dives was planned, and at the other, on the East Coast, the focus was on biological, chemical, and geologic processes at bottom stations. About 25 scientists were at each and they proposed multidisciplinary projects for the next 1 to 2 years. These are the first of planned annual workshops to broaden participation in submersible research and make advance planning.

Conclusions

Manned submersibles are being utilized for detailed studies of the deep-sea floor to extend the coverage provided by oceanographic ships. After a slow start, the marine scientific community is learning how to utilize these submersibles effectively and economically to undertake biological and geological studies. In a departure from more traditional oceanographic procedures, series of complementary cruises are being undertaken by multi-institutional groups to study problems of the deep-sea floor. Submersibles now appear to occupy a permanent place in the list of necessary oceanographic facilities.

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11. We would like to thank R. D. Ballard and L. A. Shumaker for discussions on the uses of manned submersibles. Supported in part by NSF grant IDO73-9736. This is Woods Hole Oceanographic Institution Contribution No. 3156.

NEWS AND COMMENT

Psychosurgery: National Commission Issues Surprisingly Favorable Report

They drilled the holes in my forehead. They cut the nerves over my right eye, and my legs stopped paining immediately. And I told him [the surgeon]. He said, "All right, now we'll take care of your back." And he cut the other nerve. In five days I was walking out. That's how great it was. I had no more pain in my back and leg, and I haven't had any since. Right there on the operating table, first the leg and then the back. I felt just terrific.—T.R., a psychosurgery patient.

Every year for the past 5 to 10 years, an estimated 400 psychiatric patients in this country have had psychosurgery. T.R. (quoted above) was one of them. In 1974, he was operated on in a last-ditch effort to relieve the severe depression and intractable pain that had disabled him for a dozen years, ever since he fell off a ladder and injured his back. During the intervening years, this 43-year-old man had tried everything else medicine had to offer. He took drugs, he had back surgery, and he underwent more than 150 courses of electroshock therapy. By the time he turned to psychosurgery, T.R. was a very desperate man.

T.R.'s case is one of many that are described in studies that were conducted during the past year for the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, which has just released a report* approving psychosurgery in carefully defined circumstances. The commission, which previously has recommended guidelines governing research on fetuses (*Science*, 17 October 1975) and prisoners, was created by Congress in 1974 to be the voice of and for the people in controversial areas of scientific experimentation (*Science*, 2 August 1974). At the time, psychosurgery was one of those controversial areas that was very much on Congress's mind.

Several years ago, a trio of physicians started quite a flap when they suggested that psychosurgery might be useful in taming the violent, including the leaders of the civil rights riots of the late 1960's. Their notion was not exactly greeted with enthusiasm. Then, in 1972, a Washington, D.C., psychiatrist named Peter R. Breggin launched what seemed like a one-man crusade against psychosurgery with articles with titles such as "The return of lobotomy and psychosurgery," published first in the *Congressional Record*. Partly at Breggin's urging, former Senator J. Glenn Beall (R–Md.) proposed that the bill establishing the commission be amended to ban all psychosurgery in the United States. In its stead, he accepted a provision that mandated that the commission conduct an investigation of psychosurgery in the United States and recommend policies defining under what, "if any," circumstances it should be allowed. There was a strong bias in Congress against such brain operations. And it is probably fair to say that several, perhaps most, of the 11 members of the commission approached their study of psychosurgery with a negative bias.

Therefore, it came as something of a surprise when the commission adopted its report that "encourages" the Secretary of Health, Education, and Welfare to support research on psychosurgery and that, in general, treats psychosurgery benignly. Asked by *Science* what it was that influenced the commission favorably, its chairman, J. Kenneth Ryan of Harvard Medical School, replied, "We looked at the data and saw they did not support our prejudices. I, for one, did not expect to come out in favor of psychosurgery. But we saw that some very sick people had been helped by it, and that it did not destroy their intelligence or rob them of feelings. Their marriages were intact. They were able to work. The operation shouldn't be banned."

