INSIGHTS

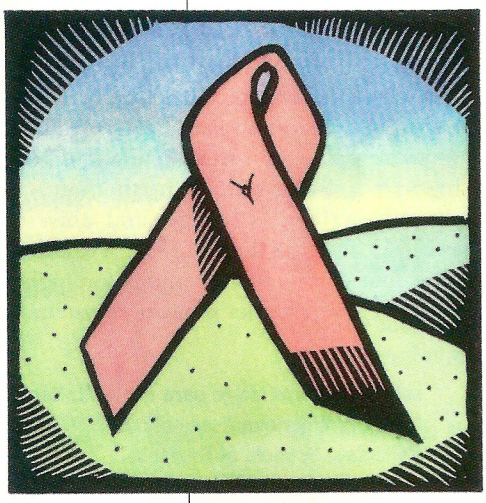
Rutgers researchers uncover new knowledge in the sciences and humanities.

Camouflage Cure

Tricking the Body into Fighting AIDS

No one likes to get a cold. It's distracting, annoying, and uncomfortable. But there may be a silver lining behind the cold's dark cloud. A husband-and-wife research team from Rutgers has found a way to disguise the virus that causes the common cold so that it partially mimics the virus that causes AIDS. The technique, they say, may lead to a potential vaccine against the deadly disease.

The researchers' work involves threading a protein segment from HIV, the AIDs virus, into sections of the cold virus. The protein segment, called the V3 loop, and the section of the cold virus to which it is attached both trigger an immune response. The altered virus, if introduced into the body in vaccine form, could stimulate production of antibodies against HIV and may offer protection against AIDS, for which there is presently no cure.



The altered virus could stimulate production of antibodies against HIV and offer protection against AIDS.

"By putting onto the surface of the cold virus a tiny portion of HIV, which itself could not cause AIDS, we're effectively dressing a wolf in sheep's clothing," says biochemist Gail Ferstandig Arnold, who collaborated with her husband and colleague, Edward Arnold. The two are affiliated with the Center for Advanced Biotechnology and Medicine, which is jointly sponsored by Rutgers and the University of Medicine and Dentistry of New Jersey, and are faculty members in Rutgers' department of chemistry. "The challenge," she says, "was keeping the fragile cold virus alive and also making the protein segment look like HIV."

The Arnolds knew that, in other AIDS vaccines, HIV protein segments twisted out of shape, turning into varying conformations that could prevent development of immune protection. That's because the body's immune system recognizes only very specific shapes, similar to a key in a lock. The researchers needed to find a way to keep the V3 loop from twisting out of its recognizable shape.

Their solution was to attach the HIV protein segment to the cold virus's surface with a special set of chemical anchors. They attached randomly selected sequences of protein building blocks, called amino acids, on either side of the V3 loop, and then used them as anchors to tack the segment onto each of the cold virus's 60 symmetrical surface sites.

So far, five different vaccine candidates—each with a different anchor sequence—have been developed and tested in guinea pigs. All vaccine candidates but one stimulated production of antibodies that blocked laboratory strains of HIV from infecting human cells in test tubes. The next step for the researchers is testing the vaccine in chimpanzees later this year. Alan Schultz, who directs AIDS vaccine research for the National Institute of Allergy and Infectious Diseases, calls the Arnolds' research "very promising. Whether this will be significant for protection remains to be demonstrated."—*Steve Eisenberg*

Mixed Messages

The Thyroid's Effect on Brain Function

The thyroid gland, which produces hormones that can affect weight fluctuation, lethargy, and hyperexcitability, has long puzzled medical researchers. For Joseph V. Martin, an associate professor of zoology at Rutgers–Camden, one of the thyroid's secrets is particularly intriguing: "It's a mystery exactly how thyroid hormones work in the adult brain." Because thyroid hormones don't seem to regulate metabolism the same way in the brain as they do in the rest of the body, scientists have long maintained that they had little effect there.

He proposes that, in most body tissues, thyroid hormones work by entering cells directly; in brain tissue, however, they first bind to receptors

Illustrations by Randy Lyhus

outside the cell. Martin thinks that this unusual mode of hormone action might hold clues to such neurological disorders as sleeplessness, anxiety, depression, and coma.

