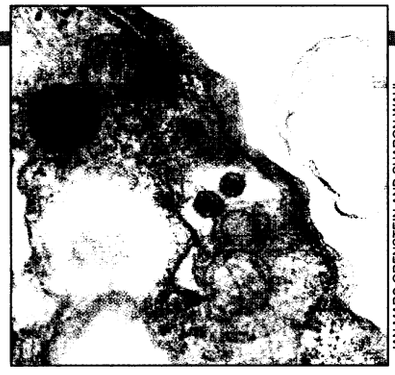

JAN MARC ORENSTEIN AND SHARON WAHL

Trojan horse? Micrograph of a macrophage bearing two HIV particles *(center)*.

way in lung macrophages and blood cells—a finding that implies that drug therapy and vaccine development may need to be tailored to different sites of infection. "We've got to know what is happening at each of [HIV's] target areas before we can control the disease," says Clarke.

Brain infiltrator. One organ in which macrophages are known to play a key role in HIV infection is the brain, where the virus appears to attack brain macrophages called microglia. "There is little doubt that HIV-infected macrophages are critically important for the development of HIV encephalopathy," says Crowe. But in addition, virologist Ruth Brack-Werner of the GSF-National Research Center for Environment and Health near Munich, Germany, reported that astrocytes—brain cells that help protect the blood-brain barrier—may also be infected by HIV, although they produce few progeny viruses.

Up to a third of AIDS patients develop neurological symptoms, including AIDS dementia in most serious cases, but how the infection leads to brain damage has been poorly understood. Several researchers at the meeting presented new evidence that HIV stimulates macrophages to produce a number of neurotoxic substances, including nitric oxide and inflammatory immune-signaling molecules. And Brack-Werner suggested that infected microglia and astrocytes may work together to cause neural damage by releasing HIV proteins—many of which are also thought to be neurotoxic—into the brain tissue.

Turning traitor. A major concern raised by work presented in Varenna is that HIV might turn macrophages, which normally help T cells recognize invaders, from friendly helpers into deadly foes. Although exactly how HIV destroys CD4 T cells is still a matter of hot debate, one long-standing theory is that they are induced to commit suicide. This process, called apoptosis, plays an important role in normal development and immune processes but might go out of control in HIV infection.

Antonio Mastino of the University of Messina in Italy reported new work showing that HIV-infected macrophages induce apoptosis when they come in contact with T cells. The macrophages appear to release substances that increase the amount of an apoptosis-triggering protein called Fas on the surface of the T cell. And Stefano Aquaro, a doctoral student in Carlo Perno's lab at the University of Rome, reported that HIV-infected macrophages can also trigger apoptosis in the brain's astrocytes.

Gatekeepers of the body. Yet another possible role for macrophages and dendritic cells, which particularly intrigued researchers at the meeting, was that they might be acting as gatekeepers that decide which strains of HIV can enter the body and establish infection. It has long been known that macrophage-tropic strains predominate in early infection, and that other more virulent strains—sometimes called T cell–tropic—emerge later. Paul Cameron and his colleagues at the Macfarlane Burnet Centre in Australia reported that when macrophage-tropic and T cell–tropic HIV are applied to skin samples, the macrophage-tropic strains are preferentially picked up by skin dendritic cells and transported across. And virologist Mario Stevenson of the University of Massachusetts Medical Center in Worcester reported that an SIV virus (similar to HIV but only infectious to primates), engineered to contain a mutation that does not allow it to infect macrophages, failed to cause disease in macaques. The wild-type virus, on the other hand, quickly caused immunodeficiency and death.

The work by Cameron and Stevenson, combined with recent findings that macrophage-tropic and T cell–tropic HIV strains use different receptors to gain entry into target cells (*Science*, 21 June, p. 1740), raises the possibility that infection of macrophages and dendritic cells may be an absolute requirement for the establishment of an HIV infection—a "bottleneck" to the spread of the virus, says UCSD's Kornbluth. Such a role implies that blocking infection of these cells should be a target for drug designers. "Macrophages and dendritic cells are the burning embers of HIV infection," adds Kornbluth. "Even if the virus is completely suppressed in T cells, they may reignite the infection if they are not treated fully." Macrophages, it seems, will not be waiting in the wings too long.

–Michael Balter

MICROELECTRONICS

First Blush for Integrated Light Emitter

Researchers at the University of Rochester in New York have just made an unlikely match. Engineers have long hoped to wed light-emitting components with conventional microcircuitry on a single chip. The result would be an integrated optoelectronic circuit, a boon for communications systems and for efforts to build optical computers. But the materials and fabrication techniques needed for light-emitting diodes and semiconductor lasers are worlds apart from the ones used in integrated circuits. Now, however, the Rochester group has created an integrated circuit that glows bright orange.

It's not yet clear whether this marriage, announced in this week's *Nature*, will flourish. The light emitter puts out too little light and too much heat for practical devices, say other researchers. As Jim Sturm, an electrical engineer at Princeton University, puts it, "It's good technology, but it's not going to change the world." But others note that the Rochester group has overcome a key impediment: finding a light-emitting material that can stand up to the rigors of chip fabrication.

An integrated circuit that could handle both electric current and light would have to be made of a single material, probably silicon, the mainstay of microcircuitry. But ordinary silicon has a small band gap—the energy needed to free an electron from the crystal lattice. As a result, excited electrons emit only low-energy infrared photons when they fall back into the lattice.

Silicon etched into fine wires—so-called porous silicon—has a wider band gap and can emit visible light. But unfortunately, says Philip Fauchet of the Rochester group, "porous silicon has absolutely unacceptable properties." The fabrication process leaves the silicon surface covered with hydrogen, which reacts with air or water vapor and creates defects that weaken the material.

Fauchet's group, however, has found a way to remove the hydrogen without ruining the porous silicon's electrical properties: heating it to about 900° Celsius in a mildly oxygenated atmosphere, which replaces the hydrogen with a thin layer of silicon dioxide. Not only is the resulting material stable and hardy, but the fabrication technique is completely compatible with those used in today's chip-fab plants. As a test, the researchers created an integrated circuit—a light emitter controlled by a transistor—on a single chip.

But the light emitter has several problems. "It's about 0.1% power efficient," admits Fauchet; 1% efficiency is a minimum for a practical circuit. Moreover, its switching time is slow: about 10 megahertz, which is insufficient even for today's slowest desktop computers. Says Fereydoon Namavar, a scientist at the Spire Corp. in Bedford, Massachusetts, which does optoelectronics research: "From the application point of view, there are a lot of question marks." But from the research point of view, there is a glimmer of hope.

–Charles Seife