In saying this, Ryan and the other commissioners are by no means endorsing the clearly destructive prefrontal lobotomies that were performed on an estimated 40,000 to 50,000 mental patients 25 years ago. (As one commission staffer put it, "We all agree that the prefrontal lobotomy was a bust.") What they are approving is study of the newer forms of contemporary surgery in which only small, selective areas of brain tissue are destroyed.

The data that so impressed the com-

*For information about the availability of the commission's report and supporting documents, write to the commission at 125 Westwood Building, 5333 West Bard Avenue, Bethesda, Maryland 20016.

mission were gathered by scientists who were asked to undertake special investigations of psychosurgery. One man surveyed the world literature of the past 5 years and two teams of researchers personally evaluated the psychological and neurological status of patients who had psychosurgery between 1965 and 1975. Between them, they interviewed and administered a battery of tests to 61 psychosurgery patients. Most of the patients were middle-aged, all were white, and all suffered from long-standing and very debilitating mental illness.

One of the studies was conducted by Hans-Lukas Teuber and his colleagues, Suzanne Corkin and Thomas E. Twitchell, at the Massachusetts Institute of Technology. Teuber, a neurophysiologist, was chosen by the commission for two reasons. For nearly 30 years, Teuber has been studying the side effects of brain injury, dealing with previously healthy individuals who suffered brain damage in an accident or in combat. The commission thought him particularly well qualified to examine patients whose brains had been selectively damaged by psychosurgery. In addition, it was no secret that Teuber did not think much of psychosurgery. In the 1950's he had seen firsthand the psychosurgical zombies that the rest of us have seen only in the movies or on the late show. As he told *Science*, "I think I was temperamentally opposed. I was not prepared to see any positive response from patients." But a positive response was what he found in some patients who had what Teuber calls this "strange operation." In retrospect, however, Teuber realizes that he should have been prepared to find that some patients had been helped. His own research over the years showed him that the brain has great resiliency. "That should have been a sign," he says.

Teuber studied 34 men and women who had been operated on by the same surgeon. Each had had a cingulotomy, an operation in which a bundle of nerve fibers connecting the frontal lobes with the limbic system (thought to be the seat of emotions) is interrupted by precise, well-placed lesions. The amount of tissue that is destroyed is very small.

The 34 cingulotomy patients were operated on for a variety of problems including persistent pain and depression, depression alone, obsessive-compulsive illness, anxiety neurosis, and borderline schizophrenia. In terms of success, Teuber reports that the patients with pain accompanied by depression "stand out." Nine of 11 such patients were cured of long-standing illness that had been refractory to drugs, psychotherapy, and electroshock. Five of seven patients with depression alone were markedly better after psychosurgery. The rest did not do so well. Four patients who had obsessive-compulsive disorders, for example, were as resistant to psychosurgery as they were to everything else. The reactions of the other patients were mixed and no clear pattern could be found; the investigators were left with the preliminary conclusion that cingulotomy appears to be the most effective for patients with depression alone or accompanied with pain.

Teuber's observations are remarkably similar to those of Allan F. Mirsky of Boston University School of Medicine, who, with Maressa Hecht Orzack, also did a study for the commission. Mirsky is well known for his research on brain functioning in primates and human beings. If they had any prejudice against psychosurgery before they undertook this study, they kept it to themselves. In a recent telephone interview with *Science*, Orzack said they were "neutral" or, perhaps, a little "skeptical." However, she says, "when we began seeing the patients, we were just amazed."

Mirsky, Orzack, and their colleagues, evaluated 27 patients who had psychosurgery performed by one of three surgeons. One of them practices in the Northeast, the other two on the West Coast. None of the three performs the same kind of operation. Therefore, the type and the amount of brain tissue that is targeted for destruction varies from surgeon to surgeon. On the basis of their examinations, the researchers concluded that 14 of the 27 patients "derived considerable benefit" from psychosurgery; most of them had been treated for depression. Several others showed "slight" or "moderate" improvement. There was no evidence of serious side effects.

