New pertussis vaccines safer, more effective

The ritual of fretful parents fussing over feverish infants after childhood vaccinations may soon be history. Two studies demonstrate that a new generation of whooping cough (pertussis) vaccines is both safer and more effective than the vaccine now used in the United States.

In studies of 15,000 infants in Italy and 10,000 infants in Sweden, the new pertussis vaccines provided better protection and caused fewer and milder side effects. "This is truly an effective vaccine," announced Anthony S. Fauci at a press conference in Bethesda, Md., last week. Fauci is director of the National Institute of Allergy and Infectious Diseases, which cosponsored the vaccine trials. The U.S. Public Health Service hopes to expedite approval of the new vaccines, perhaps in 6 months.

Pertussis is an extremely contagious respiratory infection caused by the bacterium *Bordetella pertussis*. It causes violent spells of coughing, vomiting, and inability to breathe. Gasping for breath between coughing spells creates the "whooping" sound characteristic of the disease. Pertussis may lead to pneumonia and neurological damage.

Worldwide, more than 50 million people contract pertussis every year, and more than 350,000 die—primarily infants. In the United States, mandatory vaccination at 2, 4, 6, and 18 months, with a booster at age 4 to 6, has lowered the number of infections from 160,000 in 1947 to fewer than 5,000 in 1994.

But pertussis vaccination carries some risk. Current vaccines used in the United States contain whole, but inactive, bacteria that cause fever, swelling, fussiness, and—very rarely—neurological damage (SN: 7/30/88, p.72). For this reason, some countries, including Italy and Sweden, don't require a pertussis vaccination.

The new vaccines remove these risks. Referred to as acellular vaccines, they include only the bacterial proteins needed to stimulate protection against pertussis. Two acellular vaccines are available in the United States, but only for children who are at least a year old.

The international team of researchers tested acellular vaccines in infants during pertussis epidemics in Italy and Sweden. Children in both studies got vaccines at 2, 4, and 6 months.

In the Swedish study, infants received a five-component or a two-component acellular vaccine, the standard whole-cell vaccine, or no vaccine. The five-component acellular vaccine gave 85 percent protection, while the two-component vaccine gave 58 percent protection. The Italian study tested two kinds of three-component acellular vaccines against the standard vaccine or no vaccine. Both acellular vaccines offered 84 percent protection.

Surprisingly, the whole-cell vaccine offered no better than 48 percent protection. Fauci speculates that it performed poorly because the trials omitted boosters.

Until the acellular vaccines make it to the U.S. market, Fauci advises parents to continue with the standard immunization schedule. — *L. Seachrist*

Galileo launches probe toward Jupiter

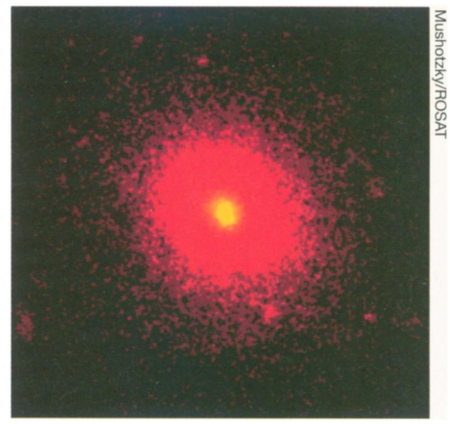
After a 6-year piggyback ride, the probe on the Galileo spacecraft successfully separated from the mother ship on July 13 and began the 51-million-mile journey to Jupiter.

The probe's plunge into Jupiter's atmosphere 5 months from now might look something like this artist's conception. Protected from the heat by a shield, the cone-shaped probe will hit the atmosphere at 106,000 miles per hour and float down on a parachute.

