Zerhouni, a radiologist and executive vice dean at Johns Hopkins University School of Medicine in Baltimore, Maryland, told members of the Senate Health, Education, Labor, and Pensions Committee that "disease knows no politics" and that NIH "must always remain factual," not "factional." Only Senator Paul Wellstone (D–MN) pressed Zerhouni on whether he agrees with President George W. Bush's decision to limit federally funded research to 78 approved lines of stem cells. "You can do a lot" with those lines, Zerhouni replied. However, he hinted that he might eventually make the case for more lines: "If it becomes evident through this research that there are pathways to develop cures and so on, I'm going to be the first one to assemble that information … and share that with everyone."

He said the director's "most important role … is to reestablish morale and momentum" as well as to recruit NIH institute directors. NIH has been run by acting director Ruth Kirschstein for more than 2 years, and five institutes do not have permanent directors. Zerhouni said he's interested in fostering "crosscutting initiatives" and promoting "access to new technologies," such as a DNA chip he brought along as a prop.

–JOCELYN KAISER

EVOLUTIONARY BIOLOGY

Timing Is Everything For *Wolbachia* Hosts

Wolbachia may be the most common infectious bacteria on Earth, but they are by no means ordinary. Among their accomplishments: They manipulate their hosts' sex life to boost their own reproductive success. Researchers have long wondered what sort of molecular trickery *Wolbachia* use to pull off this feat. Now they know at least one of their secrets: Like an auto mechanic, they can alter the timing of a key step of their hosts' reproductive cycle so that it either misfires or runs smoothly. The finding is "a really major advance," comments *Wolbachia* expert John Werren of the University of Rochester in New York state.

Out of sync. Parasitic bacteria delay a key chromosomal movement in *Nasonia* wasps.

CREDITS: (TOP TO BOTTOM) ITER; J. WERREN

Wolbachia infect millions of species of insects, crustaceans, and other invertebrates, but they can't live outside their hosts' cells. To jump to the next victim, they infect developing eggs that will grow into adult hosts. Because males cannot pass the bacteria on in sperm, *Wolbachia* have evolved many sophisticated strategies to skew populations in favor of infected females (*Science*, 11 May 2001, p. 1093).

On page 1124 of this issue, researchers at the University of California, Santa Cruz, offer the first good glimpse of how *Wolbachia* do this in a species of wasp known as *Nasonia vitripennis*. In these wasps, as in many insects, the sex of the offspring is normally determined by a bizarre process: If an egg is fertilized by a sperm, the progeny will be female, but unfertilized eggs will divide and develop into male embryos. *Wolbachia* play havoc with *Nasonia*'s reproduction. When an infected male mates with a healthy female, the offspring will all be male, but if two infected wasps mate, the result will be a normal ratio of male and female offspring, all infected with the bacterium.

Skewing the sex ratio in this way works to *Wolbachia*'s evolutionary advantage. By making uninfected female wasps produce only sons, the bacteria reduce the number of uninfected female wasps in the population. That makes it more likely that *Wolbachia* from other females will get carried down from one generation to the next.

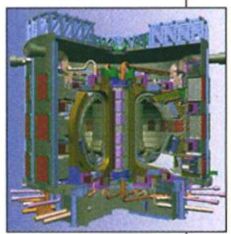
Researchers have been unable to expose how *Wolbachia* perform such manipulations largely because they haven't had the right tools, according to co-author William Sullivan. "You couldn't answer these questions 5 years ago," he says. "The technology just wasn't there." In recent years, however, Sullivan and others have figured out how to create movies of a developing embryo that reveal the activity of its proteins and genes. *N. vitripennis*'s eggs develop slowly, making them ideal for a starring role.

Once the wasp's egg is fertilized, its chromosomes go through a complex choreography. The compartments that contain each set of chromosomes (called the pronuclear envelopes) move to a special location in the egg known as the metaphase plate, then the envelopes break down, allowing the chromosomes to escape and find their correct place at the plate. Only then can they be duplicated as the egg divides into new cells.

