from Fas production by islet cells. Both in NOD mice and in people, diabetes occurs in stages. First, immune cells invade the pancreas. Later, islet cells start to die—decreasing insulin production and elevating sugar concentrations in the blood.

Chervonsky's group found that as NOD mice age, their islet cells display more Fas, presumably in response to chemicals released by invading immune cells.

The scientists also bred NOD mice with mice that could not make Fas. The resulting hybrids never developed diabetes, even when injected with immune cells that ordinarily cause the disease, Chervonsky's team reports.

Therefore, diabetes in NOD mice, and probably in many people, occurs because immune cells gradually incite islet cells to make Fas, says Chervonsky. Those islets, he explains, commit suicide when their Fas molecules interact with FasL proteins on the immune cells.

Chervonsky and other researchers note that these findings suggest an extra requirement for the proposed strategy of transplanting FasL-bearing islet cells into people: Eliminate the suicide weapon.

"You should knock out Fas in the transplanted tissue," says Richard Duke of the University of Colorado Health Sciences Center in Denver.

Some investigators, however, caution that diabetes-causing immune cells could have other ways of inducing Fas-deprived islets to commit suicide.

"There may be more than one way to kill the cell, or rather induce it to kill itself," says Jonathan D. Katz of Washington University School of Medicine in St. Louis. *—J. Travis*

Insect-borne disease: Curing the carrier

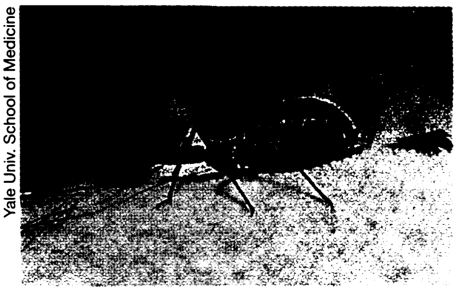
Like the cockroach and the pigeon, the reduviid bug has made itself at home alongside humans—literally. It lives within the walls of adobe houses in Latin America, where it plays a role in transmitting Chagas' disease.

The kissing bug (*Rhodnius prolixus*), as it's sometimes called, comes out at night to get a meal of blood from the face of a sleeping human host. The protozoan parasite it leaves behind can permanently infect a person. Heart and other muscles break down, often leading to death years or decades later.

"It's a very silent disease" with no good drug cure, says Frank F. Richards of the Yale University School of Medicine. Of the roughly 17 million people infected with the protozoan (*Trypanosoma cruzi*), an estimated 50,000 die from Chagas' disease each year.

Richards and his colleagues are taking an unusual approach to combating the disease by enlisting the services of a third organism—the bacterium *Rhodococcus rhodnii*, which lives symbiotically in the gut of the reduviid bug. The researchers have genetically engineered the bacterium to express cecropin A, a peptide in the defense system of insects that kills the protozoans, they report in the April 1 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

Young reduviid bugs typically acquire the bacterium as they probe through fecal pellets left by other insects, a behavior the researchers are trying to exploit to disperse the engineered form. They are testing how well the dispersal and killing system works on caged insects in


Yale Univ. School of Medicine

A blood-sucking reduviid bug deposits a droplet containing protozoan parasites and symbiotic bacteria.

Guatemala.

"It's exciting work. This is just fun stuff," says Louis V. Kirchhoff, who is developing a vaccine for Chagas' disease at the University of Iowa in Iowa City. Still, he questions whether the intricate scheme will ever make a difference in developing countries like Bolivia, where Chagas' disease is widespread.

Transmission has already been reduced in other countries by plastering the walls of houses and applying insecticides. "The low-tech approach is clearly working," says Kirchhoff.

With pesticide use comes the threat of resistance and other problems, the Yale researchers point out. They say that their symbiotic strategy might also curb diseases transmitted by sand flies or tsetse flies, for example, or even some plant diseases. "The idea is that this could potentially be a generic system applicable to other insect vectors," says Yale's Ravi V. Durvasula. *—C. Mlot*

Superfluid gyro detects Earth's spin

Measuring fluctuations in Earth's rotation rate requires a sensitive laboratory instrument. Now, two groups of researchers have exploited the peculiar quantum properties of superfluid helium to build novel gyroscopes that can sense Earth's spin.

"We have demonstrated a new kind of instrument that can detect absolute rotation at a very sensitive level," says physicist Richard E. Packard of the University of California, Berkeley, who heads one of the groups. In principle, the new device has the potential to surpass the most sensitive gyroscopes available today for high-precision measurements of rotation rates.

Packard and his Berkeley colleagues Keith Schwab and Niels Bruckner describe their device in the April 10 NATURE. Eric Varoquaux of the University of Paris-South in Orsay, France, and his coworkers presented their findings last year at a conference in Prague.

A superfluid helium gyroscope takes advantage of the fact that the flow of a superfluid filling a doughnut-shaped container is quantized. In this case, the flow velocity multiplied by the length of the path along the center of the toroidal channel must be zero or a whole-number multiple of a fundamental quantity determined by Planck's constant and the mass of a helium atom.

Sitting on a lab bench, such a container actually rotates, owing to Earth's spin. For example, if the enclosed superfluid helium is in its zero-velocity state, displaying no net flow, the container must move relative to the helium. To an observer in the laboratory, however, the superfluid appears to be flowing around the torus.

The trick is to find a way of precisely measuring the relative motion of the helium inside the container.

A decade ago, Varoquaux and his colleagues demonstrated the possibility of making that measurement by placing a partition inside the torus and monitoring the flow through a tiny pinhole in the barrier. Because the superfluid has to maintain a zero net flow, liquid must squirt through the pinhole at a high speed in a direction opposite to the rotation.

Developing the requisite technology took much painstaking effort, however. Last year, Varoquaux and his coworkers succeeded in measuring Earth's rotation rate to within 2 percent. Then, Packard and his group made that measurement with a different device based on the same principle. They achieved a precision of 0.5 percent, independently corroborating and improving upon the French results.

Packard and his colleagues contend that it should be feasible to increase the sensitivity of their superfluid gyroscope by a factor of 10,000. Such an improvement would make it possible to monitor daily fluctuations in Earth's rotation rate using a laboratory instrument rather than by relying on astronomical or satellite-based methods. *—I. Peterson*