Seven instruments will scrutinize Jupiter's roiling atmosphere, measuring its chemical composition and recording lightning, winds, and cloud properties. The probe will beam its data up to the mother ship for 75 minutes before it vaporizes. Originally, the project team planned that Galileo would relay the probe's data back to Earth in real time. But because the spacecraft's main antenna failed to open, the data must be saved on a tape recorder for gradual playback over the smaller, low-gain antenna. — C. Wu

NASA

ASCA sheds light on galaxy formation



Mushotzky/ROSAT

X-ray image of the cluster Abell 2199. Yellow denotes highest intensity.

They have the spherical shape of ordinary galaxy clusters and radiate X rays and visible light at the expected intensity. In fact, the four groupings of galaxies recently observed with the Japanese X-ray satellite ASCA probably *are* ordinary clusters—which is precisely what intrigues Michael Loewenstein and Richard F. Mushotzky.

Shortly after its 1993 launch, ASCA recorded X rays from the hot gas swaddling four galaxy clusters that lie within a few hundred million light-years of the Milky Way. For the first time, astronomers could closely examine X-ray emissions from two elements—silicon and oxygen—that provide a fossil record of ancient star-birth. Analysis of these data now reveals that the four clusters—Abell 496, Abell 1060, Abell 2199, and AWM7—contain enormous amounts of silicon and oxygen.

Only massive stars can forge these elements. When such stars explode as type II supernovas, they hurl silicon and oxygen into space, enriching the intracluster medium. The abundance of the two elements indicates that the clusters' assortment of galaxies contained in the distant past an unusually high proportion of massive stars, creating a hotbed of violence, assert Loewenstein and Mushotzky of NASA's Goddard Space Flight Center in Greenbelt, Md.

These supernovas, energetic and numerous, ejected from their home galaxies as much visible mass as remains in the galaxies today, the astronomers estimate. And if these galactic groupings resemble others in the universe, then many apparently sedate clusters suffered similarly violent pasts, Loewenstein and Mushotzky reported last month at a meeting of the Astronomical Society of the Pacific in College Park, Md.

Since the 1970s, several craft have found that clusters contain substantial amounts of heavy elements. But nearly all have relied on X-ray emissions from

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iron, which can enter the intracluster medium in two ways—the explosion of many massive stars as type II supernovas or the detonation of far fewer, lower-mass stars as type I supernovas.

The ASCA data firmly point to the type II origin.

The researchers say their findings have several implications for understanding galaxy formation. Because the energy generated by the supernovas would have exceeded the gravitational tug from visible matter, fledgling galaxies must have harbored an enormous amount of invisible, or dark, matter.

"In this very violent environment, you need a very massive dark-matter halo to keep [the galaxy] from blowing apart," says Loewenstein.

In suggesting that infant galaxies blazed with light from a huge number of massive stars, the findings add to a continuing puzzle: Searches for primeval galaxies have come up empty-handed. The astronomers cite several explanations. Dust may veil the light; starbirth may have occurred over an extended time; or the first generation of stars formed so long ago that they are now are too distant, and thus too dim, to see.

Stanislav G. Djorgovski of the California Institute of Technology in Pasadena suggests another alternative: Some bright objects identified as distant quasars may in fact represent infant galaxies fiery with starbirth. —*R. Cowen*

Using network noise to boost detection

Many animals display a remarkable sensitivity to tiny signals, even when these signals are apparently drowned out by random environmental noise. A crayfish, for example, can use special hair cells on its tail to detect tiny water movements generated by the rapidly wiggling tail of a predatory smallmouth bass approaching its victim.

Such sensitivity may arise from an effect known as stochastic resonance—the ability of randomly varying sound or other input to enhance the detection of a weak periodic signal.

Researchers have demonstrated that the addition of an optimal level of such noise can sometimes make it easier to detect faint, information-carrying signals in electronic circuits and superconducting quantum interference devices (SN: 2/23/91, p.127) and along individual sensory neurons in a crayfish (SN: 10/23/93, p.271).

Now, J.J. Collins, Carson C. Chow, and Thomas T. Imhoff of the NeuroMuscular Research Center at Boston University have shown, in a simple theoretical model, that a network of neuron-like components can make use of the intrinsic noise of the individual components to enhance the system's overall sensitivity to weak signals.

