los Angeles medical center (SN: 1/31/81, p. 78). But this technique, now available at relatively few research centers, will never reach the community hospitals, says Frederick Bonte of the University of Texas Health Science Center in Dallas. PET requires expensive equipment, a cyclotron and a supporting team of chemists and engineers.

Bonte is now exploring the possible use of a simpler, less expensive technique, called single-photon tomographic scanning (SPECT). This scanner determines cerebral blood flow by detecting ^{133}Xe inhaled by a patient. Bonte compares patients with temporal lobe epilepsy and normal volunteers. In many of the epilepsy cases, Bonte observes decreased blood flow in the focal area. Regional blood flow increases in the focal area during seizure, in a few cases where the patient has a spontaneous seizure during the 4-minute study. Bonte says his work thus far demonstrates its inherent potential for emulating the successes of PET.

Ultrasound and meningitis

Bacterial meningitis — inflammation due to a bacterial infection of the membranes enveloping the brain and spinal cord — can be successfully treated with antibiotics. Still, one-third to one-half of the infants who contract this disease experience neurological complications or even death. Henrietta K. Rosenberg of the University of Pennsylvania School of Medicine in Philadelphia and colleagues find diagnostic ultrasound can successfully be used to determine any neurological damage in infants with bacterial meningitis and thus lead to further treatment when necessary. For instance, one of the 24 patients they studied was a five-month-old girl whose ultrasound scan revealed excess water in the brain. A shunt was inserted into her brain to drain the water; she suffered no lasting damage.

Scans monitor tumor behavior

Size and location of a brain tumor can be accurately charted with computerized axial tomography (CT). But the biological behavior is not well-characterized. Nicholas J. Patronas of the National Institutes of Health reports positron emission tomography (PET) can reveal how aggressive a tumor is, how it responds to treatment and whether it affects the surrounding brain. In experiments on more than 50 patients he and colleagues find that aggressive tumors have higher metabolic rates than nonaggressive tumors. With PET, but not with CT, the investigators also could distinguish, after radiation treatment, between areas of dying cells and recurrent tumors. In addition, the PET scans revealed a secondary effect — low metabolism in areas adjacent to or remote from the tumor. These data helped explain clinical symptoms not indicated by the tumor alone.

Radioactive rings shrink eye tumor

The most common tumor inside the human eye is malignant melanoma of the choroid — a blood vessel membrane that lies between the retina and the sclera (white outer coat enclosing the eyeball). Currently there is controversy over whether such tumors should be removed by surgery, which may possibly encourage rather than halt tumor spread. Barbara Japp of the Ontario Cancer Institute in Toronto and co-workers have devised an alternative treatment for large choroid malignant melanomas. It consists of temporarily implanting multiple concentric rings of iridium-192 wire into the sclera in order to shrink the tumor. The technique shrank tumors in six patients.

Earth Sciences

Cheryl Simon reports from New Orleans at the annual meeting of the Geological Society of America

Solar marker: A natural rockfall?


USGS

Slabs of the Anasazi solar marker.

Every solstice a pointed shaft of sunlight moves between rounded sandstone slabs and intersects a spiral etched onto the wall of Fajada Butte in Chaco Canyon, N.M. (SN: 8/26/78, p. 148). When the sophisticated solar calendar (which also marks lunar cycles) was discovered in 1977, its construction was credited to the Anasazi Indians whose culture flourished in the 10th or 11th centuries A.D. Now, researchers who have visited the site say that the formation is natural, similar to rocks in the area that over time have rotated from a horizontal position to a vertical one.

Evelyn Newman and Robert Mark of the United States Geological Survey in Menlo Park, Calif., and R. Gwinn Vivian of Arizona State Museum in Tucson, were lured to the site by their interest in archaeoastronomy. "We were surprised when it looked like a natural occurrence," says Mark. They explain that natural weathering processes erode the soft base of the rocks. A pedestal forms, the slabs begin to tilt and, finally, they topple into a vertical position.

The researchers compared the three slabs in the Anasazi marker to building materials used by the Indians and find that the largest building blocks weighed only one-fifth as much as the largest slab in the marker. The Indians may have adjusted the slabs and rounded their edges to enhance the marker's precision, the researchers say. The finding that the slabs may have been emplaced naturally is significant, they say, because different levels of skills are required to plan and construct a midday solar marker than to recognize and use a natural one.

Anna Sofaer, the artist who discovered the site, says the physical evidence is not strong enough to prove that the Anasazi Indians either did or did not construct the marker. She stresses that even if the formation is natural, one cannot assume the tribe was less sophisticated, as she believes the researchers implied in an article published in the Sept. 10 SCIENCE.

Migration away from nuclear waste

The chemical composition of seawater changes in response to intense heat, a factor that must be considered before high-level radioactive waste is stored in supposedly stable geological materials, say researchers from the University of Minnesota. Edward Thornton and William Seyfried Jr. studied the effects of thermal diffusion on chemical processes in fluid-saturated media — in this case seawater and fine-grained marine clay. Over a distance of 30 centimeters they created a thermal gradient ranging from 300°C to 100°C. They report that a "profound change" occurred compared with results of experiments conducted at constant temperatures. In less than 1,000 hours major constituents of seawater, such as sodium and chloride, migrated from the hot zone to the cold zone. Further studies are needed to determine the effect of thermal diffusion in water surrounding rock exuding large amounts of heat. "The main point is that there is a strong tendency for dissolved components to migrate in a nuclear waste repository," Thornton says. He hopes to learn what effect an altered chemical environment will have on a waste canister and its contents and ways such changes could affect the movement of waste material should a canister be corroded or otherwise damaged.