Like sheep virus, AIDS virus infects brain

Discovery of an AIDS-linked virus, HTLV-III, in human brain cells, and similarities between that virus and a virus that causes a chronic, degenerative neurological disease in sheep, show that HTLV-III may play a role in causing AIDS-related neurological problems, according to two reports in the Jan. 11 SCIENCE. The studies may provide further clues to the elusive etiology of AIDS, or acquired immune deficiency syndrome (SN: 7/7/84, p. 6).

Researchers at the Johns Hopkins School of Medicine in Baltimore and the National Cancer Institute (NCI) laboratories in Bethesda, Md., and Frederick, Md., found morphologic and genetic similarities between human T cell lymphotropic virus (HTLV) type III and visna virus, a type of lentivirus that causes brain lesions and encephalitis in sheep. Both the human and animal viruses are nononcogenic retroviruses, meaning that they don't cause tumors and are made of RNA rather than DNA.

The finding is important in understanding the disease process of AIDS, says Matthew A. Gonda, main author of the paper. "It is the opening of a whole new field where visna viruses can be used to study the AIDS problem."

But the finding of similarities between the visna and HTLV-III viruses will do more than provide an animal model to simplify the study of AIDS. It will shift the direction of research, Gonda says.

"The greatest significance is to make people look at HTLV-III as a cytolytic [nononcogenic] virus instead of as a member of human T cell leukemia lymphotropic viruses and to direct research into this [cytolytic] group of viruses."

Gonda distinguishes HTLV-III from HTLV-I and -II, which cause leukemia, a disease of cellular proliferation. Visna and HTLV-III are cytolytic, causing cells to break up, or lyse, rather than multiply.

The first inkling of a relationship between the visna and HTLV-III viruses came when Gonda was looking at electron micrographs of HTLV-III and noted that the virus looked like lentiviruses he had viewed years earlier.

To show whether the viruses were indeed related, the Frederick researchers took single strands of DNA produced by HTLV-III and by a strain of visna and combined them in a vial to see how much the strands would hybridize, or join together. The greater the degree of hybridization, the greater the similarity between the two viruses.

The two strands hybridized at several locations along their lengths, suggesting that the two viruses are closely related. In separate hybridization reactions, DNA from HTLV types -I and -II hybridized with far fewer regions of the visna virus DNA. In addition, HTLV-III showed a 10-fold greater reaction with visna than it did with HTLV-I and -II.

In the other SCIENCE paper, George M. Shaw of NCI and others reported that seizures and other brain abnormalities observed in some AIDS patients may be due to the presence of HTLV-III in brain cells. Researchers obtained DNA samples from the cerebral cortices of 15 deceased patients who had shown evidence of AIDS-related neurological problems before death. HTLV-III DNA sequences were found in five of the brain samples.

How will the recent findings help in the development of preventive vaccines and therapeutic agents for AIDS? The applications may be limited, the researchers say.

Like visna, HTLV-III undergoes antigenic drift, changing its genetic makeup to escape the body's protective defenses, complicating development of a vaccine. Gonda emphasizes that the viruses are closely related at the DNA level. They must be shown to be highly related at the protein level in order to make a vaccine.

The finding that HTLV-III exists within the brain further complicates the development of therapeutic agents for the debilitating disease. In his paper, Shaw says: "In attempting to develop therapeutic agents for the treatment of AIDS, investigators will now have to allow for the presence of HTLV-III within the sanctuary of the central nervous system."

—D.D. Bennett

Japan launches probe to Comet Halley

Japan first tried to launch an artificial satellite of the earth on Sept. 26, 1966, nine years after Sputnik 1 inaugurated the space age. Three and a half years and four attempts later, a Japanese satellite finally got into orbit, and after four more years and four more tries, one of them actually reached an orbit approximating that for which it was intended. And this week, on Jan. 7, Japan sent its first space probe toward a target beyond earth orbit.

Its goal, completely bypassing the lunar missions that have been way stations of experience for the U.S. and Soviet space programs: Comet Halley.

Known as MS-T5, the cylindrical probe is expected to miss Halley by several million miles, according to officials of Japan's Institute of Space and Astronautical Science in Tokyo. But a close flyby is not its purpose. Equipped with a plasma-wave probe, an ion sensor and a magnetometer, it is to make measurements of the solar wind even as another Japanese craft — Planet A, to be launched this August — takes a closer approach, envisioned as perhaps 60,000 miles. Both will arrive in early March of next year.

Planet A, too, will carry a solar-wind instrument (a particle analyzer, to measure the distribution the solar-wind plasma above and below the plane of the ecliptic). Its primary sensor, however, will be an ultraviolet television system, to take images of the comet's huge, diffuse hydrogen "coma."

But MS-T5's role is broader than just the accomplishment of its scientific observations. Its first job was to serve as the guinea pig with which Japan verified the capabilities of the M-3S II rocket that launched it, newest member of Japan's "Mu" family of launch vehicles. The M-3S II is designed to be able to put as much as 700 kilograms of payload into a low earth orbit, although MS-T5 and Planet A each weigh about 140 kg.

En route, the probe will be providing data on its own velocity sensors and attitude control system. Such information will also be of importance for Planet A, which is a near-identical cylinder about 1.4 meters in diameter and 0.7 meters high. Both spacecraft are "spin-stabilized," like gyroscopes or the U.S. Pioneer probes, rather than maintaining their orientation in space with a complex "triaxial" system like that of the U.S. Voyager craft. Not only are "spinners" simpler devices, appropriate for a nation taking its first "steps" into deep space, but they do not require attitude control jets that can run out of fuel. Both probes are designed to maintain their stability by spinning at five revolutions per minute (r.p.m.), but because Planet A's camera must spin at only half an r.p.m. while taking its pictures, a device called a "momentum wheel" will make up the missing torque during the mission's imaging phase.

In addition, MS-T5 will help engineers evaluate the effectiveness of "deep space" communication and tracking facilities that have been under development in Japan. Ground facilities, including a 64-meter antenna in central Japan and a smaller dish at Kagoshima Space Center (which was also the launch site) near the country's southern tip on the island of Kyushu, are also being aided by the National Aeronautics and Space Administration's Deep Space Network.

Two other members of the Halley armada, meanwhile, were launched last week by the Soviet Union. Vega 1 and Vega 2 took off on Dec. 15 and 21, respectively, aimed to pass by the planet Venus in June, where they will deposit a pair of descent capsules and receive a gravitational boost to change course toward March 1986 encounters with Halley. And this July will see the launching of the European Space Agency's Giotto probe, also Halley-bound.

And the cause of it all — Comet Halley itself, on its first approach to the sun in three-quarters of a century — this week crossed inside the orbit of Jupiter.

—J. Eberhart