Sullivan and postdoc Uyen Tram observed this process using dyes that attach to proteins that help destroy the walls of the male and female pro-

ScienceScope

ITER Reconsidered Four years after bailing out due to cost concerns, the U.S. government is considering rejoining a slimmed-down international fusion power project. Secretary of Energy Spencer Abraham last week told an international conference that President George W. Bush was "particularly interested" in the International Thermonuclear Experimental Reactor (ITER) and had asked the Department of Energy (DOE) "to seriously consider American participation" in the $4 billion project (*Science*, 3 May, p. 823).



Fusion advocates welcomed the speech, as did potential partners in Japan, Russia, Canada, and Europe. But DOE science chief Ray Orbach cautioned that it will take a while "to do due diligence on the scientific issues" and decide whether ITER, or some other domestic fusion project, would be the United States' best bet. Fusion researchers are due to meet in Colorado this summer to hash out the issues, and they hope to issue a consensus recommendation by the end of the year. ITER planners, meanwhile, hope to select a site for the planned machine at about the same time. Finding funding for any fusion project, however, could be difficult.

Bigger Rebates? The United Kingdom wants to expand the reach of its R&D tax credit in a bid to spur commercial science. The government last month unveiled a budget proposal to increase existing tax credits for small firms and—for the first time—give large companies a tax break for R&D spending.

Currently, companies with fewer than 250 employees can deduct 100% of their R&D expenses. Under the new plan, these small firms would be able to deduct 125%, with large players getting a new 25% rebate. Analysts estimate that the breaks would cost the treasury about $585 million.

Government officials hope the rebates will help persuade multinational firms to shift some of their R&D operations to the island. Indeed, large pharmaceutical companies may be the biggest beneficiaries of the change, says Daniel Abrams of the U.K.'s BioIndustry Association, because small biotech outfits already benefit from other subsidies. Parliament, which must approve the new credits, is expected to consider the change later this year.

nuclei. They found that *Wolbachia* tinker with the timing mechanism. In healthy wasps, both pronuclear envelopes were destroyed at the same time. But when the sperm came from an infected male, its pronuclear envelope started decaying a minute or more after the uninfected female's, preventing the enclosed chromosomes from arranging appropriately before the cell divided. The egg then divided as if it had never been fertilized, using only the chromosomes from the mother to develop into a male.

Because *Wolbachia* block an infected male's chromosomes with a simple change of timing, they can bring the process into sync with an equally simple trick. When Tram and Sullivan fertilized an infected egg with sperm from an infected male, the walls of the female's pronuclear envelope also took longer to disintegrate. As a result, both parents' chromosomes were released late, so that both became part of the embryo's genome. Such infected wasps, in turn, grow up to do their bacterial puppet masters' reproductive bidding. –CARL ZIMMER

Carl Zimmer is the author of *Evolution: The Triumph of an Idea*.

MICROBIOLOGY

New Method for Culturing Bacteria

The well-trained *Escherichia coli* aside, the majority of bacteria don't take to the petri dish. Pull them out of their native environments, and microbe colonies seem to wither away with a terminal case of homesickness. Now, in work reported on page 1127, researchers at Northeastern University in Boston have managed to grow in the lab several strains of previously unculturable beach-growing bacteria—an advance that may provide a new means of exploring the vast diversity of microbial species.

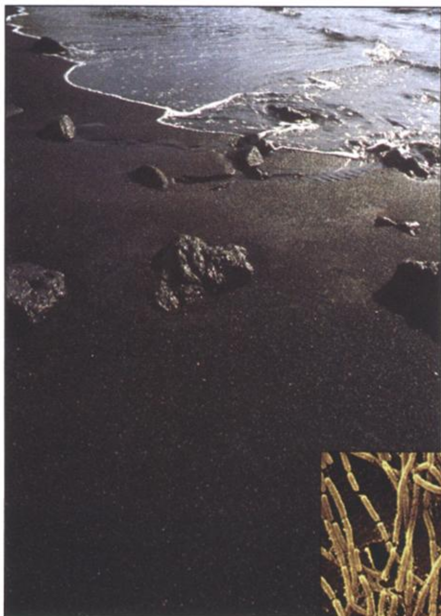
The key to their success: transplanting not just the organisms but their whole sandy neighborhood along with them. "If we recreate the natural conditions," says microbial ecologist and team leader Slava Epstein, "the bacteria will never know they've been moved."

