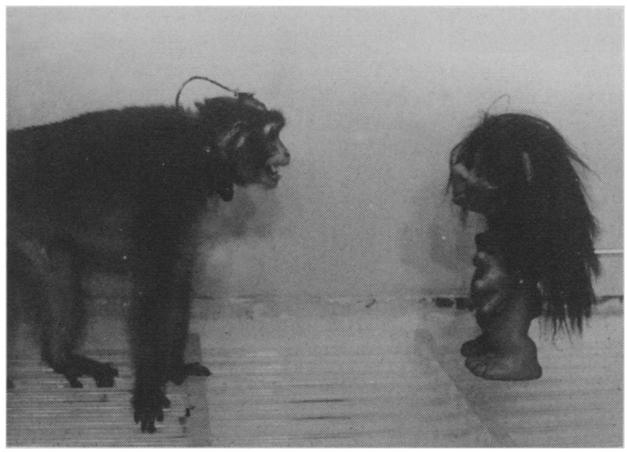
Radio EEG's incite or inhibit violence in monkeys.



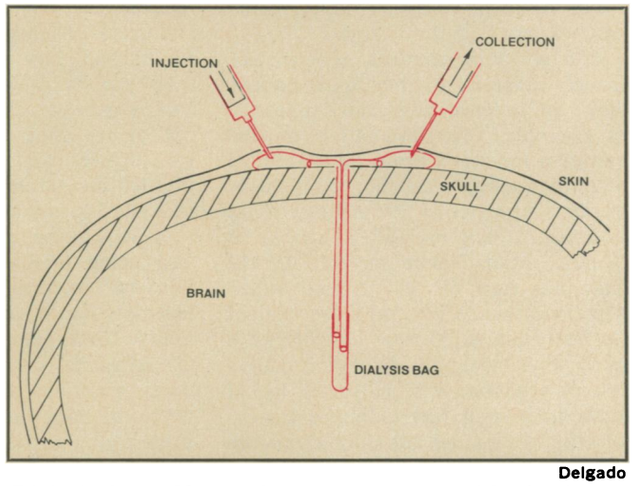
Photos: Delgado

Brain stimulation prompts monkey to attack doll.

science news
OF THE WEEK

The biology of violence: Focus on the brain

Modern methods are leading to better diagnosis of biologically induced violence



Delgado

Dialysis bag: Chemical communication with the brain.

An Institute of Social Research poll showed last summer that Americans have many concepts of what constitutes violent activity (SN: 7/3/71, p. 14). To study the neurological mechanisms of violence, however, some brain physiologists, neurologists and psychiatrists have narrowed their concept down to repeated physical attacks on another member of one's species for personal advantage, as opposed to the goal-directed aggression that is generally lauded in Western Society. Recent results and thrusts of research into the biology of violence were discussed at a symposium of the National Committee for Research in Neurological Disorders last week in New York City.

As José M. R. Delgado, professor of physiology at the Yale University School of Medicine reported, the sites involved—according to animal experiments in which violence reactions are triggered by implanted electrodes—seem to include the thalamus, the hypothalamus, amygdala, cerebellum, central gray and several other select brain areas. (Although brain mapping with electrodes goes back 80 years, some of the most publicized work with remote stimulation, by radio, was conducted by Delgado at Yale in the 1950's and 1960's.)

By implanting electrodes sequentially in these brain areas, Frank Ervin, associate professor of psychiatry at Harvard Medical School, has induced violence in the cat. Making lesions in any of these areas snuffed out the cat's aggressive behavior. One can also inhibit biologically induced violence by stimulating the septum and caudate of the brain, Ervin says. It is obviously efficient for an animal, or human, to have a preprogrammed predisposition, or set of responses, for violence. But what, he asks, calls the violence program into play? What inhibits it?

Ervin cites a recent study his group conducted suggesting that damage to vulnerable areas of the brain might provoke a person to violence. They selected 134 patients from their psychiatric clinic who had repeatedly lost control of themselves in the past—engaging in violence, experiencing impairment in speech or reading, or giving other indication of brain dysfunction. Men outnumbered women 10 to 1 in this study, compared with a ratio of 5 to 1 in national homicide statistics. The persons chosen for the study, Ervin explains, were not just terrified of doing violence. Some 60 percent had been arrested at least once. Some had committed murder. And ironically, some of them had sought help of a physician before committing an act of violence, yet had been shrugged off with advice such as "learn to control yourself," or "seek out your minister or neighborhood policeman." These patients seem to have lost control over something small, such as a wife's burning the toast, or a traffic snarl. Such recollections as "I became violent in spite of myself," or "it was as if I were watching myself in horror," were frequent among those persons.

Of the 134 patients, the Harvard psychiatric investigators found that 28 percent showed striking abnormalities in brain-wave patterns from the temporal lobe of the brain. (The temporal lobe includes the amygdala and hippocampus.) More than 50 percent responded to anticonvulsants and for six months or more did not experience attack behavior.

Ervin believes that many Americans

may resort to violence because of some brain damage. Some 85 percent of those persons appearing before a court for personal violence have appeared before, he says, and such statistics might possibly point toward an inherent tendency toward violence. Arthur Ward, chief of neurology at the University of Washington School of Medicine, contends that since about 15 percent of uncomplicated deliveries in the United States entail some kind of anatomical damage, which may or may not affect the brain, birth trauma might account for considerable violent behavior in the population. Getting hit on the head in sports could also do the trick, he stresses.

