The bottom's up, at long last

A group of 79 physicists, searching for three years through millions of pieces of evidence, has gotten the world's first direct look at the fabled B-meson. The elementary particle is a significant find not so much for itself as for what it packs around: an estranged b- (or bottom) quark; this discovery at the Cornell Electron Storage Ring (CESR) makes the b-quark the fifth quark species to be definitely accounted for, out of an anticipated six. Quarks themselves are significant, because they, with leptons, are conjectured to be the seeds of all matter.

It took finding the B-meson — made up of a b-quark and a u-quark — to get a glimpse at the b-quark, because quarks generally are notorious for traveling about in pairs consisting of a quark and an antiquark. The net result of such a union is that the one quark neutralizes the other's presence, much as a base neutralizes an acid, its chemical opposite. This is why the upsilon, discovered in 1979 (SN: 9/22/79, p. 196) and believed to be made up of a b- and anti-b-quark, left physicists ultimately uncertain about the b-quark's characteristics.

In the B-meson, high energy physicists now have their much-awaited observation of an unneutralized b-quark and therefore of its intrinsic, unadulterated properties. Comparable evidence already exists for the so-called u-, d-, s- and c-quarks (respectively, the up, down, strange and charmed quarks). Theoretical physicists are betting, furthermore, that in the near future, their experimental colleagues will also succeed in hunting down a t- (or top) quark.

Much of the credit for the landmark discovery lies with the physicists' strategy. It was common knowledge that B-mesons, if they existed at all, were very rare birds. Consequently, most past attempts to locate the particle had relaxed as much as possible the criteria any particle would have to satisfy in order to be considered a B-meson. Particles are not commonly seen directly in these experiments; instead, their presence is inferred by the tracks either they or their decay products leave behind in a variety of detection devices.

The CESR physicists, who represent eight universities (Cornell, Harvard, Ithaca College, Ohio State, Rochester, Rutgers, Syracuse and Vanderbilt), disdained previous strategies. Whereas others had hoped to spot as many B-mesons as they could by dilating the pupils of the detectors, as it were, the CESR participants opted to narrow the apertures to cut down on some of the obscuring background glare. As a consequence of their decision, they anticipated that many B-mesons would go unnoticed, but that the loss would be more than made up for, because the background of extraneous elementary particles would be reduced by even a greater factor. "A little luck, a lot of hard work and just the right insight were the keys to finding these needles in the haystack," David G. Cassel, a Cornell member of the group, told SCIENCE NEWS.

The CESR physicists based their criteria on information garnered from previous experiments, which indicated that the b-quark within the B-meson was given to decaying into a c-quark; the c-quark, in turn, had been observed to prefer decaying into an s-quark. It was by being choosy, as it were, by restricting their search to only those clues bearing the likeness of this conspicuously characteristic chain of events, that the physicists achieved their success. □

A chemical cause for Huntington's?

A human brain chemical has been found that may be part of the cause of Huntington's disease—an inherited, progressively degenerative, neurological disorder characterized by jerky movements, irritability, violence and profound mental deterioration. The chemical is quinolinic acid, a breakdown product of the amino acid tryptophan. It was identified by Robert Schwarcz and Richard M. Mangano of the University of Maryland School of Medicine in Baltimore and by William O. Whetsell Jr. of the University of Tennessee School of Medicine in Memphis. It is reported in the Jan. 21 SCIENCE.

Huntington's disease is known to involve the death of nerve cells in the basal ganglia — an area in the cerebrum of the brain — as well as the depletion of the two neurotransmitters, acetylcholine and GABA, that these nerve cells make. At the same time, the axons of nerves from the brainstem that reach into the basal ganglia are not affected, nor is the neurotransmitter they make — dopamine. Consequently, a relative excess of dopamine accrues in the basal ganglia.

In 1976 Schwarcz, along with Joseph Coyle and Robert Zacazk of the Johns Hopkins Medical Institutions in Baltimore, injected kainic acid — an amino acid not normally found in the brain and excitatory to nerve cells — into the basal ganglia of rats. They found that it produced neuropathological and neurochemical changes in the basal ganglia remarkably similar to those found in the basal ganglia of Huntington's victims (SN: 10/23/76, p. 263). In 1977, while working in Sweden, Schwarcz found that ibotenic acid — another amino acid not normally found in the brain and excitatory to nerve cells — did the same thing.

Subsequently Schwarcz, with Mangano and Whetsell, wondered whether a neuroexcitatory amino acid naturally found in the brain might produce similar changes and, if so, whether it might play a causative role in Huntington's. They injected a number of these amino acids into the basal ganglia of rats. Finally they found one that did the trick — quinolinic acid. And as Schwarcz told SCIENCE NEWS, they have repeated the experiment with quinolinic acid on hundreds of rats and have produced identical results in all of them. "It is possible that quinolinic acid has a role in the etiology" of Huntington's, Schwarcz and his co-workers conclude in SCIENCE.

In an interview, Coyle said he found this finding "very exciting." He was quick to point out, however, that it remains to be seen whether quinolinic acid truly helps trigger Huntington's. Schwarcz agrees. He, Whetsell and Mangano will now attempt to see whether the basal ganglia of Huntington's victims contain an excess of quinolinic acid compared with the basal ganglia of the normal population. If this is the case, it will be further evidence that quinolinic acid is indeed a causative factor in Huntington's.

And in the event that quinolinic acid *does* turn out to play a causative role, an antagonist to quinolinic acid might eventually prove to be an effective treatment for Huntington's, something that is not now available. Schwarcz and his colleagues say they have already developed such an antagonist. —*J.A. Treichel*

Ocean plunge for satellite

On Jan. 23, a section of the nuclear-powered Soviet satellite Cosmos 1402 (SN: 1/15/83, p. 37) broke into burning fragments as it plunged through the atmosphere. If any of the pieces survived, they fell into the Indian Ocean, south of India, west of Australia and far from any inhabited areas. U.S. aircraft and ships are now surveying the impact area for traces of radiation.

Meanwhile the North American Aerospace Defense Command continues to track a second, smaller piece of the satellite still circling the earth. This segment, containing the reactor core, is expected to burn up completely when it falls, perhaps as early as Feb. 5. Its radioactive debris will scatter as fine particles throughout the atmosphere.

Critics of nuclear satellites used the incident to call for a ban on nuclear reactors in space and to focus attention on the escalating military race in space. "What goes up must come down, whether it is an orbiting fission power plant or a war fought in space," said Eugene J. Carroll, a retired rear admiral with the Center for Defense Information, Washington, D.C. The Soviet Union has launched about 20 nuclear-powered spy satellites, while the United States shot one reactor into a high polar orbit in 1965 and now is studying 100-kilowatt reactors for future "supersatellites."

—*I. Peterson*