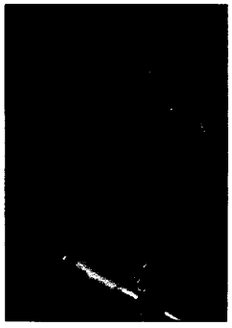
RESEARCH MANAGEMENT

Richardson Reverses Course On DOE Reorganization

In a switch that surprised supporters and opponents alike, Energy Secretary Bill Richardson last week endorsed a controversial proposal to reorganize the Department of Energy's (DOE's) nuclear weapons program into a semi-independent agency. But it's not yet clear where this change of heart will lead, as lawmakers and DOE officials continue to joust over key details of the plan, which was prompted by allegations of Chinese spying at DOE's weapons laboratories. Although proponents say the changes are needed to prevent future espionage, critics charge they will harm the labs' extensive civilian research programs and allow officials to hide environmental and safety problems from the public.



Last month, in the wake of a White House report that harshly criticized DOE management and security, Republican senators Pete Domenici (NM), Jon Kyl (AZ), and Frank Murkowski (AK) introduced legislation calling for the first major shake-up of the agency's structure since it was created in 1977 (*Science*, 2 July, p. 18). Their plan would put DOE's sprawling weapons complex, which employs more than 30,000 people at dozens of research and bomb-making facilities around the United States, under the control of a new, largely independent Agency for Nuclear Stewardship led by a high-ranking DOE official. The agency is needed, the sponsors say, to make DOE managers more accountable for protecting secrets.

Richardson repeatedly denounced the plan, charging that it would create "a fiefdom within a fiefdom" and unconstitutionally undermine his authority over nuclear weapons research and production. He also said it would "be a disaster" to place the lab's unclassified science—which includes everything from materials research to climate studies—under the security agency's control, as it would make it harder for researchers to share information and recruit talented colleagues. DOE's Office of Science, which supports some $2.7 billion worth of non-defense science a year, would still be able to fund research at the labs, but it would no longer have direct authority over the work. Other critics worried that the agency would be able to block public scrutiny of environmental cleanup and worker safety in the name of national security. "Information that makes the labs look bad could suddenly become classified," fears Maureen Eldredge of the Alliance for Nuclear Accountability, a Washington, D.C.–based watchdog group.

Forging ahead. Senators Domenici *(left)* and Murkowski *(above)* back independent agency.

On 8 July, however, Richardson told *The Washington Post* that he was ready to cut a deal with the Senate trio, apparently encouraged by a revised draft of the bill that made it clear he would retain ultimate control over the new agency. The announcement came "as a big surprise—even to some senior DOE folks," says a Senate staffer. But hopes for a quick compromise dimmed a few days later, when a meeting between Senate aides and DOE staff ended with little substantive negotiation. "Staffers were there with sharp pencils ready ... but [DOE officials] wanted to talk more generally," says another aide.

DOE officials expressed concern, for example, about the bill's requirement that the agency have its own security and counterintelligence staff, rather than answer to an agencywide czar. They are also uneasy about plans to insulate the agency from the direct oversight of the department's environment and worker safety officials, who would instead be restricted to making recommendations to the secretary. Such changes "could create a serious bottleneck in decision-making," says a DOE official. A Republican aide, however, says the shift would "put responsibility where it belongs—at the top of the pyramid."

The two sides planned to meet again this week, and "the secretary is hopeful an agreement can be reached," a DOE spokesperson said. But the senators may not let the discussions linger: If there is little sign of progress, aides say they could move to attach their measure—which appears likely to pass the Senate—to national security legislation as early as 16 July.

The reorganization plan faces an uncertain reception in the House, however, where the Science and Commerce committees met on Tuesday, as this issue went to press, to hear from a panel of plan critics, including Eldredge. The joint hearing, an aide says, was designed "to raise some issues the Senate doesn't seem to be focusing on, such as the reorganization's impact on science." Scientists working on cleaning up DOE's many contaminated nuclear weapons sites, for instance, could face a bureaucratic maze if they want to share their results with colleagues outside the new agency, says political scientist Don Kettl of the University of Wisconsin, Madison, a former department adviser who testified at the hearing. "You could reduce DOE's ability to respond [to pollution problems] by building walls that are too high," he says.

Whether such sentiments will convince the House to reformulate the Senate plan won't be known until later this month, when lawmakers from both bodies will meet to hammer out an agreement on the issue. Whatever the outcome, however, a House aide predicts that "DOE's structure is going to change; the only question is how."

–DAVID MALAKOFF

MICROBIOLOGY

Anti-Immune Trick Unveiled in *Salmonella*

The *Salmonella* pathogen is best known as an intestinal bug. But various species also cause severe systemic illnesses such as typhoid fever, and part of the reason people get so sick is that their immune systems cannot quell the infection immediately. Now researchers studying a particular *Salmonella* protein have discovered a surprising new weapon that may help explain the pathogen's

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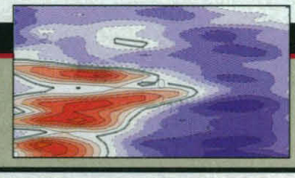
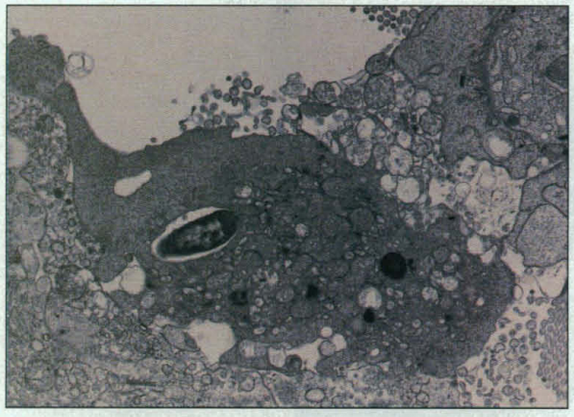


virulence: At least one species can create an intracellular traffic jam within certain of the host's immune cells.

