Biomedicine

More AIDS, more questions

Is AIDS a new plague descended on humankind, or, like Legionnaire's disease, has the syndrome actually been around awhile, unrecognized? A report in the March 1 SCIENCE indicates AIDS, or something very like it, existed in Africa in 1972.

Researchers from France, Denmark and the National Institutes of Health (NIH) in Bethesda, Md., thawed blood samples collected in Uganda from apparently healthy individuals in 1972 and 1973 as a control group in a cancer study. The scientists looked for the presence of antibodies to HTLV-III, a putative cause of AIDS, and found it in 50 of 75 samples checked, suggesting, they say, "that the virus detected may have been a predecessor of HTLV-III or HTLV-III itself but existing in a population acclimated to its presence."

Whether the virus that elicited the antibodies is actually HTLV-III can't be determined for certain because there isn't enough blood left, and it hadn't been stored under ideal conditions for virus survival, says W. Carl Saxinger, one of the NIH researchers. And because of the difficulty of follow-up in Uganda, the current health status of the donors is unknown.

What remains to be determined, says Saxinger, is how the African viral infection relates to the current U.S. epidemic. "Is it the same virus transported to a more susceptible population?" he asks. "If it's not the same virus, has it progressed into a more virulent form, or is it an unknown variant whose properties we don't know? . . . . If it [AIDS itself] was there [in Uganda], it could be it just wasn't noticed. If it wasn't there we're left with explaining how and in what way the people were infected that they didn't get the disease."

Whatever was there didn't spread very quickly. A report from British researchers in the Feb. 16 LANCET describes finding AIDS antibodies in 20 percent of 51 apparently healthy people in Uganda but in only 2 percent of 158 people in nearby Zambia.

T cells as a cause of autoimmunity

In autoimmune diseases such as systemic lupus erythematosus, the immune system attacks the body, and one goal of researchers is to determine what step in the complex immune system progression goes awry. The popular theory about lupus, says William E. Seaman, is that B cells, antibody-producing cells that are normally controlled by T cells, become independent of T cells. Now, he reports, "our studies show that's not true."

He and David Wofsy of the University of California at San Francisco injected three strains of mice prone to lupus with monoclonal antibodies against T cells. In one of the three strains, the disease disappeared, indicating T cell involvement in the condition, they report in the February JOURNAL OF EXPERIMENTAL MEDICINE. The finding is in agreement with a report in the Jan. 25 SCIENCE in which Stanford University researchers described reversing an experimentally induced autoimmune disease in mice by using monoclonal antibodies against T cells.

While Seaman expects that the T cell dependence also holds for humans, he doesn't think monoclonal antibody therapy is ready for use. Stopping the helper T cells may leave a person open to infections or possibly cancer, he says.

Coffee: Grounds for concern?

The latest chapter in the coffee vs. health debate comes from Stanford University researchers. In the March 8 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION they report finding a positive correlation between elevated cholesterol and daily consumption of more than two cups of coffee a day.

The California researchers measured coffee intake and cholesterol in 77 men, and adjusted for age, cigarette use, fat, fitness, food intake and stress. They note that what they found was an association, not a direct proof of cause-and-effect.

Technology

A tungsten coat for silicon

Tungsten is hot. During the last few years, dozens of microelectronics companies have formed research teams to study this tough, hard metal, which is more commonly associated with light-bulb filaments. They are interested in using it as a replacement for the thin, conducting threads of aluminum or polycrystalline silicon that connect transistors and other devices laid down on integrated circuit chips.

At the Sandia National Laboratories in Albuquerque, N.M., where tungsten research has been going on for two years, a group of researchers recently announced several advances in techniques for depositing tungsten on silicon surfaces. Their results may be particularly useful in the manufacture of the newest generation of electronic circuits — "very large-scale integrated" (VLSI) chips.

"The circuits are getting smaller and smaller, and the features on them are shrinking correspondingly," says Sandia's Robert S. Blewer. "The use of tungsten solves several problems."

In VLSI circuits, even a small current coursing through a thin wire, which may be less than one-hundredth the thickness of a human hair, generates a high current density. In the case of aluminum, this is high enough to bump aluminum atoms from one part of the wire to another, eventually thinning the material enough in some places to break the circuit. "Tungsten is very resistant to this kind of behavior," says Blewer. It is also a better electrical conductor than doped polycrystalline silicon, an alternative wiring material.

The Sandia work shows that thick, as well as thin, tungsten films can be chemically deposited exactly where needed on silicon surfaces. This requires careful cleaning of the silicon wafers on which circuits are built, along with precise control of the temperature, pressure and chemical environment in a special chamber where the process, called "chemical vapor deposition," takes place.

In the past, the two chemical reactions that produce tungsten films were allowed to occur at the same time. In one process, gaseous tungsten hexafluoride reacts with silicon to deposit tungsten and produce a gaseous byproduct. A second reaction involves hydrogen gas and leads to the deposition of more tungsten atoms. The Sandia researchers discovered that doing the two reactions in sequence rather than together produced much better results.

Sealing a ceramic sandwich with a zap

One way to form a ceramic bond is to spread a glass slurry between the ceramic layers and then to heat the sandwich to create a seal. But if the heating is done in a microwave oven instead of in a furnace, the materials intermingle so well that the joint is hard to detect with the naked eye. Conventional heat sealing leaves a more visible bond that may contain flaws. Tom Meek and Rodger Blake of the Los Alamos (N.M.) National Laboratory, who discovered the microwave bonding method, can't explain why microwave processing makes a difference. They are now refining their technique.

Firing up the furnaces

A new type of fibrous insulation that takes advantage of the high melting point of the ceramic zirconium oxide (zirconia) may enable furnaces to operate continuously at temperatures as high as 2,000°C. Existing fiber-lined furnaces run at 1,700°C or less. Higher-temperature furnaces would allow the development of new alloys, ceramics and composites that contain larger concentrations of metals with very high melting points. This insulating material was developed by George E. Wrenn Jr. and his colleagues at the Oak Ridge (Tenn.) Y-12 Plant, a manufacturing complex that produces components for nuclear weapons.