This possibility suggests that neuronal noise, caused by biochemical and electrical activity in cells, may play a useful role in biological sensory systems, the researchers note. They describe their model in the July 20 NATURE.

The Boston group used a computer model to study the behavior of a set of networked components, each one mimicking a neuron with a certain level of intrinsic noise. Firing spontaneously and randomly, the fake neurons of such a bundle all receive inputs from the same weak signal source, and they send their individual outputs to a "summing center."

The researchers found that although the input signals were too weak to trigger neurons in the absence of noise, they did show up in the noisy output. Unexpectedly, they also discovered that for a large number of components, the processed signal's coherence no longer depended on the noise intensity.

In other words, for large arrays, there is apparently no need to fine-tune the noise intensity to an optimal level in order to detect a particular weak signal. A networked system requires only a certain minimal noise intensity to boost signal detection. —*I. Peterson*

New efforts to decloak 'invisible' science

In the late 1970s, Iceland's director of geothermal energy programs looked over a couple of just-published reports and lamented that U.S. scientists were continuing to "reinvent the wheel." He then pulled out several documents—one a decade old—that he said described what the U.S. geothermal studies reported as new.

The documents he pulled had all been written in Icelandic—a language spoken by barely a quarter of a million people. Why? Because the Icelandic government required the scientists it funded to publish in the country's native language, the director told SCIENCE NEWS.

Though Iceland has abandoned this policy, the anecdote illustrates the role a scientist's native tongue can play in shrouding science—and possibly in retarding research advances. In the August SCIENTIFIC AMERICAN, reporter W. Wayt Gibbs outlines the extent to which this and related factors continue to bury the contributions of many scientists.

Gibbs reports that "[a]lthough developing countries encompass 24.1 percent of the world's scientists and 5.3 percent of its research spending, most leading journals publish far smaller proportions of articles... from those regions." To illustrate the underrepresentation of scientists from developing countries, the magazine mapped the residences of authors appearing in last year's Science Citation Index (SCI), a commercial service that abstracts some 3,300 journals.

Citing more than 100 interviews with scientists and journal editors, Gibbs examines the roots and fallout of this bias against research from developing countries.

For instance, commercial indexing services ignore the vast majority of the world's journals. In addition, libraries tend to subscribe only to the more popular, frequently cited journals, contributing further to the invisibility of scientists who publish in nonindexed ones.

Though some abstracting services cover non-English journals, the editor of one Mexican medical journal noted that it had to provide English abstracts for its articles, publish on time, and buy a $10,000 subscription to SCI in order to qualify for inclusion. In 1982, hard times hit and the journal could no longer meet those conditions. Since then, it has struggled unsuccessfully to get back into SCI—despite the fact that it now publishes solely in English, has a U.S. editor to avoid translation errors, and has even recruited an editorial board of the top-cited Mexican scientists in the field and an international review board.

Even in the former Soviet Union, non-English-speaking scientists face many of these obstacles, Marjorie M.K. Hlava of Access Innovations in Albuquerque told SCIENCE NEWS. But several firms are working to change that. Moreover, their technologies and strategies might later be adapted to build an English-speaking audience for research in less economically developed nations.

Interlock Systems Group in Lanham, Md., for example, is beginning to market English-language compact discs of Russian patent filings, medical abstracts, and other Cyrillic databases. By year's end, its president says, Interlock hopes to offer on-line English abstracts of the holdings in Russia's National Public Library for Science and Technology, a primary repository for research documents in the former Soviet Union.

Hlava's firm is testing an on-line "browser" that translates English queries into Russian, scouts Russian-language journal abstracts, then converts any finds back into English. And the American Association for the Advancement of Science in Washington, D.C., hopes to raise the visibility of major scientists from the former Soviet Union by posting on the Internet the addresses and phone numbers of those who recently won major competitive research awards.

—*J. Raloff*