Once inside those immune cells, *Salmonella enterica*, the bacterium that causes food poisoning in humans and a typhoid fever–like illness in mice, shoots a protein called SpiC into the host cell's cytoplasm. Somehow that protein clogs an intracellular transport system that would normally dump the organism into a toxic cellular chamber called the lysosome. The blockage is so far-reaching that it also prevents other deliveries to the lysosome and other cellular locations, according to work in the 15 July *EMBO Journal* by Eduardo Groisman, a microbiologist at Washington University School of Medicine in St. Louis, and colleagues.



Safe at home. *Salmonella* inside a vesicle can avoid being shuttled to the cell's death chamber.

"This [finding] opens up a new area of research," says Jorge Galán, a microbiologist at Yale University. Researchers already knew that *Salmonellae* have a specialized protein export machinery that they use only within host cells and that helps them replicate, but SpiC is the first secreted protein of this system to be identified. Galán adds that "there has to be a target for that protein in the host cell." SpiC may lead scientists to that target, illuminating both normal intracellular traffic patterns as well as how *Salmonella* jams them.

Immune cells such as macrophages normally kill bacteria by first engulfing them—encircling them with the cell membrane and thus forming a vesicle. The vesicle then moves through the cell, stopping in a regular itinerary to fuse with other vesicles and transfer its contents. Eventually it docks with the lysosome—a death chamber where toxic chemicals and enzymes chew up the cargo. Some research suggests that *Salmonella* survives in vesicles that have lysosome-like characteristics. But other experiments indicate that the organism manages to avoid this fate.

Seeking a clue to *Salmonella*'s activity once inside a macrophage, the researchers focused on an apparently unique gene, *spiC*, that they had previously sequenced from the bacterium. The team created a mutant strain that doesn't produce SpiC and found that it grows poorly in macrophages and is much less virulent in mice than are wild-type bacteria. This suggested that the protein is central to *Salmonella*'s harmful effects.

The team labeled cells with gold particles, which collect in the lysosome and highlight it, then infected the cells with wild-type *Salmonella* or SpiC mutants. The researchers found that wild-type *Salmonella* were less likely to end up in the gold-labeled lysosomes than were SpiC mutants. In a separate experiment, they used radioactively labeled molecules to monitor vesicle traffic. Even for vesicles that didn't contain *Salmonella*, they found, transport seemed to be inhibited in cells infected with wild-type bacteria, while lysosomes received their usual deliveries in cells infected by SpiC mutants.

To find out whether SpiC alone could block vesicular transport, the team analyzed the protein's effect on the movement of transferrin, a protein that normally uses vesicular transport to ferry iron from outside the cell to compartments inside and then returns to the surface. The researchers found that cells infected with a genetically engineered virus that produces SpiC both brought less transferrin into the cell and recycled it to the surface less efficiently than did those carrying virus without SpiC. Similarly, in a system of cell extracts, the team found that purified SpiC prevented vesicles from fusing.

Other bacteria trapped in vesicles have evolved ways to prevent their compartment from fusing with the lysosome, but SpiC is the only known bacterial protein to tie up global vesicular traffic. "This is a totally new way of altering trafficking," says Galán. "It points at a mechanism that's very different from that of any other bug. … It has to be interfering with some key regulator of the trafficking pathway."

The new work may open the way to resolving the long-standing controversy about whether *Salmonella*-bearing vesicles fuse with lysosomes, but it also raises questions. Vesicles normally fuse with lysosomes within 20 minutes of infection, but researchers can't detect SpiC until about an hour later. SpiC production may begin while the bacteria are in other cells, but before they enter the macrophages, suggests Samuel Miller, a microbiologist at the University of Washington, Seattle. And because macrophages rely on vesicle fusion to secrete factors that stimulate and attract other cells of the immune system, SpiC's blockage of vesicle fusion might also affect macrophage activity in unanticipated ways, hampering immune system function, says Ralph Isberg, a microbiologist at Tufts University School of Medicine in Boston.

Just as one crucial accident can slow activity throughout a city, SpiC's traffic snarl may have profound effects on its host cell.

–EVELYN STRAUSS

CREDIT: D. MONACK AND N. GHORI, STANFORD UNIV.

QUANTUM MECHANICS

Physicists Tame a Single Photon

"To catch a baseball without stopping it" may sound like a Confucian riddle, but that is the essence of a groundbreaking quantum manipulation experiment reported in this week's issue of *Nature*: A team of French physicists has managed to detect a single photon repeatedly without destroying it. "The basic idea is that we can trap a single photon in a box … and monitor and make repeated measurements on it as though it were a particle in a box," says Serge Haroche, who led the team at the Ecole Normale Supérieure (ENS) in Paris. The experiment is a unique demonstration of a phenomenon known as quantum nondemolition—the repeated nondestructive measurement of a quantum state—that a few teams of physicists have managed to demonstrate before, but never with anything as delicate as a single photon. "I think it's marvelous," says Wojciech Zurek, a quantum measurement guru at the Los Alamos National Laboratory in New Mexico. "They have implemented one of the goals, one of the mileposts, which has defined the field of quantum measure-