

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, recom-

mends 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-

vironmental Defense Fund (EDF), representing a coalition of environmental organizations, has been after Mirex since 1970 when it brought an unsuccessful suit claiming that the environmental impact statement for the chemical was insufficient. The EPA tried to cancel registrations for Mirex in 1971. For the past 3 years, the fire ant program has been the subject of a marathon administrative hearing to determine whether Mirex should be allowed to remain in use. Adoption of the plan would mean termination of the hearing.

To some people, the case against Mirex—evidence of carcinogenicity in mice and rats, its stability in the environment, the fact that some of it degrades to the carcinogenic and neurotoxic pesticide Kepone—is overwhelming. But Mirex has continued to be staunchly defended by the Department of Agriculture (USDA) and, until recently, many Southern officials and politicians.

#### Hot Public Topic

Fire ants have been a burning political issue in the South since the late 1950's when the pests, inadvertently imported from Argentina in the early part of this century, had spread to nine southern states and attained the proportions of a large regional nuisance, now infesting some 133 million acres. The fire ant does not do significant damage to crops or livestock. It bites people, however, and when it does they holler loud enough to be heard in Washington. Fire ants deliver venomous stings comparable to those of wasps or bees. One ant can deliver up to 20 bites, and when thousands come boiling up out of a mound to swarm over a hapless human it is very unpleasant and potentially fatal to someone allergic to the venom. The ants are a menace in backyards and school yards, and the mounds they build in fields and pastures interfere with farming operations. Farmers say they are frequently unable to get field help because workers don't want to expose themselves to attack.

Introduced in the South in 1962, Mirex was hailed at the time as the perfect replacement for dieldrin and heptachlor, which were raising the mortality rate for many animals in addition to ants and were subsequently found to be carcinogenic. Mirex was admired for its selectiveness—mixed in small quantities with soybean oil and corncob grits it only kills ants—and its effectiveness. Ants drag the bait home and wipe out their whole colony.

In a 50-50 matching funds operation, the Department of Agriculture launched a giant campaign—to cost \$200 million

over 12 years—aimed at eradication of the pest. As more data on Mirex accrued, including evidence that it caused cancer in mice and was harmful to crabs and shrimp, the EPA, under pressure from environmentalists, issued a cancellation order on the pesticide. Allied Chemical Corp., the manufacturer of Mirex bait, appealed the order and, following hearings, the EPA issued new guidelines calling for a modified spraying program aimed at control, rather than eradication, of the ants.

The administrative hearing on Mirex was convened in 1973 to find out more about it and the severity of the fire ant scourge. As the hearings wore on, it became clear the noose was tightening on Mirex. There was new evidence from the National Cancer Institute that the substance was carcinogenic in rats as well as mice. In the summer of 1975 Allied Chemical, which claims that the Mirex battle was being fought more on political than scientific grounds, decided, rather than to continue defending its use, to discontinue its manufacture. It gave its Aberdeen, Mississippi, plant to Mississippi for \$1 and sold its inventory to the state. Mississippi thus became the sole registrant for Mirex.

Meanwhile, more damaging evidence was accumulating. A few months ago the EPA reported that up to 25 percent of the population living in sprayed areas may have Mirex stored in their bodies. Of the bodies of 186 Southerners analyzed so far (the total sample is 1000), small concentrations of the pesticide have been found in the adipose tissue of 41.

And then there was the Kepone disaster that reached full-blown proportions early this year. Employees of Life Science Products in Hopewell, Virginia (a subcontractor of Allied Chemical), were found to be suffering from severe nervous system disorders from exposure to the pesticide. Kepone is a close relative to Mirex, and it is estimated that 2 to 5 percent of the latter substance eventually degenerates to Kepone. The extent of the danger posed by this finding is not clear, but the Kepone disaster delivered a mammoth jolt to public awareness and helped a lot of people realize, as John Quarles of EPA says, that Mirex was by no means "all benefit and no risk."

William Butler, general counsel of EDF, believes that all this information finally softened up officials in Mississippi who did not want their state to end up holding the bag in the event of a Mirex disaster.

The people at USDA were left out in the cold in the negotiations between

EPA and Mississippi, and the feeling at EPA seems to be that it serves them right. USDA consistently opposed efforts to reduce the spraying program and, says Butler, the department "has used the fire ant program as a major stick to beat EPA with on the Hill." An EPA official says USDA went through 4 years of hearings "sitting there sucking their thumbs," and not devoting any money to research on alternatives to Mirex because they were so confident that the program's popularity would outweigh the objections.

The EDF thinks the phaseout plan still permits too much Mirex to be dispersed in the South before its use is terminated, but figures that if the agreement were not accepted at least as much Mirex would be introduced into the environment by the time the hearings were wrapped up and EPA took action. The Mississippians favor the plan for the opposite reason: according to Bill Fancher, consultant to the state agricultural commissioner, they fear that if the plan were not accepted, the hearings would terminate, the judge would rule against Mirex, and the South would be left with no phaseout time at all.

#### Manufacturer Wary

In light of the latest development, the whole problem may be academic. Hooker Chemical Co. of Niagara Falls, N.Y., the supplier of technical grade Mirex, recently told Mississippi that it would sell no more to the state unless it were assured immunity from liability. Hooker is in hot water these days for polluting Lake Ontario, and although it stopped making technical Mirex in 1967 the plant has been found to be discharging up to 1 pound a day of the substance, causing damage to seagull eggs and fish. Mississippi doesn't have enough Mirex on hand even to complete the proposed program.