Although Mirsky and Teuber independently concluded that, in at least some cases, psychosurgery appears to work, they could not explain how. The fact that four different surgeons using four different techniques obtained similar results complicates an already difficult problem.

One possibility is that the effect of psychosurgery is brought about more by chemical than by purely physical changes in the brain, that it is not the severing of nerve fibers, for example, but the neurochemical consequences of it that count. Thus, Teuber speculates that the destruction of a small amount of brain tissue at any one of a number of sites may lead to important alterations in the availability of neurotransmitters at certain critical locations, possibly even at some remove from the area attacked by the surgeon. Thus, it may be neurochemical changes that affect behavior.

Another possibility (not incompatible with Teuber's idea), which Mirsky suggests in his report, is that those individuals who do best with psychosurgery end up with a rather selective loss of cognitive functioning. This does not significantly impair an individual's ability to think and function—in fact, one recovered patient is going to college—but some patients do show a subtle deficit in their ability to deal with certain abstract concepts as measured by a couple of highly specific psychological tests. ". . . [R]ecovery from the severe and crippling psychiatric illnesses from which these patients suffer may in some cases be made at a price—the loss of certain cognitive capacities. And in some way, this loss permits the patient to function in a more effective and less troubled way," the report states. What it amounts to is that in some patients too much thinking causes emotional distress. In suggesting this explanation, Mirsky frankly admits that observations of patients yield a picture that is by no means consistent (his hypothesis, he says, "cannot be considered to have robust support in these data"), but he argues that the association between recovery and selective cognitive loss should be pursued, as he and Orzack are now doing. (Teuber, too, will continue his studies under contract from the commission).

A third possibility, and one that cannot be dismissed, is that successful psychosurgery is nothing more than a placebo effect. The commission was struck by the fact that both Mirsky and Teuber reported that patients described their recovery in almost religious terms and that they were utterly devoted to their surgeons, who, in turn, were unusually attentive to their patients' day-to-day postoperative care. The fact that each of the patients had had years of other types of therapy and, therefore, plenty of opportunity to have had a placebo response before, is among the evidence against the placebo hypothesis, but there are not now sufficient grounds to rule it out.

Generally speaking, psychosurgery in this country has been regarded, among those who have any regard for it at all, as part of medical practice rather than an experimental procedure. As a result, it has not been subjected to as much rigorous research as is needed if questions about its value are to be answered. Psychologist Elliot S. Valenstein of the University of Michigan, who surveyed the literature on psychosurgery published since 1971, discovered how little psychosurgery is done with anything that even resembles an eye toward research. Among other things, he established that of approximately 110 neurosurgeons in

the United States who say they do some psychosurgery, only 30, or 27 percent, publish their results. And, Valenstein indicates, much of what they publish is not very good. Very few articles contain adequate information about patients, he reports. Of 700 articles reviewed, only 153 contained firsthand data about patients. In particular, there is an abysmal lack of data on postoperative follow-up of patients. For example, only 25 percent of articles from the United States reported that patients had been evaluated by more than three objective tests of intelligence, memory, ability to concentrate, and other indicators of psychological capacity after surgery. Valenstein rated the articles for scientific merit and found 90 percent of them seriously lacking. If the Secretary of HEW and other health officials take seriously the commission's first recommendation that research on psychosurgery should be encouraged and supported, things may improve.

Although it is apparent that the commission ultimately was persuaded by the Teuber, Mirsky, and Valenstein reports that *research* on psychosurgery should be encouraged, it must be noted that in an open hearing that was held well before the commission reached its conclusions, it did hear testimony against allowing any psychosurgery at all.

