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.

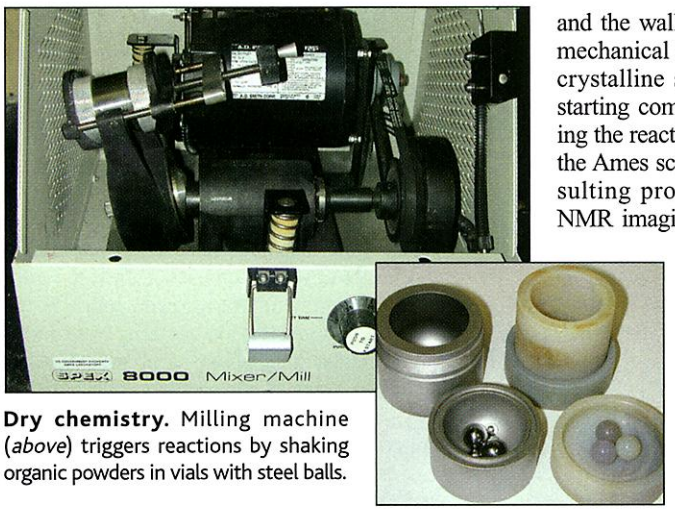
The finding could influence the current way that vaccines are developed. For one, "it may change the way we think about trials," says DiRita; perhaps tests must be done in which people are exposed to *Vibrio* prevalent during epidemics, rather than the current practice of exposing healthy volunteers 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

wolves—a reliable indicator of levels in the bloodstream. In the June issue of *Conservation Biology*, Creel's group reveals that elk in Yellowstone National Park show higher levels of stress hormones during the snowmobile season and that levels rise and fall with the amount of daily snowmobile traffic. Wolves in Voyageurs National Park in Minnesota, where snowmobile use is heavy, show higher hormone levels than those of wolves in nearby Isle Royale National Park in Michigan, which is closed to snowmobiles. During the 2-year study, wolf glucocorticoid levels at Voyageurs dropped 37%, paralleling a 37% drop in snowmobile activity.

Creel says the findings provide an "early warning" that the populations, which have been stable so far, could suffer in the future. Chronically elevated stress hormone levels in vertebrates suppress the immune system, inhibit reproduction, and cause other maladies. But in the absence of population declines, Creel says his team is not out to push recreation from the parks. "We're being careful not to recommend policy to managers; that's their job," he says.

Wildlife ecologist Joshua Millspaugh of the University of Missouri, Columbia, says that it's not clear whether the glucocorticoid levels measured are detrimental to the animals, but that the researchers' noninvasive techniques are informative and might indeed suggest incipient population effects. Samuel Wasser, a conservation biologist at the University of Washington, Seattle, adds that policy-makers should err on the side of caution: "If we wait to show a fitness effect, it may already be too late to turn things around." **–JAY WITHGOTT**

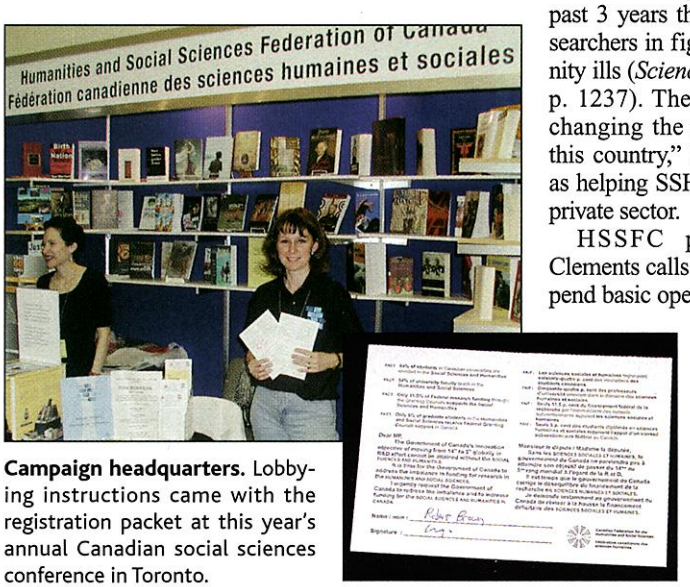
Jay Withgott is a science writer based in San Francisco.

