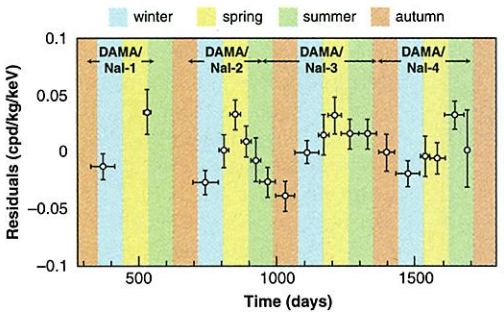


Blown away. Seasonal ups and downs in particle detections were not due to a dark-matter "wind," a new study shows.

Rita Bernabei of the University of Rome, a physicist with the DAMA collaboration, says differences in the two detectors make a direct comparison between the results misleading. But other researchers say EDELWEISS has all but put the matter to rest. "For the first time, you exclude this DAMA positive evidence for dark matter," says Michel Spiro, also at CEA Saclay. "I'd prefer that it was confirmed than excluded, but this is important physics."

Yorck Ramachers of Oxford University suspects that DAMA's seasonal variation is a systematic error. The cumulative effects of annual cycles of temperature, humidity, and other factors might explain the "detection," he says. In any case, he says, several other dark-matter searches are likely to release data this year, so those who were rooting for the DAMA result might soon have fresh puzzles to console them. **–CHARLES SEIFE**

INFECTIOUS DISEASE

Cholera Strengthened By Trip Through Gut

Poor sanitation promotes the spread of cholera, but that's not the only way humans foster the deadly diarrheal disease. Microbiologists have discovered that the human gut seems to prime the bacteria responsible. Before *Vibrio cholerae* exit the body in watery stools, something about the intestinal environment causes them to rev up the activity of certain genes. These genes, in turn, seem to prepare them for ever more effective colonization of their next victims, possibly fueling epidemics, says Andrew Camilli, a microbiologist at Tufts University School of Medicine in Boston.

"The hypothesis that passage through the host enhances infectivity is quite provocative," comments Matthew Waldor, a microbiologist at Tufts–New England Medical Center in Boston. Adds Vic DiRita, a microbiologist at the University of Michigan, Ann Arbor: "It's really amazing. It may explain the rapid and explosive nature of these epidemics."

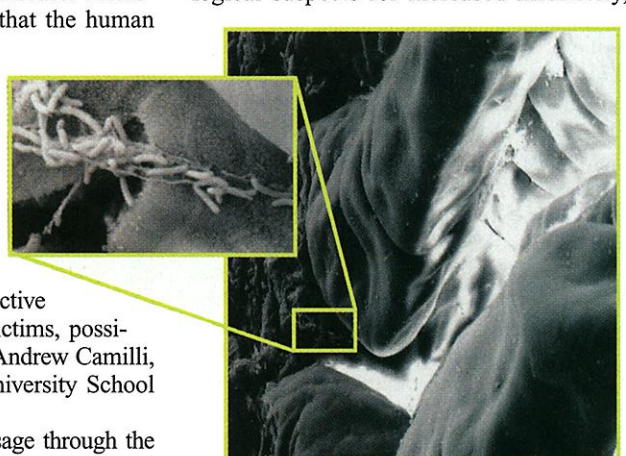
A thwarted experiment put Camilli and his colleagues on the trail of this so-called hyperinfectivity. He and others had long wondered why cholera epidemics become rampant as quickly as they do. Camilli thought the microbes residing in the human gut might develop defenses against the gut's acid environment. As a result, more of the excreted, acid-tolerant bacteria would survive in subsequent hosts. But when the researchers went to Dhaka, Bangladesh, to get fresh *Vibrio* to test this idea, technical difficulties foiled the experiment.

Instead, graduate students Susan Butler and D. Scott Merrell, who is now at Stanford University School of Medicine, made a peculiar observation. While in Bangladesh, they injected mice with a mixture of bacteria grown in the lab and isolated from human stools. The stool-derived bacteria greatly outcompeted the lab-derived bacteria, the researchers found, calculating that the former were up to 700 times more infectious than the latter.

This increased infectivity lasted at least 5 hours in bacteria living in pond water—long enough for someone to drink the infected water, says Camilli. However, the hyperinfectivity disappeared when the microbes were grown more than 18 hours in the lab, the team reports in the 6 June issue of *Nature*.

To understand what made excreted *Vibrio* different from their laboratory counterparts, Camilli and Stanford microbiologist Gary Schoolnik looked for changes in gene expression. They exposed a microarray made with pieces of *Vibrio*'s genes to *Vibrio* RNA isolated from fresh stools or lab strains. Some 3120 of the 3357 genes studied were equally active. But in the stool-derived sample, 44 genes were more active and 193 were less active.

