AAAS

From Anaheim, Calif., at the 165th national meeting of the American Association for the Advancement of Science

Viruses—just a flush away?

Joan B. Rose conducts what may be described indelicately as toilet science. This pollution microbiologist at the University of South Florida in St. Petersburg is flushing germlike things down toilets, then dispatching round-the-clock monitoring crews to log where these microbes show up and when. It's a dirty business, but one that is cleaning up confusion over the source of fecal viruses tainting coastal waters and some shellfish.

Fecal viruses have turned up in some 90 percent of the coastal waters that Rose has tested—though usually at low concentrations. The identified germs have been linked not only to gastroenteritis but also to flu-like symptoms (SN: 9/28/96, p. 199), earaches, and even heart disease.

To probe how the germs got there, Rose employs nontoxic phages—viruses that infect bacteria. The same size and shape as viruses shed in human feces, phages model the transport of their disease-causing brethren. However, because phages aren't normally detected in open waters, their presence can be traced directly to the experiments.

Rose flushes 100 million or so of these viruses into a septic tank or waste-water injection well; both are small-scale disposal systems that lack waste-disinfection processes and are common in Florida. Then, she waits as the wastes percolate through the ground and into the sea.

Around Key Largo, she has recovered the septic-tank viruses from nearby canals within just 11 hours of a flush, and in open marine waters, 12 hours after that. These viruses exit relatively shallow injection wells even more quickly. Some reached canals in 8 hours and appeared in the sea within 16 hours. Rose attributes the viruses' speedy travel, which she has clocked at 35 meters per hour (m/h), to the pumping action of tides around Key Largo. The far smaller effect of tidal pumping and geological factors in the middle Keys hold viral transport there to an average of just 1.7 m/h. However, Rose notes, this is still fast enough to dump excreted viruses into Florida Bay within 76 hours.

Storms also can speed the viruses along. Last year, during a major rainstorm, she notes, "we were able to demonstrate a significant relationship between [the weather] and the presence of viruses moving out half a mile into shellfish waters that were open to harvesting." —*J.R.*

Why old immune systems get creaky

The immune system doesn't exactly turn gray and wrinkly when a person grows old, but it does gradually lose power.

A major reason for this little-understood decline could be that T cells, the system's equivalent of attack dogs, are more likely to commit suicide as a person ages. Sudhir Gupta of the University of California, Irvine presented this idea to the AAAS meeting. He and his colleagues published the latest supporting data in the Feb. 15 JOURNAL OF IMMUNOLOGY.

According to Gupta's new study, T cells from senior citizens are more sensitive than young adults' cells to tumor necrosis factor–alpha (TNF-α), a molecule that signals "kill yourself now." In addition to initiating this cellular self-destruction, a process called apoptosis, TNF-α plays a role in inflammation and other immunologic functions.

Analyzing T cells from 15 university students and staffers in their 20s and 15 emeritus professors, ages 65 to 95, the researchers found more abundant receptors for TNF-α in the professors' cells. Also, retirement-age T cells were faster at activating the enzymes that chop up DNA and other cell parts during apoptosis.

The new study parallels Gupta's earlier findings. Certain genes, known as *Fas, FasL,* and *Bax*, that promote apoptosis become more active in elderly people's T cells. Meanwhile, activity fades for suicide-prevention genes called *bcl-2* and *bcl-x_L*. Designing drugs to shore up old T cells would be tricky, according to Gupta, but he's not saying it's impossible. —*S.M.*

Earth Science

Did El Niño make societies bloom?

A tiny pond perched near the rim of the Andes has helped geologists decipher when the climatic trickster known as El Niño first started disrupting weather in South America. Their findings provide some support for the idea that El Niño's appearance helped stimulate the growth of prehistoric societies.

In its modern incarnation, El Niño is an irregular but frequent visitor to the Pacific basin. Every 2.5 to 7.5 years, it warms up the central and eastern equatorial Pacific, bringing rains to Ecuador and Peru. Up in the Andes, these storms wash loose sediment into mountain lakes, providing a means of tracking El Niño's history, says Donald T. Rodbell of Union College in Schenectady, N.Y.

Rodbell and his colleagues drilled into the bottom of an Ecuadorian lake and pulled up a core of the sedimentary layers deposited over the past 15,000 years. The core has hundreds of light and dark bands, which the team dated using carbon-14 analysis. Dark bands represent sediments rich in the organic remains of vegetation that accumulated between storms. Light-colored layers, poorer in carbon, formed when rains swept freshly eroded rock into the pond.

The banding revealed a fundamental shift in the frequency of rains. Before 7,000 years ago, the storms came only once every 15 to 70 years—a pattern quite different from the modern El Niño cycle, the researchers report in the Jan. 22 SCIENCE. The El Niño pattern of storms every few years didn't start until 5,000 years ago, something hinted at in previous studies. "It supports the argument that prior to 5,000 years ago, there wasn't El Niño," says Rodbell.

That timing matches up with the growth of more complex societies in coastal Peru, says Daniel H. Sandweiss, an archeologist from the University of Maine in Orono. Agriculture spread, and people started building temple mounds along the central Peruvian coast. China, Japan, and other places also show cultural shifts at about the same time. The more frequent rains of El Niño, he suggests, triggered societal changes perhaps by spurring agricultural development or disrupting life in ways that allowed new political opportunities.

Don't give too much credit to El Niño, argues Lisa E. Wells, a geologist at Vanderbilt University in Nashville, Tenn. While the shift in storm frequency may have helped societies, she says, sea level also played an important role. Global sea level steadied about 6,000 years ago, after rising rapidly for thousands of years. Once the spreading seas stopped gobbling up land, river deltas started to form and silty soils covered flood plains. In coastal Peru, "there was no place for them to do agriculture before sea level stabilized," she says.

Rodbell's team plans to check its findings by getting equivalent records from other Andean lakes this year. —*R.M.*

Global warming: No urban myth

Climatologists have long recognized that global temperatures are rising, but some skeptics argue that urban sprawl has created the appearance of warming where none has truly happened. A team of researchers has now dismissed that critique.

Meteorologists are concerned about urbanization because rampant development has surrounded some formerly rural weather stations. As heat-trapping concrete replaces vegetation, temperatures tend to rise at these sites.

Thomas C. Peterson of the National Climatic Data Center in Asheville, N.C., and his coworkers weeded out the urbanization effect. Of the 7,280 stations in a global weather network, they examined measurements made at the 2,290 sites that have clearly remained rural. The average temperatures at these stations increased by 0.8°C since 1880, nearly the same upswing recorded by urban and rural stations combined, Peterson's team reports in the Feb. 1 GEOPHYSICAL RESEARCH LETTERS. —*R.M.*