# High-dose rotavirus vaccine protects kids

Few microbes span the globe like rotavirus, which causes diarrhea. Virtually everyone in the world, rich or poor, has had a bout with this virus by age 5. Although rotavirus is largely controlled in the United States, causing fewer than 100 deaths each year, the dehydration it produces kills 873,000 children annually in poor countries.

A rotavirus vaccine exists, but it hasn't been approved for general use. The vaccine proved effective in a 1996 U.S. study, but two subsequent studies, in Peru and Brazil, indicated that it gave infants only marginal protection.

Now, a trial in Venezuela using doses 10 times stronger than those in the earlier tests has yielded the first large-scale positive results in a developing country.

Employing a form of the vaccine that targets the four main strains of rotavirus, researchers gave the new doses orally to 1,112 infants at ages 2, 3, and 4 months. A control group of 1,095 other babies received an inactive substance. Neither researchers nor parents knew which infants got the vaccine.

For 19 months, whenever the babies became too ill to be treated at home, their parents took them to a hospital near Caracas. These visits revealed that unvaccinated babies were four times as prone to dehydration due to rotavirus as treated infants and more than three times as likely to be hospitalized because of it. Moreover, unvaccinated babies accounted for three times as many cases of rotavirus-induced diarrhea that lasted more than 4 days, and they ran eight times the risk of getting the most severe cases of diarrhea, researchers report in the Oct. 23 New England Journal of Medicine.

The vaccine's only side effect was a brief, mild fever in some of the children.

"Every child should receive this vaccine in the United States and in developing countries," says study coauthor Albert Z. Kapikian, a physician and virologist at the National Institute of Allergy and Infectious Diseases (NIAID) in Bethesda, Md. Kapikian and his colleagues have been perfecting the vaccine since 1980; rotavirus was discovered in 1973. After several preliminary trials to arrive at the proper dosage, NIAID and Venezuelan researchers collected the recent data.

The vaccine used in Venezuela derives from a rhesus monkey rotavirus. Putting a modern spin on the work of English physician Edward Jenner, who used cowpox virus 200 years ago to vaccinate people against smallpox, Kapikian and his colleagues at NIAID employed a weakened rotavirus strain that infects these monkeys.

For one strain of human rotavirus, the weakened form of the monkey virus itself offered protection. To guard against the other three strains, the scientists let the monkey virus exchange a gene with each of the target human rotaviruses. This gene encodes a cell surface protein recognizable to the human immune system, which then makes antibodies to fight the virus.

Researchers were surprised that some unvaccinated children showed traces of the viral mix used in the vaccine, indicating that the harmless viruses had spread in the community.

In December, a committee of scientists will recommend whether the Food and Drug Administration should approve the rotavirus vaccine for general use in the United States.

Some people are already convinced of its value. "I don't see any impediment [to approval] at this point," says Margaret B. Rennels of the University of Maryland School of Medicine in Baltimore. "Prevention is always better than treatment."

In the United States, rotavirus causes 500,000 visits to the doctor and 55,000 hospitalizations of children each year, says Jon R. Gentsch of the federal Centers for Disease Control and Prevention in Atlanta. —*N. Seppa*

# Laser cooling yields Nobel in physics

Using high-intensity lasers to cool atoms may seem paradoxical, but it works—and works well enough to earn a Nobel prize.

Steven Chu, Claude Cohen-Tannoudji, and William D. Phillips have been awarded the 1997 Nobel Prize in Physics for developing methods of using laser light to chill gases to within a few millionths of a degree of absolute zero. By probing atoms' behavior in this supercold realm, researchers have been able to observe odd quantum effects not apparent in the everyday world. Harnessing such effects may allow more accurate measurement of time and gravity.

Because photons of light carry momentum, they alter the speed and direction of any atom with which they interact. In particular, an atom that repeatedly absorbs a photon head-on and then emits a similar photon in a random direction will be slowed considerably.

This year's physics laureates devised ways of tapping the momentum of laser beams to slow atoms from room temperature, where they travel at speeds of a little more than a kilometer per second, to supercold conditions, in which they move at a glacial few centimeters per second (cm/s).

Chu, now at Stanford University, developed a method of slowing atoms in 1985. He and his colleagues at Bell Laboratories in Holmdel, N.J., used an array of six lasers that converged at a single point in space to create a region they called "optical molasses." The researchers then steered sodium atoms into this space, where they became stuck.

With this technique, Chu and his team reduced the average speed of atoms to about 30 cm/s, which corresponds to a temperature of about 240 microkelvins. This agreed well with a theoretical calculation of the lowest temperature obtainable by laser cooling—but it turned out that the theory behind the calculation was incomplete.

In 1988, Phillips and his coworkers at the National Institute of Standards and Technology in Gaithersburg, Md., found that they could use the same method to cool sodium atoms to 43 microkelvins, well below the supposed theoretical limit (SN: 7/23/88, p. 52).

Scientists later realized that they had based their predictions on a simplified model of the sodium atom and that they had not accounted for variations in the laser-induced electric fields within the optical molasses. Complex interactions with those electric fields caused the atoms to slow down, and cool off, more than expected.

Subsequently, Cohen-Tannoudji and his colleagues at the Collège de France and École Normale Supérieure in Paris developed a way to cool atoms even further (SN: 7/16/94, p. 47). By converting the slowest atoms in the optical molasses into a "dark" state, in which they no longer absorb photons, the team was able to chill helium atoms to a mere 180 billionths of a degree above absolute zero, where the atoms moved at the terrapinlike pace of 2 cm/s.

Laser cooling may not lead to colder or more efficient household refrigerators, but it has a remarkable variety of other applications. "This is a scientifically rich area," says Daniel Kleppner, a physicist at the Massachusetts Institute of Technology who served as Williams' thesis adviser in the early 1970s.

The technique has already proven itself in the lab, Kleppner says. It could lead to atomic clocks some 100 times more precise than those currently in use and to supersensitive instruments capable of detecting subtle changes in the gravitational field above mineral or oil deposits.

In 1995, researchers used laser cooling to achieve a milestone in physics, producing so-called Bose-Einstein condensates (SN: 7/15/95, p. 36). More than 70 years earlier, Albert Einstein and Indian physicist Satyendra Nath Bose had predicted such a low-temperature condition, in which atoms fall into the same quantum state and essentially behave as a single atom. —*S. Perkins*