Martin's preliminary evidence indicates that

Thyroid hormones might hold clues to such neurological disorders as sleeplessness, depression, anxiety, and coma.

thyroid hormones may bind to $GABA_A$ receptors, proteins outside the neuronal membranes of brain cells. These receptors control the chemical messages passed between brain cells by GABA, a neurotransmitter. By modifying the work of the $GABA_A$ receptors, says Martin, thyroid hormones might "alter the transmission of messages in the brain and, subsequently, throughout the body."

With a three-year, $170,000 grant from the National Science Foundation, Martin is testing his theory with the help of several graduate and undergraduate students. By injecting rats with thyroid hormones, Martin is studying $GABA_A$ receptor binding, its effect on cellular response, and the results of electroencephalograms. His research may help science understand and eventually control both the negative and beneficial effects of thyroid hormones. "For example, the hormones might regulate the neurons that allow you to stay awake," says Martin. "They can cause problems, but they may also help the body function well."—*Lori Chambers*

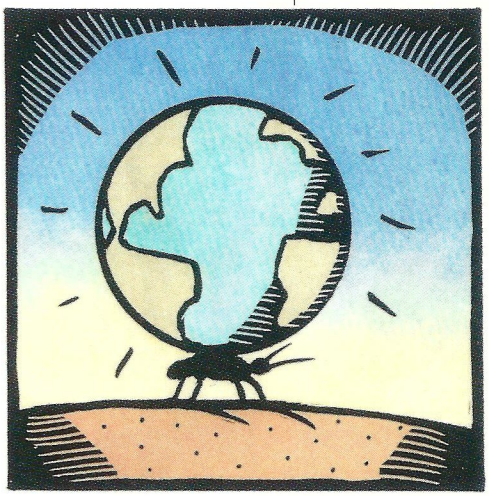
Small Wonders

Ants Can Move Rubber Tree Plants

When Steven Handel was a boy, he wouldn't think twice about squashing an ant with his tricycle. These days, however, the associate professor of biological sciences uses words like "spectacular" and "momentous" to describe the creatures he calls "the workhorses and plant partners of the insect world." "E. O. Wilson, the Harvard ecologist who won a Pulitzer Prize for his nonfiction book *The Ants*, receives numerous calls each year from people wondering what they should do about ants in their home," Handel says, with a twinkle in his eye. "Wilson always says, 'Just be careful that you don't step on them.' "

Handel's fondness for ants began in graduate school when he realized that they are major players in the world's ecosystems. Since then, the professor has made the insects a linchpin of his work to restore damaged natural habitats. Handel, whose research was featured on the recent "Nova" special "The Little Creatures Who Run the World," used a three-year National Science Foundation grant to study the roles of ants in seed dispersal and the architecture of woodlands near Sydney, Australia. He found that while the ant may be tiny, it has a monumental ability to reshape its habitat.

"Ants are social insects, always on the lookout for food to eat or bring back to the nest," he explains. "When they find a wildflower seed, they carry it to the nest so the babies can consume the seed's fat. Once the fat is eaten, the unharmed seed is left behind, and a plant may grow in the new location. It's analogous to us eating an apple and throwing the core and seeds away." Ants also protect plants by chasing or killing enemies and help organize and recycle nutrients in rain forests through seed dispersal, he adds.



The ant may be tiny, but it has a monumental ability to reshape its habitat.

Ants are crucial to Handel's latest research project: landfill restoration. By spreading new soil and leaf mulch and planting trees and shrubs, a research team led by the biologist has already restored to their natural states 20 acres off exit 15W on the New Jersey Turnpike and 15 acres at the Fresh Kills landfill in Staten Island. At the latter site, plans call for restoring an additional 200 acres. Based on his research findings, Handel believes that ants are a crucial element in assuring that the new and fragile ecosystems prosper. "At a study site in upstate New York, [I found] that ants have helped move seeds about four meters. Some European studies indicate that ants move seeds up to 100 meters."—*Bill Glovin* ❑