AIDS Vaccine: Research on Target

Since the AIDS virus, now known as HIV, was first identified in 1983, more than a half-dozen related viruses have come under scrutiny by scientists trying to understand HIV's mechanism of infection. Two previously unknown relatives of HIV have also been discovered (HIV-2 and STLV-III), leaving researchers awash in an alphabet soup of distinct but related viruses — including some that infect humans, some that are restricted to monkeys, some that cause disease and some that apparently do not. The genetic diversity displayed by the HIV family, and the fact that HIV itself fails to cause AIDS in other animals, has hampered the study of the disease and the search for a vaccine (SN: 5/9/87, p.297).

But two new studies published in the Aug. 6 NATURE go a long way toward sorting out the relationship among these viral varieties. Moreover, they offer hope that AIDS vaccine development may proceed more rapidly than was anticipated.

Researchers at the National Cancer Institute (NCI) report that they have determined the entire 9,264-nucleotide sequence that makes up the genome of an AIDS-like virus found in African green monkeys. The researchers, Genoveffa Franchini, Robert C. Gallo and their colleagues, then compared that sequence to the genetic codes of previously cloned AIDS-related viruses. They found that the newly sequenced STLV-III_{AGM} virus, although apparently nonpathogenic in green monkeys, is genetically very similar to HIV-2 (the cause of AIDS in West Africa) and is to a lesser extent related to HIV-1 (the cause of AIDS in the United States).

The new analysis resulted in two important findings. First, the scientists identified genetic variations that may explain why certain strains of AIDS-like viruses do not cause disease. Second, and more important from the standpoint of vaccine development, they found striking similarities within certain genomic regions that code for the production of viral envelopes, or outer skins, of the strains they compared. In almost all cases, for example, the nucleotides that code for the amino acid cysteine are located in exactly the same positions on the genome. This is true even in strains whose genomes otherwise vary by as much as 25 percent.

Researchers theorize that such highly conserved regions are critical to the process of infection — perhaps enabling the virus to bind to the T4 antigen on human lymphocytes. Because so many strains of AIDS-related viruses share these nucleotide sequences, the proteins they code for may be ideal targets for antibody tests and vaccines.

In related research, Pierre Tiollais and others at the Institut Pasteur in Paris say they have cloned and sequenced the entire genome of a virus that causes an AIDS-like disease in macaque monkeys. The virus, STLV-III_{MAC}, is the only virus that is known to share most of the properties of human AIDS-causing viruses and that actually causes an AIDS-like disease in animals. The accomplishment opens the door to preliminary tests of recombinant vaccines on animals.

Animal models are considered essential for testing potential vaccines, but until now scientists have been frustrated by the lack of an appropriate animal to work with. Chimpanzees, although they can harbor HIV, are in short supply, and in any case fail to develop AIDS when infected. Although the STLV-III_{MAC} virus differs somewhat from human AIDS-causing viruses, it has several genetically conserved regions identical to some regions in HIV-1 and HIV-2. Scientists hope to test a variety of STLV-III_{MAC} antigens as potential vaccines in macaques, and then — by referring to the newly created nucleotide map — test analogous HIV antigens in humans. *— R.Weiss*

Manipulating milk in mammals

All mammals produce milk, but not all mammal milk is identical. In ruminants such as cows and sheep, for example, the major milk protein is beta-lactoglobulin (BLG). Rodents, on the other hand, don't produce any BLG at all. At least they never used to.

J. Paul Simons and fellow researchers at the Edinburgh (Scotland) Research Station report in the Aug. 6 NATURE that they have successfully bred mice carrying the sheep BLG gene, and that these mice now produce milk that is chock full of BLG. The researchers suggest that similar experiments with dairy animals may not be far behind, and that "the manipulation of milk composition by gene transfer has considerable potential."

The experiments were done by microinjecting genetic material coding for BLG into fertilized mouse eggs that were then reimplanted into "surrogate" female mice. Of the 46 offspring successfully weaned, 16 carried the BLG sequence, and the females among them later produced BLG-rich milk. In the case of one such female, BLG was produced at more than five times the concentration usually found in sheep milk. Moreover, some of the mice passed on the BLG gene to their offspring.

The authors note that milk provides 20 to 30 percent of the total protein intake of people in the industrialized world, and claim that "gene transfer into dairy animals should be viewed as a realistic approach for the production of milk with enhanced nutritional value."

In addition, they say, it may be possible to engineer dairy animals to produce nonnutritional but otherwise valuable proteins in milk. They have already taken the gene that codes for the production of human Factor IX (a blood protein lacking in certain forms of hemophilia) and fused it to the BLG gene in sheep — with an eye, it seems, toward extracting Factor IX along the whey. *— R. Weiss*

No resistance to superconductivity

If it's true that sound travels faster than the speed of light in the nation's capital, then the phrase "high-temperature superconductivity" might have set new records last week, prompting a pack of political proposals designed to speed commercialization of an as-yet-unproven technology.

Led by President Reagan, officials announced the creation of councils, committees and consortia to aid the push to move superconductivity out of the lab and into the marketplace before foreign competitors do so. The proposals came at a Washington, D.C., gathering of more than 1,000 government officials, industry experts and academics brought together by invitation only for the Federal Conference on Commercial Applications of Superconductivity.

The major thrust of government involvement came under the President's Superconductivity Initiative, an 11-point plan designed to speed research on the technology that enables certain materials to lose their electrical resistivity at temperatures high enough to replace today's expensive liquid-helium cooling with more affordable liquid-nitrogen cooling techniques (SN: 3/28/87, p.196). If scientists can overcome the obstacles needed to perfect the technology, high-temperature superconductivity could eventually cut costs and increase per-