tions of pure lecithin available in the near future.

Although tardive dyskinesia is the first disorder to respond to choline treatment, researchers are optimistic that it will not be the only one. Among a number of other disorders they are now trying to treat with choline are mania and senile dementia.

A number of psychiatrists believe that mania may be caused by a relative lack of brain acetylcholine. As evidence, John Davis and his associates at the Illinois State Psychiatric Institute and, independently, Kenneth Davis, Berger, and Hollister report that when manic patients are given the drug physostigmine, their mood often changes. They gradually become more and more depressed, going through a normal stage and then sinking into severe depression. When he first saw this happen to a manic patient, Hollister said, "This is the most impressive and the most dramatic thing I have ever seen."

Manic patients are usually treated with lithium, which is fairly toxic and must be closely monitored. It may be possible, however, to potentiate the effects of lithium with choline and thereby give less lithium to manic patients. William Millington and Anthony McCall of the Massachusetts Institute of Technology find that when rats are given lithium, the effectiveness of dietary choline in increasing brain acetylcholine concentrations is enhanced. They speculate that one of lithium's actions may be to inhibit the efflux of choline from the brain.

The common senile dementia known as Alzheimer's disease also seems to result, at least in part, from a lack of acetylcholine. Several groups of investigators, including Peter Davies and his associates at the University of Edinburgh, David Bowen and his associates at National Hospital, Queen's Square, London, and Robert Perry and his associates at Newcastle General Hospital have recently shown that the disease is associated with a partial loss of neurons that make and use acetylcholine as well as with a reduction in activity of the brain enzymes that make acetylcholine from choline. These biochemical changes correlate with dementia scores on psychological tests.

Nonetheless, researchers have not yet reported any unqualified successes in treating Alzheimer patients with choline. David Drachman of the University of Massachusetts Medical Center speculates that because selective arrays of neurons may not function properly in patients with this disease, a general increase in brain choline concentrations may not be sufficient to correct the deficiencies of these neurons. He suggests that treatment with both choline and a drug that prevents acetylcholine breakdown may be more effective than choline alone. Another possibility, suggested by Janice Christie of the Medical Research Council Unit in Edinburgh, is that Alzheimer patients should be treated early in the course of their disease before their neurons degenerate too much.

Although investigators still hope that Alzheimer's disease may respond to choline administration, they believe that other disorders are too complex and involve too many kinds of neurotransmitters to respond to choline treatment alone. One of these diseases is Huntington's chorea, which does seem to be related to a lack of brain acetylcholine but which also is associated with many other degenerative changes in the brain.

Choline, then, is not expected to be a panacea for all disorders characterized by a lack of brain acetylcholine. But it may herald a new era in the treatment of neurological disorders. Choline is specific, in that it is only converted to acetylcholine by neurons that are able to and need to make this neurotransmitter. And it has no serious side effects.

Already some investigators are looking to precursors of other neurotransmitters for the treatment of other sorts of neurological disorders. For example, Arvid Carlsson and Marget Lindequist of the University of Göteborg in Sweden suggest that the amino acids tryptophan and tyrosine, which are presursors for the catecholamine neurotransmitters, might prove useful in the treatment of depression.

Although it is still too soon to say how effective neurotransmitter precursors will be in the treatment of psychological disorders, increasingly many investigators are sufficiently convinced by the evidence at hand to at least try this approach.—GINA BARI KOLATA

Speaking of Science

The Great Titration Contest

Football teams from Yale and Princeton rarely get into any of the major postseason bowls. In the spirit of the season, however, Princeton chemistry lecturer Miles Pickering has devised a suitable alternative competition that is more in keeping with the academic status of those institutions—The Great Titration Contest. The second annual edition of this formidable event was held this December in chemistry laboratories on the two campuses, and Yale squeaked through with a 51-49 win, keeping the team undefeated in postseason play. Yale won the first contest by the somewhat larger margin of 53-47.

In the contest, some 450 freshman inorganic chemistry students at each institution are given a solution containing an unknown quantity of sodium oxalate. The students titrate the solution with potassium permanganate to determine its concentration. In this year's playoff, 51 percent of the Elis calculated a concentration within one percentage point of the actual value, while only 49 percent of the Tigers achieved the same feat. Pickering is pleased by the narrowing of the gap between the two schools and predicts a Princeton win next year.

Titration was chosen for the context, Pickering says, because it is an "objective test of laboratory proficiency" that provides "an excellent benchmark for the teacher" in gauging how well students are mastering basic laboratory skills. The exercise, adds his Yale counterpart Robert Crabtree, places a premium on attention to detail and ability to follow instructions. The fact that only about half the students complete the titration accurately, despite a dry run the week before, is attributed to the fact that most of the students in the class are not chemistry majors.

The success of the titration contest opens up several other possibilities. In addition to the expansion of the contest to other schools, there might also be parsing contests for grammarians, dissection contests for biologists, and creating unusual names contests for physicists. The vistas are endless, and if the contests just happen to increase motivation of the students, that will be merely a fringe benefit.—T.H.M.

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