Frightened as industry has become, it would be a mistake to conclude that either the producers or supporters of Mirex have been persuaded by the scientific evidence. A lawyer from Allied Chemical says that company's studies showed Mirex had no ill effects on rats or mice. Fancher, a former USDA official, says, "I'm not convinced it's harmful. It's one of the safest materials I've ever used . . . a lot of people make statements that really don't understand the situation. Most of our problems are associated with communication," that is, the publicity surrounding the affair. Jim Lee, biologist at USDA, says, "We do not share the concern about the alleged human problem or the so-called environmental problems." He says the depart-

ment's environmental monitoring program "has convinced us that Mirex is one of the least hazardous pesticides in the environment today." Says Lee, "residues per se I don't think mean anything," and "I don't think anybody has determined what persistence means." He claims that the evidence of ill effects on aquatic life was derived under artificial conditions and that out in the field there is at least a thousandfold safety factor.

There continues to be disagreement on the ultimate threat the fire ant poses. Environmentalists claim they have just about reached their natural limits; Southerners claim that the ants, who favor a warm, moist climate, could spread as far west and north as California and New Jersey. Entomologists not employed at the USDA agree that total eradication of the ant (which is still the heart's desire of USDA) is a preposterous goal given the amount of money it would entail. They say, too, that persistent attacks on the pests have prevented them from settling into an ecological niche where the population would become stable and predictable. They believe the ant population is beginning to level off nonetheless and that ground applications of pesticide in

areas where the ants come in contact with humans would be sufficient to keep the problem under control.

Biologist E. O. Wilson has said, "the fire ant control program in the South is the South Viet Nam of entomology." Another entomologist, William L. Brown of New York State College of Agriculture and Life Sciences, calls the aerial spraying program "absolute insanity." An EPA official says, somewhat hyperbolically, "There's been nothing like Mirex in the history of man . . . the government pouring stuff over 25 percent of a state's territory free of charge that is known to be toxic, and continuing in the face of great opposition."

An issue that has been sucked so deeply into the vortex of politics cannot readily be brought under control by facts alone; probably the emotion generated in a public that is becoming increasingly frightened by the loading of toxins into the environment has as much to do as anything else with closing down the Mirex program. Butler adds that without constant pressure from environmentalists and their efforts to stiffen spines at EPA, "this would have collapsed on the shoals of politics long ago." An EPA lawyer concurs: "We'd never do anything

around here if it weren't for the environmentalists."

The question now is what to substitute for Mirex. Congress recently voted \$400,000 to the Agricultural Research Service and \$100,000 to EPA to work on this problem. USDA has looked over thousands of compounds and found nothing promising. The work that has generated the most interest is that directed by Earl Alley at Mississippi State University, who is seeking to develop a version of Mirex that will be less long-lived (it has a half-life of 12 years). Alley says the work was on the back burner for a while but now it's been moved to the front, and field tests are planned soon, using Mirex combined with amines that are supposed to make it more polar. Mirex is very nonpolar, which means it is nonwater soluble. Ideally, the new compound would degrade in a matter of days because it only takes about 4 days for the bait to become rancid and unattractive to ants. As for non-Mirex alternatives, the cupboard is now bare, but an EPA lawyer says he believes the free enterprise system will come up with something before long—"there's a lot of money in the fire ant market."

—CONSTANCE HOLDEN

## Recombinant DNA: A Critic Questions the Right to Free Inquiry

When the issue of recombinant DNA came up last month before the Senate health subcommittee, the following exchange occurred between the senators and Robert Sinsheimer, chairman of the biology division at Caltech:

*Kennedy:* Do you agree that in terms of magnitude this is of as great significance as the splitting of the atom?

*Sinsheimer:* What this technology does is to make available to us the complete gene pool of evolution. We can take the genes of one organism and recombine them with those of others in any manner we wish. To my mind that is an accomplishment as significant as the splitting of the atom.

*Schweiker:* Are you saying that all that has gone before, we now have the power to change in some way—the evolutionary process?

*Sinsheimer:* Yes.

The senators did not follow up on the implications of the comparison they

were drawing, but the analogy between nuclear energy and the recombinant DNA technique is one that Sinsheimer himself has raised. In a voice too gentle and well-mannered to receive much attention, he has been asking whether the scientist's claim of an absolute right to free inquiry should not sometimes be limited in the interests of society. Nuclear energy may yet turn out to be one such field that would better have remained forbidden territory. The recombinant DNA technique, he suggests, could prove to be another. "To impose any limit upon freedom of inquiry is especially bitter for the scientist whose life is one of inquiry; but science has become too potent. It is no longer enough to wave the flag of Galileo," Sinsheimer said in a lecture last year to the Genetic Society of America.

With the notable exception of Erwin Chargaff of Columbia, Sinsheimer has stood virtually alone in his doubts about the wisdom of going ahead with the recombinant DNA technique, a method of genetic engineering which in essence allows each gene in an organism to be manipulated, whether for study or practical purposes. Most biologists believe that the work should proceed under appropriate safeguards. That approach has prevailed, and is embodied in the guidelines for research issued by the National Institutes of Health this June. Most of the public debate about the technique has revolved around what particular level of safeguards is appropriate, and public attention now rests on the next logical stage in the approach, that of ensuring that the NIH guidelines are followed by other government agencies and by industry (see box).

The approach of the NIH guidelines is a reasonable and responsible first step which has the full endorsement of those who first drew attention to the possible hazards of the technique, including biologists such as Paul Berg, Maxine Singer, David Baltimore, and Norton Zinder. How can Sinsheimer both differ from such eminent authorities and have a case worth making? The answer, perhaps, lies