Representative Louis Stokes (D–Ohio), a member of the Black Caucus, testified that there have been no successful psychosurgical operations, that it is impossible for anyone to give informed consent for such surgery, and that because it could become a tool for the repression of minorities, it should be banned. Stokes has a bill that would prohibit any psychosurgery in hospitals receiving federal money. (At an earlier meeting at which the commission considered issues of minorities in medical experimentation generally, they heard a somewhat different view of the question of psychosurgery and blacks. In fact, there has been very, very little psychosurgery on blacks or members of other minority groups and, it was suggested by Dr. Jesse Barber of Howard University, and others, it may be that minorities are actually being deprived of therapy to which they have a right.)

Another hearing witness who spoke against psychosurgery was an attorney named Gabe Kaimowitz who, in 1973, successfully argued in a Michigan state court that involuntarily confined mental patients cannot be subjected to psychosurgery because there is no way one can presume them able to give informed consent.

In addition, the commission heard from representatives of a number of neurological and psychological societies who tended toward the view that psychosurgery is an *experimental* procedure to be employed only as a last resort.

The one person from whom the commission did not hear was psychosurgery critic Breggin who has done so much to turn opinion against the operations. Breggin, who told *Science* he has "done all of the critical studies of the psychosurgery literature," and who considers himself "something of a resource on the subject," was offended because the commission did not extend a personal invitation to him to testify at the hearing. Instead, he received only a mimeographed notice of invitation which he thought inadequate, so he stayed home.

The Recommendations

The commission's recommendations on psychosurgery reflect the evidence that psychosurgery can be good for one's mental health but their stringency reflects equally the sense of uncertainty and potential for abuse that remains predominant in this field. The commission recommends that psychosurgery be performed only at an institution that has an "institutional review board" composed of individuals of diverse professional, social, and racial backgrounds. The board must certify that the surgeon who intends to perform the operation is competent, that the patient will be carefully evaluated before and after surgery, that the patient has been chosen for psychosurgery for the right reasons, and that there is informed consent. Before psychosurgery can be performed on children, prisoners, or mental patients who are involuntarily confined, the matter must be taken before a court that will determine whether the patient's best interest is being served. (In this, the commission is wittingly making a recommendation contrary to the ruling of the Michigan court in the Kaimowitz decision, saying, "With respect to the question of safety and efficacy, it is clear that the information presented to the court in 1973 differs significantly from that which has been presented to the Commission.")

In addition, there is a recommendation that HEW establish some sort of national registry to gather data about what types of psychosurgery are performed and for what clinical reasons. And finally, the commission recommends that the Secretary withdraw *all* HEW money from any institution that allows psychosurgery to be performed in violation of the proposed regulations.

It is too soon to know what effect the commission's report will have on psychosurgery. No one expects the incidence to increase dramatically but it may increase a little. More important, the report may encourage a few people to look at psychosurgery in a new light, and it may stimulate research to find out whether it works and, if it does, why.

—BARBARA J. CULLITON

Mirex: Persistent Pesticide on Its Way Out

The Environmental Protection Agency and the state of Mississippi have finally gotten together, after 6 years of tortuous political hassles and unremitting pressure from environmental groups, to write the final chapter in the story of Mirex, the anti-fire ant compound said to be one of the most persistent pesticides known to man.

The proposed settlement, which is expected to be approved shortly by EPA administrator Russell Train, recommends that current Mirex registrations be phased out over an 18-month period. Under the plan, the aerial spraying of the strong version of Mirex, called 4X bait, would have to be terminated by the end of 1976. Cancellation for a recently developed diluted form of Mirex, called Mirex 10 : 5, would go into effect the end of 1977. Stocks of Mirex 10 : 5 would be permitted for selective ground application until June of 1978. After that, no more Mirex.

Mirex is a persistent pesticide in more ways than one, for seldom has such a substance been the focus of so much interagency friction, politicking, investigations, litigation, and emotion. The En-