SCIENCE NEWS of the week

Mutated HIV Could Serve as Vaccine

A group of Australians infected with human immunodeficiency virus (HIV)—the virus that causes AIDS—have remained symptomfree and in good health for 10 years or more because they harbor a mutated and weakened form of the virus, a new study indicates.

The HIV that infects the group lacks pieces of DNA in a region constituting the *nef* gene, a team of researchers from across the Australian continent found. The finding points to a new target for antiviral drugs and may offer a promising candidate for an HIV vaccine.

"It looks as though infectious HIV that has deletions in *nef* does not cause disease," says team member Nicholas J. Deacon of the National Center for HIV Virology Research in Fairfield. "Such a virus may be the basis for a live attenuated vaccine against HIV."

In 1989, researchers identified this group of seven long-term survivors during a review of records kept by the New South Wales Red Cross Blood Transfusion Service in Sydney. Six of the individuals became infected with HIV when they received blood transfusions from the seventh.

At the time, none of the seven had suffered any of the opportunistic infections characteristic of AIDS, experienced drops in HIV-susceptible immune cells known as CD-4 cells, or shown any sign of the disease. To this day, none of these individuals suffers from AIDS-related symptoms.

Some scientists suspected that these long-term survivors remained healthy because the virus they had acquired failed to cause disease. Finding the source of the virus' relatively benign nature, however, proved difficult because the virus grows slowly.

In the Nov. 10 SCIENCE, the Australian researchers announce not only that they have isolated virus from the blood cells of four of the seven people, but also that the virus lacks DNA sequences in an area of overlap between the *nef* and *ltr* genes. Although scientists don't know the exact role that *nef* plays, they do know that it speeds the progression of AIDS. The *ltr* gene aids in virus replication.

"What we see here in this cohort is a virus that is defective in terms of rapid replication," says Deacon. However, he notes that this finding does not explain all other long-term survivors—many of whom have nonmutated forms of the virus yet remain healthy.

Anthony S. Fauci, director of the National Institute of Allergy and Infectious Diseases in Bethesda, Md., studies a group of long-term survivors with nonmutated forms of HIV. He points out that the reasons the infection hasn't progressed in these people "are probably heterogeneous." Some have a defective form of the virus, some have a strong immune response, and others remain healthy for reasons that scientists have yet to identify, he notes.

Nonetheless, Fauci says, the Australian group's work shows definitively that one of the avenues to long-term nonprogression is infection with a defective virus. What's more, the work "fortifies the idea that you can have an attenuated virus in an individual without causing disease."

Both Fauci and Deacon maintain that such a virus could be adapted to make a vaccine. Deacon notes that "successful vaccines for polio and smallpox have been live attenuated viruses."

Studies of the simian immunodeficiency virus (SIV), a retrovirus similar to HIV, support such speculation. Monkeys infected with SIV that harbors deletions in *nef* fail to develop disease. More important, these monkeys acquire immunity against strains of the virus that do cause disease.

Researchers don't expect an HIV vaccine anytime soon. Although polio and smallpox vaccines infect cells, the infection can be cleared by the immune system. As a retrovirus, HIV infects by inserting itself into a cell's DNA, where it becomes a permanent fixture.

A vaccine made up of a weakened form of the virus would also enter cells' DNA, creating a permanent, though less virulent, infection. Deacon maintains that scientists will need to prevent the attenuated virus from permanently infecting people before it can be considered safe.

— L. Seachrist

Tracking growth and flow in microgravity

When Columbia touched down on the morning of Nov. 5 after the second longest space shuttle flight in history, it returned to Earth with a handful of small potatoes grown from tubers, dozens of protein crystals, and a large amount of data from a variety of scientific experiments.

Launched on Oct. 20, this mission marked the second flight of the U.S. Microgravity Laboratory. Taking advantage of a low-orbit environment in which the force of gravity appears to be only about one-millionth as strong as it is on the ground, researchers pursued investigations of such phenomena as crystal growth, fluid flow, and combustion dynamics.

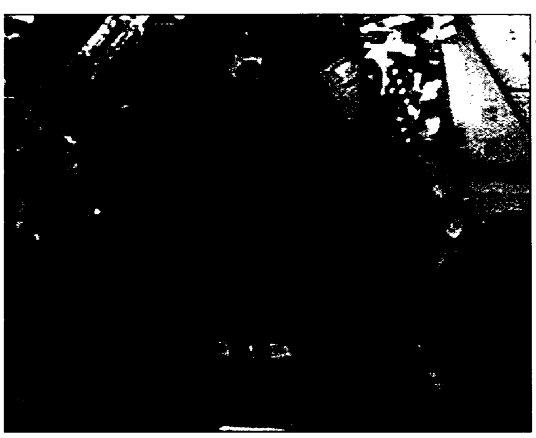
The Interface Configuration Experiment (ICE) involved the behavior of a liquid in containers of various shapes. On Earth, gravity causes fuels and other liquids to drain from containers in predictable ways. Under microgravity conditions, the contact angle between a liquid and the container's wall has a strong influence on these movements.

To develop mathematical models for predicting the location and configuration of fluids in space, Paul Concus of the Lawrence Berkeley (Calif.) National Laboratory, Robert Finn of Stanford University, and Mark M. Weislogel of NASA's Lewis Research Center in Cleveland designed a system for observing fluid configurations in containers with different shapes. The researchers obtained preliminary results during a 1992 shuttle flight (SN: 8/22/92, p.124).

Their new experiment allowed them to check additional aspects of fluid behavior. "We were testing a different set of theorems and different phenomena than we did last time," Concus says. "When you change the container shape or contact angle a little bit, you can get large bulk movements of the fluid from one place to another."

By way of a video link, the researchers observed the surface configurations of a dyed water-ethanol mixture in specially shaped chambers after a shuttle crew member injected the liquid, then jarred or shook the container. They could see definite differences in the way the liquid adhered to the chamber walls in these vessels as it sloshed about.

Such results will allow Concus and his team to evaluate how well their idealized mathematical model matches physical reality. *— I. Peterson*



NASA

Mission specialist Catherine G. (Cady) Coleman works with the ICE apparatus in the Glovebox aboard space shuttle Columbia.

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