But unfortunately biologically triggered violence cannot be explained so simply. Ample evidence was also cited at the conference that central nervous system feedback—sensory input, emotions, memory, culture, environment—to crucial brain violence centers can strongly shape a basic biological susceptibility to violence. Delgado has found, for example, that stimulation of one area of a monkey's brain might induce different responses depending on memory or the situation. When electrodes prompted a male monkey to attack, he lit into another male monkey in the cage, not into his girl friend. When stimulated, another chimpanzee snarled but remained submissive in front of a more powerful opponent. Ervin cites a case of a woman who had tried to kill someone several times. In the laboratory the woman did not exhibit violence until she saw the chief nurse.

Relationships between epilepsy and violence are also being studied. According to Richard Masland, chief of neurology at the Columbia College of Physicians and Surgeons, only one to two percent of all epileptic seizures result in violence. Most seizures consist of loss of consciousness, rigidity of body, violent jerks and momentary loss of speech. But Delgado points out that when epilepsy leads to violence, it seems to originate in the temporal lobe—the seat of some other kinds of violence. And as B. J. Wilder, associate professor of neurological science at the University of Florida, says, applying certain chemicals—penicillin—or metals—cobalt—to particular areas of an animal brain has touched off epileptic seizures that have continued on and off for a few years. This evidence also suggests that epileptic violence is a biological disorder. But with epilepsy, as with some other kinds of biologically provoked violence, biology seems to be keenly influenced by nervous system inputs and feedbacks. Francis Forester, professor of neurology at the University of Wisconsin, has been following some epileptics who have seizures when they hear certain kinds of music.

Electrophysiology, microreadings of individual brain cells, computer compilation of data, tissue cultures and other biochemical advances are allowing a better diagnosis of biologically induced violence, and investigators are now trying to use the techniques for treating such disorders as well. Paul Crandall and Richard Watter of the department of neurology, University of Southern California, for example, have implanted sensors into the brains of epileptic patients. When the patients have an attack, brain activity is telemetered into the USC laboratory. This way the investigators hope to get a better idea of where the brain epileptic lesion is, so that they can operate on it more successfully. About 150 epileptics a year undergo brain surgery, but only about half are completely cured. Delgado, however, anticipates chemicals replacing surgery in the correction of biological violence in the near future. His group has successfully inserted small dialysis bags into animal brains and withdrawn chemicals through the bag at the time of brain stimulation. He foresees that chemicals might be inserted into strategic areas of the brain in a similar manner.

As might be expected, attention is also being directed toward the possibility of controlling nervous system inputs to brain violence centers. J. K. Penry, for example, is now developing telemetry to correlate epileptics' seizures, emotions and drug effects with temporal lobe activity. Forester has been trying to decondition the epileptics who experience seizures at hearing certain music. Alpha-wave autonomic control (SN: 11/6/71, p. 314) over seizures has been tried but has not worked so far.

Both, Penry of the National Institute of Neurological Diseases and Stroke, and Ward, caution, though, that new therapies for biological violence should not be applied to patients before it is known exactly what brain centers are being affected. "We know what nuclei we are stimulating with electrodes or drugs," Penry says, "but we do not know how far the stimulation spreads—which brain currents are open or closed. This is what is holding us up."

Some of the techniques under discussion are probably already technologically possible in humans (quieting a classroom of boisterous youngsters with remote electrical stimulation of the brain, for example). Ward cautions investigators to be especially careful not to apply radical electrical or chemical methods until they can confidently predict the behavioral consequences. And even if the consequences can be predicted, he and others—like their medical colleagues on related subjects (SN: 10/23/71, p. 275)—stress the necessity of seriously considering the ethics of such mind manipulation. □

Cancer compromise: NCI looks to future

After months of lobbying convolutions and legislator-scientist confrontations, the Senate and House agreed last week to a conference committee report on legislation to strengthen the national effort to lick cancer. The bill was expected to be signed by the President this week. It will take effect 60 days later.

The conference report reflects both the House and Senate bills (SN: 10/9/71, p. 243). It is a little closer to the House bill, however, in that the National Cancer Institute would stay intact, and within the National Institutes of Health family. Under the compromise, the President would appoint the NCI director (in the past the NCI director has been appointed by the director of NIH, with the approval of the Secretary of Health, Education and Welfare). The National Cancer Advisory Council, which gives out NCI grants, would be expanded from 15 to 18 persons, and would go under the name of the National Cancer Advisory Board. The board would also give out only some 60 percent of the grants, those over $35,000. The NCI director would channel the other 40 percent himself. The NCI would have a new three-man advisory panel, to be appointed by the President. What type of people would comprise the panel and how the panel would fit into the NCI administrative setup is not spelled out.

The House-Senate compromise also calls for the NCI to send its budget directly to the Office of Budget and Management with comments, but no changes, by the director of NIH. Although the bill emphasizes research over patient care, it calls for special funds for detecting oral, cervical and breast cancer, and for setting up 15 new centers for patient treatment as well as for research. Although money for cancer research in fiscal 1971 is set at $337 million, the compromise bill authorizes up to $1.6 billion over the next three years. The President will submit his budget for cancer research in January. It will then be up to Congress to decide whether the full $1.6 billion should be appropriated.

Supporters of this final legislation expect it to accelerate by several months the approval of grants of $35,000 and under; grant approval for larger grants would probably still take the usual six or seven months. The bill, supporters believe, would also ensure that money earmarked by Congress for cancer work would go to NCI and not end up in other NIH coffers.

Critics, however, view the legislation as not much different from the current NCI-NIH arrangement. The director of NIH, for example, could be appointed to the National Cancer Advisory Board