Anomalons get more and more anomalous

Anomalons — if they exist — are atomic nuclei with an abnormally strong propensity to interact with other nuclei. As such they could represent exotic and potentially very interesting states of nuclear matter. They might be swollen or ballooned nuclei, nuclei in strange nonspherical shapes or quark-gluon plasmas, nuclei in which the identities of neutrons and protons have been destroyed, leaving only the quarks that make up the nuclear particles and the gluons that bind them together. Last summer, at the end of the Sixth Heavy-Ion Study and Second Workshop on Anomalons, the conclusion seemed to be a somewhat tentative "yes" to the existence of anomalons (SN: 7/9/83, p. 20). Now come two experiments, one recently published, the other not yet made public, that cast serious doubt.

Evidence for anomalons first turned up a few years ago in experiments in which high-energy atomic nuclei struck solid targets. In such a collision the incoming nuclei often strike nuclei of the target material and fragment. Some of these fragments seemed to go anomalously short distances before they interacted with other nuclei in their turn. The question of anomalons' existence has always been full of statistical traps. How short does a fragment's free path have to be to qualify as anomalous? If anomalons exist, can experimenters be sure that they are not present and biasing the statistics in experiments used to calculate the mean free path of all fragments, against which the anomalous paths have to be compared? And so on. However, by last summer the consensus seemed to be, perhaps a little tentatively, in favor of anomalons. In a summary talk that delivered that opinion, Ingmar K. N. Otterlund of the University of Lund in Sweden suggested further experiments of the kind that had already been done, using either nuclear emulsions or stacks of plastic leaves, and of a third kind, using Cherenkov detectors.

It is the Cherenkov experiments that have now been done. Nuclear emulsion is the same as photographic emulsion except that it is made in blocks rather than in films. The paths of the nuclei show up as dark lines in the emulsion. In the plastic leaves, passage of the nuclei weakens the material so that proper etching brings out holes. The paths are followed through the stack of leaves by the alignment of the holes. The third type of experiment involves nuclei that enter a (transparent) solid or liquid material in which they happen to be going faster than the speed of light in that material. Consequently they emit a particular kind of light called Cherenkov light. Recording and analyzing this light can reveal information about the electric charge of the nucleus: where it was, how fast it was going and, in a sequence of counters, how far it flew.

In the experiment reported in the Feb. 13 PHYSICAL REVIEW LETTERS by J. D. Stevenson, J. A. Musser and S. W. Barwick of the University of California at Berkeley, the Cherenkov counters were Lucite paddles. Like most of the experiments on anomalons, positive or negative, this one was done at the Bevalac accelerator of the Lawrence Berkeley Laboratory (LBL). No evidence for anomalons was found.

As a result of the experiment, Stevenson told SCIENCE NEWS, he and his co-workers can say there is something wrong with the experiments that found anomalons in stacks of plastic leaves. The case of the emulsion experiments is more complicated, because the emulsion contains heavy elements not present in the plastic or the Lucite. If the anomalon phenomenon depends on an incoming nucleus striking such a heavy element, the emulsion experiments could still be correct. Stevenson suggests, however, that people who have believed in anomalons are revising their opinions.

One who is not doing so is Erwin M. Friedlander of LBL, who has been involved in a few of the positive experiments. In Friedlander's view, the most recent experiments serve to narrow the range in which the anomalon phenomenon should be looked for. He says that he and his colleagues did a global survey of all the evidence for anomalons in the world so far. Most of the evidence, he says, falls in ranges of flight and involves changes of electric charge (from parent nucleus to fragment) that the recent experiments did not search. "They have narrowed the range, but in no way invalidated the older experiments," he concludes.

Both sides agree that there is more work to be done. Stevenson wants particularly to test whether heavy elements in the targets have anything to do with the phenomenon. The end of the question is by no means near. —*D. E. Thomsen*

Dimming depression in stroke victims

A psychiatric drug used to treat depressed patients has been shown for the first time to be an effective treatment for the depression that often follows a severe stroke.

Researchers at Johns Hopkins University and the University of Maryland, both in Baltimore, report in the Feb. 11 LANCET that 14 stroke patients treated with the antidepressant drug nortriptyline were significantly less depressed than a similar group of 20 patients given a placebo.

"We feel that the success of nortriptyline in the treatment of post-stroke depression represents a potentially important advance," says Johns Hopkins psychiatrist John R. Lipsey, who headed the study. He was joined by psychiatrists Robert G. Robinson of Johns Hopkins and Godfrey D. Pearlson, radiologist Krishna Rao and neurologist Thomas R. Price of the University of Maryland.

The patients in the study all suffered a thromboembolic stroke, in which the blood flow in a major vessel to the brain is blocked, resulting in a massive seizure and brain injury. Partial paralysis and speech difficulties often follow these strokes. Each year 400,000 Americans have a thromboembolic stroke. Several recent studies directed by Robinson indicate that between 30 percent and 60 percent of patients who survive a stroke are clinically depressed, not just "down" or "blue." Their depressions usually last for at least six months. Prior to the study, half of the 34 patients had a major depression, said they experienced little or no pleasure from anything in their lives, felt worthless and often had sleep and eating disturbances.

Over a six-week treatment period, the patients in the study, their families, clinical examiners and nursing staff did not know who was receiving the antidepressant and who was on the placebo.

By the end of the study, patients given nortriptyline had an extremely low overall depression score compared with that for the placebo-treated patients. The depression score for each patient was based on a combination of responses to three standard depression scales.

Contrary to the belief that post-stroke depression is an understandable but usually untreatable psychological reaction, nortriptyline's effectiveness indicates that there is often a biological component that can be countered with antidepressant drugs.

"Some post-stroke depressions are psychological reactions to the consequences of a stroke and require psychotherapy," says Lipsey. "But we think the majority of these depressions are due to chemical imbalances in the brain." Neurotransmitters, the chemicals that facilitate the transmission of messages across brain cells, probably decrease following a severe stroke, he adds. Nortriptyline may act to correct the stroke-induced imbalance of two of these chemicals, noradrenaline and serotonin.

Stroke victims with injuries to the left frontal side of the brain usually have the most severe depressions, but Lipsey's group studied only six patients with left hemisphere damage alone. They are now examining patients with left-brain damage for their response to nortriptyline. Speech and communication skills are controlled by the left frontal brain.

"Our work requires some replicating studies," says Lipsey. "But we wanted to convince the general practice physicians who often handle stroke patients that antidepressants are effective in treating post-stroke depression." —*B. Bower*