When the researchers looked at the most logical suspects for increased infectivity,

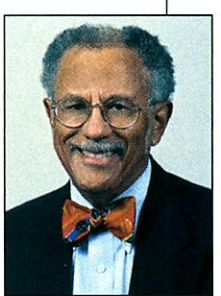


Pathogenic squatters. In this mouse small intestine, *Vibrio cholerae* bacteria (*inset*) have latched onto cells lining the gut.

CREDITS: (TOP TO BOTTOM) ADAPTED FROM BERNABEI *ET AL.*; UCAR; MICHAEL ANGELICHIO AND A. CAMILLI

ScienceScope

Prying Open the Board Federal legislators are urging the governing board of the National Science Foundation (NSF) to conduct more of its business in public—or else. The U.S. House of Representatives this week was expected to pass an NSF authorization bill that calls on the agency's in-house watchdog, the inspector general (IG), to ensure that the board is complying with all relevant federal statutes pertaining to open meetings.



The House vote follows a Senate hearing last month at which Senator Kit Bond (R–MO) told atmospheric scientist Warren Washington (right), newly installed as chair of the National Science Board, "to avoid the heartburn and take care of the matter before it becomes a problem." Washington replied that he was "philosophically" in favor of "doing as much business as possible in the open" but that he needed to check with NSF officials before giving a fuller answer. IG Tina Boesz says that her office has started to look into the matter in anticipation of a formal request from Congress.

Let the Race Begin This week, at a meeting in France, the partners in the $4 billion International Thermonuclear Experimental Reactor (ITER) were to formally submit their candidate sites to host the mammoth fusion experiment. Japan, the favorite, last week announced its choice of Rokkasho, a village in Aomori Prefecture about 540 kilometers north of Tokyo that is already home to a controversial nuclear fuel reprocessing plant. The European Union was expected to offer two candidates: Vandellos, near Barcelona, the site of a shuttered nuclear plant; and Cadarache, near Aix-en-Provence, next to France's main nuclear power research facility. A private Canadian group is pushing a site in Clarington, near Toronto.

The winner, to be chosen by the end of the year, is supposed to be the best site within the country willing to pick up the largest share of the tab. Each potential host has a huge financial stake in the decision. The Aomori provincial government, for example, expects to reap some $10 billion in economic benefits over the expected 30-year lifetime of the project.

Contributors: Philipp Weiss, Gretchen Vogel, Jeffrey Mervis, Dennis Normile and Xavier Bosch

they came up empty-handed. Neither virulence genes nor acid-tolerance genes were up-regulated. But unexpectedly, several genes involved in helping the microbes head toward or away from chemical targets were silenced. As a result, "they don't have directional motility," Camilli predicts.

Camilli suspects that this lack might help the bacteria invade the gut. Those that can sense where to go are guided by chemical signals to the lower part of the small intestine, where for unknown reasons they like to settle. But he has shown that mutant strains that are not directional "colonize everywhere in the intestinal tract," and the same might be true of stool-derived *Vibrio*. This widespread colonization might mean that more bacteria find space to start multiplying, thereby speeding the development of symptoms.

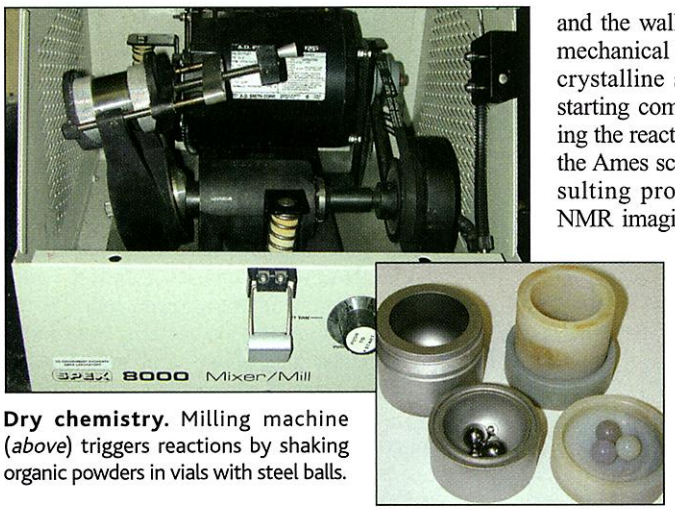
The finding could influence the current way that vaccines are developed. For one, "it may change the way we think about trials," says DiRita; perhaps tests must be done in which people are exposed to *Vibrio* prevalent during epidemics, rather than the current practice of exposing healthy volunteers to hobbled lab strains. And the proteins up-regulated by exposure to the human gut "might be good vaccine targets," Camilli speculates. But Harvard microbiologist John Mekalanos cautions that even though the data look convincing, the experiments need to be replicated. And well-controlled tests demonstrating that stool-derived *Vibrio* is more infectious in humans as well as mice will be difficult if not impossible to do for ethical reasons. **–ELIZABETH PENNISI**

