edited by CONSTANCE HOLDEN

## Fighting HIV: A Clue from Hemophilia

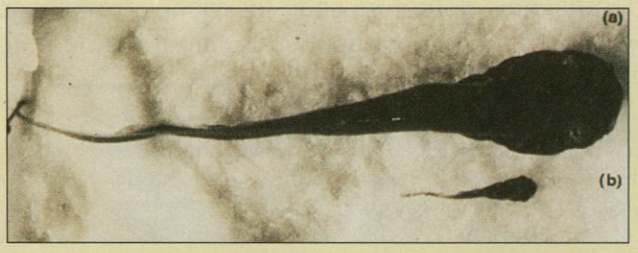
Five hemophiliacs, practically guaranteed to have acquired HIV from contaminated blood products in the late 1970s and early 1980s, haven't so much as dodged the infectious bullet as had it bounce off them. Antibodies that showed up in their blood, suggesting HIV infection, subsequently disappeared. Now a team of Tulane University School of Medicine researchers is scrutinizing them for clues to beating AIDS.

Before 1985, when a test became available to screen blood for HIV antibodies, thousands of hemophiliacs became infected with the AIDS virus via transfusions of contaminated batches of clotting factors. But perhaps 10% to 15% of severe hemophiliacs escaped infection. Last month in Washington, D.C., at the First National Conference on Human Retroviruses and Related Infections, the Tulane researchers explained how they had combed through stored blood samples taken from hemophiliacs at various times before the HIV screening procedure was in place. They found five people who had antibodies to the AIDS virus at one point, but in later blood samples taken from those five, the antibodies had disappeared.

Scott Tenenbaum, a graduate student who headed the study with Cindy Leissinger, has a few ideas about how these people may have resisted permanent infection with HIV. Preliminary studies of their blood cells suggest that they may have mounted an effective cell-mediated immune response, triggered by low doses of the virus, which can clear already infected cells or retard the production of new virus.

Another possibility, albeit a remote one, is that these hemophiliacs were never infected by HIV—rather, they actually may have been vaccinated against the virus by the clotting factor. Tenenbaum explains that even before HIV screening, clotting factor was treated with chemicals to purify it, and the virus may have been killed in some batches. This killed HIV might have then acted like a vaccine, causing a transient rise in antibodies.

The hemophiliacs are not the first documented cases of "seroreversion," but scientists believe this cluster of five potentially offers a chance to better understand the phenomenon.




**Brobdingnagian pollywog.** Cell biologists attending a meeting last month in New Orleans were startled and amused to see this picture of a 2-year-old, 13-cm-long, 12-gram tadpole of a South African clawed frog. Hatched without a thyroid gland—a must for metamorphosis—the creature failed to become a frog and just kept on growing. Regular tadpoles, like the 26-day-old animal shown beneath the giant, are ticketed to become frogs around day 60. Yun-Bo Shi of the National Institute of Child Health and Human Development showed the slide, from a 1976 book, *Physiology of the Amphibia*, at the annual meeting of American Society for Cell Biology. Although giant athyroid tadpoles were first documented as early as 1916, to the cell biologists, more familiar with individual cells than with whole animals, the monster swimmer came as a pleasing surprise.

## Torture Test Nets a New Prime

By putting a new machine to the "torture test," a pair of computer scientists have notched a new record for the largest known prime number—a number that can be divided only by itself and by 1. Paul Gage and David Slowinski of Cray Research, Inc., in Eagan, Minnesota, identified the 33rd known Mersenne prime, $2^{859433} - 1$, a behemoth 258,716 digits long. Mersenne primes, named after the 17th-century monk and mathematician Marin Mersenne, have the special form $2^q - 1$, where the exponent q is itself prime. The new number eclipses a 227,832-digit mark set in 1992 (*Science*, 10 April 1992, p. 175).

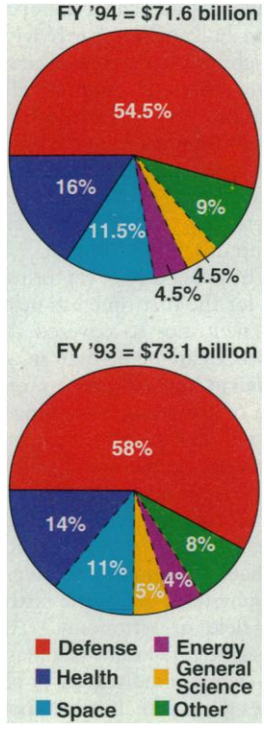
The torture test, designed to find primes, "rigorously tests all elements of a system, from the logic of the processors to the memory, the compiler, and the operating and multi-tasking systems," says Slowinski. It is based on a computation known as the Lucas-Lehmer test, which reveals whether a number is a Mersenne prime. Starting with 4, the test involves squaring the number and subtracting 2, and repeating that process with the resulting numbers a total of $q - 2$ times. If the final number is exactly divisible by $2^q - 1$, then $2^q - 1$ is prime.

While conceptually simple, the computation is a nightmare to carry out. The procedure calls for hundreds of thousands of multiplications, each involving numbers with hundreds of thousands of digits. Even on a supercomputer, that's a lot of arithmetic. The familiar grammar-school algorithm for multiplication is much too slow. Instead, the last several Mersenne primes have been found using procedures based on the Fast Fourier Transform, a widely used algorithm for handling large data sets.

Gage and Slowinski ran the fancy programs on a Cray Research Y-MP M90 Series Supercomputer, sifting through values for q at around the 850,000 level in hopes of hitting a Mersenne prime. The latest find provided a stunning glimpse into the rapid progress of technology: Verification took only about 1/2 hour—compared with 19 hours for last year's new Mersenne.

## Fewer weapons in the pie

The federal government will spend less overall on research and development in fiscal 1994, but nondefense R&D spending gains both proportionally and in absolute numbers as the government moves toward President Clinton's goal of balancing civilian and defense R&D by 1998. This year's defense R&D budget has declined by $3.3 billion to $39 billion, largely because of fewer weapons systems and a $1 billion reduction in the Ballistic Missile Defense program, formerly the Strategic Defense Initiative. On the civilian side, the biggest factors in the $32.6 billion budget (which contains a $1.7 billion increase) are the cancellation of the Superconducting Super Collider and the Advanced Solid Rocket Motor for the space shuttle, and increases in cooperative programs with industry. The gain in health research reflects a 6% increase for the National Institutes of Health.




SOURCE: AAAS REPORT ON "CONGRESSIONAL ACTION ON RESEARCH AND DEVELOPMENT IN THE FY 1994 BUDGET."