Bio-tick-nology yields Lyme disease vaccine

An experimental vaccine made from bacterial proteins has completely protected mice against Lyme disease, raising hopes that people may someday benefit from a similar vaccine. But researchers say the road to human trials remains as twisted as the corkscrew-shaped bacterium that causes the syndrome.

The incidence of Lyme disease, which can bring serious nerve, joint and heart problems, has skyrocketed in the United States and Europe in recent years. But the causative bacterium, *Borrelia burgdorferi,* has a knack for deceiving the body's defenses. That trait — coupled with the lack of a good animal model in which to test candidate vaccines — has impeded the search for a shot that could help the immune system repel the tick-borne troublemaker.

Recently, Erol Fikrig and his coworkers at the Yale University School of Medicine developed a strain of mice that, when infected with *B. burgdorferi,* show many of the arthritic and cardiac symptoms seen in humans with Lyme disease. Now they've used those mice to test a new vaccine.

With recombinant DNA methods, Fikrig's team mass-produced a protein called OspA, which normally sprouts from the surface of *B. burgdorferi.* They vaccinated their mice with doses of the protein, then challenged each mouse with one of three different strains of *B. burgdorferi.* Vaccinated mice fought off the infection and showed no evidence of joint inflammation or heart disease at autopsy, the researchers report in the Oct. 26 SCIENCE. In contrast, they say, unvaccinated mice remained infected and showed clear signs of disease.

The results are "very encouraging," Fikrig says, noting that the vaccine — made from a Westchester County, N.Y., variety of *B. burgdorferi* OspA — protected against all three Lyme-causing strains tested.

Unfortunately, the jump to human application "is not so simple," says Alan G. Barbour, a medical microbiologist at the University of Texas Health Sciences Center in San Antonio. He says further work must establish that the vaccine works when the bacteria are transmitted by live ticks rather than by injection. Barbour cites unpublished evidence suggesting that tick saliva may somehow enhance infectivity or that lab strains living couch-potato existences in culture plates may lack the vigor of wild-type bacteria.

He and Fikrig also caution that some strains of *B. burgdorferi* may bear OspA variants different enough to sneak past the immune systems of hosts vaccinated with the Westchester OspA. The Yale team is now testing its vaccine against additional U.S. and foreign strains and determining how long immunity lasts against the strains already used.

The lack of a primate model to confirm rodent findings still slows the path to a human vaccine. "There's not enough money to do that research now," Barbour says, noting the high cost of primate studies. "But we'll need to do it" if a Lyme vaccine is ever to reach the market.

— *R. Weiss*

Hydrogen levels increasing in atmosphere

Analyses of air samples from around the globe reveal that atmospheric levels of molecular hydrogen have climbed over the last five years, apparently because of human activities, two atmospheric scientists report. Over many decades, rising levels of this gas could stimulate greater loss of protective ozone above Earth's polar regions, they suggest.

M.A.K. Khalil and R.A. Rasmussen of the Oregon Graduate Institute in Beaverton measured air samples collected from six sites in the northern and southern hemispheres. Technicians at these locations take weekly samples and send them in stainless steel canisters to the Beaverton lab for analysis.

Examining 3,500 air samples taken from October 1985 through April 1989, Khalil and Rasmussen found molecular hydrogen (H_2) rising at an average annual rate of 0.6 percent, or 3.2 ± 0.5 parts per billion, they report in the Oct. 25 NATURE. The current level of hydrogen in the atmosphere measures just over 500 parts per billion.

The researchers attribute the hydrogen buildup to various human activities, including the burning of vegetation and emissions of the greenhouse gas methane — which reacts with other gases to produce hydrogen — arising primarily from rice cultivation and cattle raising. They estimate hydrogen levels were 200 parts per billion before the industrial era began. Future studies of air bubbles trapped in glacial ice might help determine the preindustrial level, Khalil suggests.

Hydrogen accumulating in the lower atmosphere can leak up into the stratosphere, where it oxidizes to form water vapor. The addition of water vapor to the extremely dry stratosphere could increase the number of clouds over Earth's coldest regions — an effect that might accelerate the destruction of ozone molecules in the polar stratosphere (SN: 10/15/88, p.249), Khalil says. In this way, a hydrogen buildup could enhance ozone loss near the poles, he says.

Because the observed hydrogen increase is right at the margin of detectability, researchers must confirm the trend by gathering several more years' worth of data, says chemist F. Sherwood Rowland of the University of California, Irvine. He contends that rising levels of methane should add significantly more water vapor to the stratosphere than would increasing levels of hydrogen, posing an even greater threat to the ozone layer. Researchers believe methane concentrations are currently rising by about 1 percent per year. — *R. Monastersky*

African bees make U.S. debut

After years of anticipation, entomologists in southern Texas last week captured the first swarm of African bees known to have entered U.S. airspace. When measurements of wing and leg lengths and other physical traits confirmed the bees' African lineage, the researchers destroyed the colony, preserving some of the insects in alcohol and others in −80°F freezers for future analysis.

Officials expect many more arrivals of the African bees — popularly called killer bees because of their reputation for fatally stinging those who disturb them (SN: 5/26/90, p.328). But researchers say the Texas swarm appears less interesting from a scientific standpoint than others studied farther south.

African honeybee (left) and its slightly larger but more passive European cousin.

USDA researchers found the bees during a routine monthly check of hundreds of bee traps placed near the Mexican border. The traps had been laced with a synthetic version of bee aggregation pheromone, a chemical that bees secrete when they agree upon their choice of a new home. Brood maturity suggests the African bees had used the trap as a hive for at least 2½ weeks, says Anita Collins, an entomologist at the USDA's Honeybee Research Laboratory in Weslaco, Texas. She estimates the 3-pound colony held more than 5,000 bees — although, she adds, "we didn't count 'em."

Collins says that scientists, curious about the degree of interbreeding between African and local, European-derived bees, are more interested in bees with European-style physiques and African behaviors, or vice versa, than in bees that seem all-around African, like those just trapped. "Publicly, this was the big event everybody had been waiting for," she says. "Scientifically, it's 'Well, they've moved just a little further north.'"

— *R. Weiss*