Human Aggression Linked to Chemical Balance

In the first reported study of its kind with human beings, federal researchers say they have evidence that "human aggression ... may have a biological component to it." The component appears to revolve around the critical balance of two or three key brain chemical neurotransmitters.

The findings are consistent with previous animal studies indicating that aggression seems to be mediated by the production levels of serotonin and norepinephrine. Animal results also indicate that dopamine may be related to aggression, but that was not corroborated in the human study, says Frederick K. Goodwin, chief of the National Institute of Mental Health's clinical pyschobiology branch.

The results are additionally significant because the research subjects — 26 Navy enlisted men — had no apparent psychiatric problems. This means that in addition to influencing the occurrence of various mental illnesses, "a biological variable ... can also play a role in determining a range of behaviors considered reasonably normal," Goodwin told SCIENCE NEWS.

Goodwin and his colleagues first evaluated the aggression levels of the volunteers, each of whom "had some difficulty adjusting to service life." Their ratings were based on interviews, records of past behavior and on a 10-item aggression scale that included nonspecific fighting, specific assaults, temper tantrums, antisocial behavior not involving police, school discipline, loss of jobs, difficulty with police, difficulty with military judicial system, difficulty with military discipline and separation from military service because of pre-existing personality disorder.

The men had a wide range of aggression scores among themselves — but their mean score was nearly five times higher than that of a control group of "normal" subjects (employees at the National Naval Medical Center in Bethesda, Md.). In general, the 26 enlisted men were considered to have poor control over impulsive behavior, high levels of anger and aggression and poor judgment.

But an initial analysis of the volunteers' cerebrospinal fluid also showed a wide man-to-man variability in metabolite levels of serotonin. "Serotonin is known to be an inhibitory, modulatory influence" in animal aggression levels, Goodwin says (SN: 12/4/76, p. 362). "Animal studies have suggested that a decrease in serotonin level coincides with a rise in aggressiveness." Similar work also indicates that increases in norepinephrine and dopamine correlate with increased aggression.

Subsequent, more detailed, studies of the men's spinal fluid yielded a "very high correlation between behavior and chemical levels," Goodwin says. The men with the lowest aggression scores almost invariably had the highest levels of serotonin — up to five times higher than those at the opposite end of the scale. And those who were most aggressive had the highest levels of norepinephrine. Dopamine levels, however, did not correlate with aggressiveness as they had in animal studies. "This was an interesting aspect," Goodwin says. "It may signal some kind of difference between species."

Comparison of the results with various control groups revealed that the chemical-behavior relationship in aggressive personalities is essentially unique, contrasting sharply with correlations among nonpatients, manics, depressives and alcoholics. Particularly noteworthy among these comparisons was the clear chemical difference between depressed patients and those aggressive personalities who had attempted suicide. The results suggest that attempted suicide may not always be an act of desperation by a depressed person, but may constitute "an aggressive act motivated by anger, rage and usually the desire on the patient's part to manipulate a person, a situation or an institution," Goodwin says.

Goodwin, who presented the report at the recent meeting of the American Psychiatric Association, says the chemical-behavior link "doesn't have to be genetic. Environment, particularly early life experiences, can have an influence" on biochemical balance. The treatment implications are obvious, he says. "There may be medications which could alter such [aggressive] conditions.... Lithium has been seen to have beneficial effects on aggressive prisoners," he says.

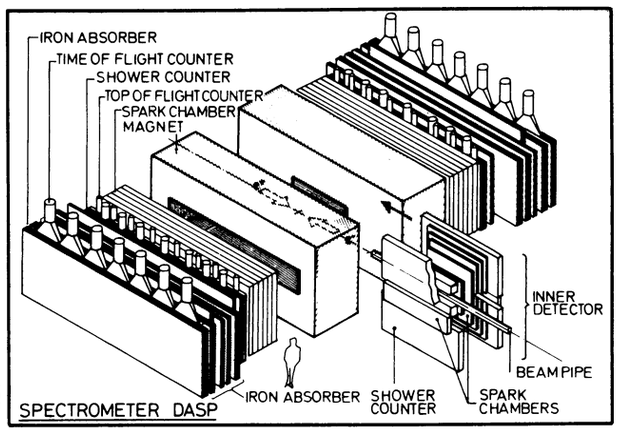
Lithium has also been shown to boost serotonin levels in animals, Goodwin says. There are indications that other drugs for depression might do the same thing and help counteract aggression, he says. "Of course there are ethical issues, but to me this is just a question of common sense ... as long as you make sure the subjects are volunteers." This is the "first direct measure" of such metabolites in men, he says. □

Beautifying the quark theory

The most massive subatomic particle yet found by physicists is the upsilon, which weighs in at about 9.5 billion electron-volts (9.5 GeV). It was first discovered last summer at the Fermi National Accelerator Laboratory in Illinois (SN: 8/6/77, p. 87; SN: 8/13/77, p. 100). Few laboratories in the world are able to put that much energy at the disposal of the forces that create new particles, so there was and is a difficulty concerning confirming experiments. A number of independent confirming experiments would be desirable, especially some confirmations in which the upsilon is produced in different ways.

The Fermilab experiment struck very energetic protons against atomic nuclei to produce the upsilon. Another, very elegant, way of making new particles is through the annihilation of matter and antimatter in the collisions of electrons and positrons (anti-electrons). The electrons and positrons are energized in apparatus called storage rings and then collided head on. There are a few such installations around the world, but none of them had the requisite energy to make an upsilon. At the Deutsches Elektronen-Synchrotron (DESY) in Hamburg they decided to push for it, and they have made it.

DESY possesses the electron-positron apparatus called DORIS (Doppel-Ring Speicher). DORIS was designed to collide electrons of maximum energy of 3.5 GeV



DASP *is one of two detectors that found the upsilon particle in* DORIS's *electron-proton collisions.*