ORGANIC CHEMISTRY

New-Model Reactions Skip the Drip

If you think organic chemistry is a dry subject now, just wait. Researchers at the Department of Energy's Ames Laboratory in Iowa are trying to make it literally as dry as dust. In the latest issue of the *Journal of the American Chemical Society*, a team led by Vitalij Pecharsky—a materials scientist with a joint appointment at the Ames lab and Iowa State University, Ames—reports that it has carried out a battery of common organic chemistry reactions using solid compounds, without first dissolving them in the usual liquid solvents. If this new "dry chemistry" approach works for other reactions, it could light a fire under attempts to make everyday compounds without using toxic organic solvents.

"It's an encouraging result," says Lawrence Scott, a synthetic organic chemist at Boston College in Massachusetts. The vast majority of organic reactions today require organic solvents, many of which are environmentally hazardous and costly to dispose of. "This new method gets around that



Dry chemistry. Milling machine (*above*) triggers reactions by shaking organic powders in vials with steel balls.

completely, because there isn't any solvent present," Scott says. Dry chemistry, says Kim Janda, a chemist at the Scripps Research Institute in La Jolla, California, "could be a new branch of green chemistry and open up new avenues to simplify a variety of chemical reactions."

Until now, few researchers suspected that scrapping solvents altogether was even possible. For most reactions to occur, precursor compounds must be free to come into contact with one another. That's easy in liquids, where ions and molecules move about freely. "But in solids, things are pretty much frozen," Scott says. As a result, solids normally make poor reactants for synthesizing new compounds.

To get around that problem, Pecharsky and his colleagues—organic chemist Viktor Balema and nuclear magnetic resonance (NMR) spectroscopists Jerzy Wiench and Marek Pruski—used a mechanical mill to break up organic crystalline solids, hoping to bring molecules into contact with one another long enough to form new compounds. According to Pecharsky, other groups in Japan and Russia had previously carried out related attempts at such solvent-free chemistry. But in those cases the groups had either melted the materials with heat or added small amounts of solvent, making it impossible to be certain that the reactions were taking place among the solids themselves. This work, Pecharsky says, is the first example that conclusively proves that all the reactions take place in the solid state.

For their experiment, the Ames researchers started with powdery organic compounds such as phosphonium salts, solid aldehydes or ketones, and anhydrous potassium carbonate. They placed them into 10-centimeter-long hardened steel vials loaded with steel balls the size of marbles and BBs. Then they flipped the switch on the mill, which shook each vial for between 3 and 20 hours. "The balls fly all around the vial and [crush] the powder as they hit one another and the walls," Pecharsky says. The mechanical energy broke down the crystalline solids and churned the starting compounds together, allowing the reactions to take place. When the Ames scientists examined the resulting products with solid state NMR imaging and other tools, they found that between 70% and 99% of the starting compounds had transformed into the final products.

Pecharsky says the novel method won't work for all reactions, and it would still require solvents to separate reaction products from unwanted byproducts. "It's no magic wand that will cover the entire field of organic chemistry," he says. But it might be enough to stir things up a bit. **–ROBERT F. SERVICE**

ECOLOGY

Signs of Stress Seen in Snowmobile Season

As biologists, recreationists, and policymakers debate whether snowmobiles should be allowed in U.S. national parks, a new study of animal feces suggests that the noisy machines raise the stress hormone levels of elk and wolves.

In April 2000 the National Park Service announced plans to ban snowmobiles in national parks, but it later reversed itself following a lawsuit by the snowmobile industry. A ban is now being debated again—and the machines' impact on wildlife is at the heart of the issue.

Earlier studies demonstrated that mammals and birds move to avoid areas of snowmobile use and that their heart rates increase in the presence of the machines. To look for more direct signs of stress, Scott Creel of Montana State University, Bozeman, and colleagues measured levels of glucocorticoid stress hormones in the feces of elk and gray

Peace and quiet? Elk might be stressed by the drone of snowmobiles.

CREDITS: (TOP TO BOTTOM) AMES LAB; GERALD AND BUFF CORSI/CALIFORNIA ACADEMY OF SCIENCES