ECT: All seizures are not the same

For several decades, psychiatrists have thought that certain dose levels of electroconvulsive therapy (ECT) ease the symptoms of severe depression in many patients by sparking a seizure throughout the brain. A group of recent research findings, however, suggests that considerably lower doses of electric current, when applied to both brain hemispheres, may result in therapeutic effects comparable to those at higher, "standard" doses. In findings presented at the International Conference on Electroconvulsive Therapy last week in New York City, researchers also said that it may not be the seizure itself but the *ending* of that seizure — through a brain reaction triggered by ECT — that is the key to the controversial treatment.

"The anticonvulsant properties of ECT may be critical," says Harold A. Sackeim of the New York State Psychiatric Institute in New York City. "Our goal in using ECT is to potentiate the process that ends the seizure."

The chemical reactions in the brain — and related physiological changes — that squelch a seizure are poorly understood. The New York researchers report, though, that low doses of ECT just strong enough to create a seizure in both brain hemispheres appear to be as effective in many cases as higher standard doses. The lower dose, which varies from person to person, also causes fewer memory problems.

Sackeim, Sidney Malitz and co-workers randomly assigned 52 patients with severe, incapacitating depression to two treatment groups. About half received bilateral ECT, in which electrodes stimulate both brain hemispheres. The rest had only the right, nondominant hemisphere stimulated in what is known as unilateral ECT. Bilateral ECT is more commonly used, but researchers disagree about the comparative effectiveness of the lower-energy, unilateral version.

Instead of giving every patient the same standard dose of electrical energy, the investigators determined the minimum amount needed to produce a seizure in each subject. The range of these "seizure thresholds" was greater than 10-fold, says Malitz. The average seizure threshold increased by 52 percent over the course of six to 10 treatments administered twice a week; there were greater increases among bilateral ECT patients. By the end of the treatment, 70 percent of the bilateral group was markedly less depressed, compared with 28 percent of the unilateral subjects.

This suggests that low-dose seizures of the same length work far better when both brain hemispheres are stimulated, says Malitz. "The main issue is dosage," he explains. "At a relatively low dose, bilateral ECT has strong therapeutic effects, while those of unilateral ECT are weak." Higher doses of unilateral ECT are probably required to reduce depression.

In further tests, says Sackeim, it appears that temporary memory loss, especially for events in the several months prior to the first ECT session, does not become progressively worse over the course of low-dose bilateral treatment. In contrast to these results, cumulative memory losses are fairly common when standard doses are used.

Low-dose unilateral ECT creates even fewer memory deficits, but may fail to relieve depression because "different regions in the right hemisphere probably have different seizure thresholds," says Sackeim. The regions most critical to dampening a depression may also require higher doses for a seizure.

This notion is supported by a study of cerebral blood flow in 28 ECT patients, directed by Isak Prohovnik, one of Sackeim's co-workers. Using detectors on the scalp to track radioactive ions, Prohovnik finds distinctive patterns of cerebral blood flow reduction 50 minutes after bilateral and unilateral ECT. Bilateral ECT results in equal flow reductions in both brain hemispheres, with more severe losses in the frontal lobes. Blood flow changes after right unilateral ECT are largely limited to the right hemisphere; the most reduction occurs in the central lobe.

"Antidepressant medication is also associated with blood flow changes in the frontal lobes," says Prohovnik, "but we may only be seeing the local path of current discharge in the brain after ECT. The deep structure of the brain also needs to be studied."

Changes in cerebral blood flow appear to influence ECT's anticonvulsant action, says Sackeim; reductions in neurotransmitter metabolism and increases in seizure threshold over the course of treatment probably also spur the anticonvulsant process.

In addition, there is evidence that anticonvulsant drugs such as carbamazepine lessen the symptoms of depression and mania, points out Robert M. Post of the National Institute of Mental Health. ECT produces strong anticonvulsant effects in animals, he adds. A series of seven daily shocks given to rats suppresses experimentally induced seizures for up to five days. In humans, ECT may somehow trigger the brain to shut off the seizures, observes Post, but there are only scattered indications of how this happens.

There are also questions, says Sackeim, about the long-term effects of ECT on chemical processes in the brain and on depressive symptoms. But if other investigators reproduce Sackeim's findings, "ECT practitioners may end up using lower doses of bilateral ECT," says psychiatrist Max Fink of the State University of New York at Stony Brook. —*B. Bower*

Genes of AIDS viruses

The genes of viruses thought to cause AIDS have now been analyzed in detail, several independent groups of scientists report. These new analyses provide the strongest indication thus far that the two independently isolated viruses linked to AIDS (SN: 4/28/84, p. 260) are basically the same, and that they have few similarities to the other viruses in the group known as retroviruses. Each research team reports the sequence of the more than 9,000 subunits, called nucleotides, that make up the viral RNA, the material that encodes the genetic information in these viruses.

The AIDS-linked virus known as HTLV-3 was analyzed in a collaboration of scientists at the National Cancer Institute in Bethesda, Md., Harvard University, E.I. du Pont de Nemours and Co. in Wilmington, Del., and Centocor, a biotechnology company in Malvern, Pa. Their report appears in the Jan. 24 NATURE. The other version of the virus, called LAV, was analyzed by scientists at the Pasteur Institute in Paris, France. Their results are published in the January CELL. Two California genetic engineering companies also have analyzed the genetic sequences of AIDS viruses; one report will be published in the Feb. 1 SCIENCE. □

Laser-activated switch

Los Alamos Nat'l Lab.

One of the latest developments out of Los Alamos (N.M.) National Laboratory is the super-fast, high-power electrical switch. A pulse of laser light activates the device, turning electricity on in less than a billionth of a second.

The principle behind the photoconductive switch is similar, at a much more powerful level, to that of the familiar "electric eye" that operates mechanical doors. William Nunnally (above), the switch's developer, says the new switch is at least 10 times faster and more precise than any existing high-power switch. It is also safer than conventional switches since the operator is not in direct contact with the high voltage.

Los Alamos plans to use the switch for particle accelerators, laser applications and "Star Wars" research.