CANADA

Social Scientists Go For a Political Dip

TORONTO—For more than 3 decades, sociologist Ralph Matthews of the University of British Columbia in Vancouver had quietly gone about his academic business, producing five books and over 80 journal articles on such issues as how energy megaprojects affect communities. Negotiating a new contract was as close as he ever came to political activism. But last week, within hours of arriving here for the 71st Congress of the Social Sciences and Humanities, Matthews experienced two "unprecedented" events that have turned him—and thousands of his colleagues—into lobbyists for their profession.

Canada's social scientists have complained for years about getting the short end of the funding stick. They are particularly fond of noting that only 11% of the government's allocation to the country's three funding councils goes to the social sciences, although they represent 54% of all academic researchers. Last week the head of the social sciences council, Marc Renaud, sharpened the rhetoric. He announced that he would be forced to end the council's bread-and-butter awards to individual investigators unless the government came through with substantial funding increases. The threat was designed to get legislators to notice his proposal for more than tripling the council's $92-million-a-year budget. It certainly got Matthews's attention. "It would be close to a tragedy if Standard Research Grants were cut," he says. "They are the intellectual base for curiosity-driven fundamental research."



Campaign headquarters. Lobbying instructions came with the registration packet at this year's annual Canadian social sciences conference in Toronto.

Renaud's threat helped convince Matthews to participate in a novel exercise. His registration packet, assembled by the Humanities and Social Sciences Federation of Canada (HSSFC), which organizes the congress and serves as the national lobbying arm for 90 organizations and their 24,000 members, contained a postcard to be filled in and mailed to Industry Minister Allan Rock and other members of Parliament. Such a campaign might not seem like a big deal in the United States, but it represents a major step for most Canadian scientists. "One of the sad facts about the Canadian scholarly community is that we have tended to let our national representatives do the job for us," says philosopher Andrew Brook of Carleton University in Ottawa. "But this has served as a real wake-up call. I haven't heard of anybody who hesitated a second about signing the postcards."

The $21-million-a-year individual grants program is the largest component of the base budget for the Social Sciences and Humanities Research Council (SSHRC). It provides researchers $15,000 in seed money for studies that ultimately gestate into books or larger research initiatives. Renaud says an inadequate budget is now forcing him to choose between eliminating those grants or dismantling programs aimed at helping society, such as the 37 science shops established over the past 3 years that enlist university researchers in fighting various community ills (*Science*, 13 November 1998, p. 1237). The latter programs "are changing the nature of research in this country," Renaud notes, as well as helping SSHRC make allies in the private sector.

HSSFC president Patricia Clements calls Renaud's threat to suspend basic operating grants "the most serious and chilling thing that I have ever heard in my lengthy career." And although Renaud says he's invigorated by the community's initial response to his call for political action, he's also aware of the government's propensity to respond to critics by tightening the purse strings. It's a risk he's willing to take. "I'm not directing this against the government," he says. "But if they don't like it, they can fire me." **–WAYNE KONDRO**

Wayne Kondro writes from Ottawa.

RICE SEQUENCE DATA

Syngenta Agrees to Wider Release

TOKYO—In a step anticipated by rice genome researchers, the company that published a draft sequence of the rice genome earlier this year has agreed to a fuller release of its data. On 23 May Syngenta, a Swiss-based agricultural biotechnology giant, announced that it would transfer the assembled sequence together with the underlying data to the publicly funded International Rice Genome Sequencing Project (IRGSP), which is working on its own draft of the rice genome sequence. The Syngenta data will be incorporated into the IRGSP sequence, which will be deposited in public databases.

On 5 April *Science* published a draft of the genome sequence of the *japonica* subspecies of rice that was produced by Syngenta's Torrey Mesa Research Institute in San Diego, California (p. 92). Instead of following the traditional practice of depositing the data in a public database, such as GenBank, the Syngenta group made the sequence available on its own Web site and on a CD-ROM. Researchers could use the raw sequence data in

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