Biomedicine

Protein plays Trojan horse

How certain bacteria elude the body's defense systems to invade individual cells is a puzzle that scientists are trying to piece together. By using bacteria amenable to genetic tinkering, one team of researchers has determined how one invasive microorganism gets its foot in the door. Recently reported results reveal the presence of a specialized protein, perched on the bacterium's surface, which allows it to enter cells disguised as a wanted guest.

Called invasin by its discoverers, the newly described protein is necessary for the bacterium *Yersinia pseudotuberculosis* to penetrate epithelial cells, say scientists from Tufts University School of Medicine in Boston and Stanford University School of Medicine. Epithelial cells cover the surfaces of the body and normally provide a first-line defense against pathogens. But *Y. pseudotuberculosis* uses trickery to enter the cells, and thus to gain passage into the body, say the authors in the Aug. 28 CELL. By testing mutant bacteria that do not produce invasin, the scientists found that the protein was necessary for host-cell penetration. Inserting invasin-coding genes into *Escherichia coli* also converted that normally noninvasive bacterium into an aggressive invader.

Invasin apparently has roles both in binding bacteria to cells and in expediting their subsequent entry. "What is so surprising is that a single protein species is responsible for both functions," Stanford's Stanley Falkow told SCIENCE NEWS. "Invasin may be recognized by cells as something other than part of a bacterium. The cell then readily embraces the bacterium as something it thinks it wants, when in effect it's taking in a Trojan horse." Falkow says a similar fakery is practiced by bacterial toxins that appear to cells as harmless hormones.

Desperately seeking smokers

Cigarette manufacturers earlier this month heard some bad news from both the Centers for Disease Control (CDC) and the JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION. Then, last week, R.J. Reynolds Tobacco Co. announced the ongoing development of a new and debatably safer "smokeless" cigarette.

According to a federal study published in the CDC's Sept. 11 weekly report, smoking is becoming increasingly unpopular in the United States. The study found that as of late last year only 26.5 percent of American adults were cigarette smokers—down from 30.4 percent in 1985. The rate is the lowest ever recorded in the United States. Moreover, research in the Sept. 10 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION may encourage some of the remaining smokers to quit. Gary M. Goldbaum and his colleagues at the CDC found that women who smoke and use oral contraceptives are at increased risk of heart attack, but that smoking is by far the greater risk factor of the two.

Four days later, Reynolds unveiled its intention to market a cigarette that would heat, but not burn, a blend of tobacco and flavor-impregnated chemicals. The cigarette, scheduled for test marketing next year, provides the flavor and nicotine of a conventional cigarette. But because it doesn't burn, combustion products such as tar are virtually nonexistent.

A number of physicians immediately expressed doubts about the new cigarette's implied safety, however. Nicotine and carbon monoxide levels in the new product are approximately the same as those found in a full-flavor, low-tar cigarette, according to the company. Both compounds have been linked to heart disease and circulatory problems.

Some have also questioned whether the new product may require approval by the Food and Drug Administration (FDA). The FDA does not regulate ordinary cigarettes, but has in the past required testing of "alternative nicotine-delivery products" such as nicotine gum.

Environment

Sulfur that doesn't stay put

The emission of sulfur compounds from marshes, bogs and other wetlands may account for as much as 30 percent of the sulfur pollutants found in the atmosphere in remote areas of Canada, according to data collected by a team of researchers at the National Water Research Institute in Burlington, Ontario. However, the data also suggest that much of this marsh-emitted sulfur may have started out as sulfur emissions from coal-burning power plants or other industrial sources, deposited in the bog by acid rain and then reemitted considerably later in a somewhat different form. "Reemission of previously deposited pollutant sulfur in soils and wetlands may be an important phenomenon that has not been recognized previously," Jerome O. Nriagu and his colleagues report in the Sept. 4 SCIENCE. "Its role in the continuing acidification of the environment even after reduction of the quantity of anthropogenic sulfur emissions should be a matter of concern."

The researchers collected their data over a four-year period by regularly taking precipitation samples at a remote location in northern Ontario. They also took water samples from selected bogs and marshes to determine dimethyl sulfide concentrations. By measuring variations in the ratio of two sulfur isotopes, they were able to trace the flow of sulfur through the environment.

The Canadian study is one of the first to identify the role that inland aquatic ecosystems may play in contributing to atmospheric sulfur levels. Researchers were already aware of the large quantities of sulfur emitted as the result of biological activity in oceans. Nevertheless, in both cases, the impact of human activities often outweighs natural contributions.

What a difference the lead makes

One sure way to foment a border dispute is to complain that your neighbor is sending noxious air pollutants in your direction. One such case is the emission of nitrogen and sulfur oxides, the precursors of acid rain. Countries argue about how much of the pollution comes from neighbors and how much is generated locally. Over the last few years, scientists have been exploring the value of measuring ratios of selected trace elements to identify the origin of wind-carried particles (SN: 1/21/84, p.39). The idea is that because different regions use different fuels, have different industries and require different levels and types of pollution controls, particles in the air are likely to have different chemical signatures. Now two Canadian researchers suggest the use of lead isotope ratios to differentiate between U.S. and Canadian emissions.

In the Sept. 10 NATURE, L.A. Barrie and W.T. Sturges of the Atmospheric Environment Service in Downsview, Ontario, say that lead emitted into the air by industrial processes or gasoline consumption carries with it the distinctive isotope ratio of the ore from which the lead was derived. That ratio varies from ore body to ore body. Because most lead emitted in the United States comes from geological sources that differ from Canada's, the variations in isotope ratios can be used to apportion blame.

"We have discovered," say the researchers, "that . . . the [lead isotope ratio] is sufficiently constant between sites in each country over periods of several months to allow characteristic isotope ratios to be defined for each."

Barrie and Sturges applied the technique to samples collected from March to May 1986 at a site in central Ontario. They found that about 69 percent of lead pollution came from Canadian factories and cars; 24 percent was from the United States. The remainder seemed to come from copper smelters in northern Ontario. A similar approach applied by the same researchers on a hemispheric scale is providing insight into the source of atmospheric lead in the Arctic.