The inability to culture bacteria has dampened efforts to study microbial diversity. Whereas scientists have described roughly half of plants and animals and maybe a fifth of insects, "we know only a tiny fraction of a percent of the bacterial species," says Abigail Salyers, a bacteriologist at the University of Illinois, Urbana-Champaign.

Given the difficulty of culturing most microbes, researchers have mostly explored microbial diversity secondhand by hunting for RNA signatures in the environment that signal the presence of novel active genes. Although such information can point to the existence of microbial life, it doesn't help much when it comes to identifying and characterizing the organisms. "Nothing beats actually having the organism in culture," says microbiologist Stephen Giovannoni of Oregon State University in Corvallis.

Studying the organisms in culture can not only provide new information about microbial evolution and ecology but may also yield a host of useful compounds, such as antibiotics or enzymes with unexpected properties. For example, the Taq polymerase used in the polymerase chain reaction comes from a thermophilic bacterium.

Because attempts to grow bacteria in standard lab cultures had so often failed, Epstein, microbial ecologist Tammi Kaeber-



Beach colonies. Beaches harbor a wealth of microbes now being cultured in the lab. The micrograph (*inset*) shows a lab-grown colony.

lein, and molecular microbiologist Kim Lewis wanted to test their idea that a natural setting would supply the ingredients needed for the bugs to survive. To do this, the researchers collected samples of prime bacterial real estate on a sandy beach near the university's Marine Science Center on Nahant island north of Boston. The team cut blocks of sand that were 60 centimeters long, 30 cm wide, and about 15 cm deep. Although the bacteria reside on the surface, the depth was essential to maintain the same chemistry and oxygen conditions as at the beach, Kaeberlein says.

Once each block of sand was in an aquarium, the team created chambers in which they hoped to mass-produce pure cultures of some bacterial strains. The chambers, which rested on the sand and were covered with seawater, had walls consisting of permeable membranes that allowed nutrients and other environmental chemicals to enter the chamber but prevented the bacteria from escaping.

Bacteria in these chambers thrived, forming 300 times the number of colonies produced in conventional lab culture dishes. At least 20% of the organisms placed in the chambers formed colonies, compared to much less than 1% in the culture dishes, Epstein says. Using this technique, the researchers so far have isolated two previously unknown microbes, called MSC1 and MSC2 (MSC for Marine Science Center), and are investigating nine more.

The work also provided an intriguing hint about why some microbes don't grow well. When Kaeberlein was cleaning out the refrigerator, she noticed that one supposedly pure bacterial strain that had surprisingly thrived in a culture dish wasn't pure after all. "There was more than one type of organism growing in there," she says.

When the researchers investigated, they found that MSC1 and MSC2 would grow in the petri dish only when both strains were present. Because the growth didn't seem to depend on the food supply, the team suggests that the bacteria may signal each other in the environment, transmitting some sort of "all's well" call that certain species need to hear before they'll proliferate. Such signals have been detected in the biofilms formed by many bacteria.

Marine microbiologist Edward DeLong of Monterey Bay Aquarium Research Institute in Moss Landing, California, points out that the new method isn't going to solve all bacterial culture problems; many environmental niches aren't compatible with the diffusion-chamber format. Even so, he says, any advance in culturing microbes will help put more microbe species on the map.

–KATIE GREENE

FISHERIES RESEARCH

No More Surprises From Evanescent Squid

CAMBRIDGE, U.K.—In a good year, fishing boats can haul almost 300,000 tons of squid out of the South Atlantic ocean. But this spring, many are returning virtually empty. In fact, 2002 is shaping up to be the poorest year for one of the world's largest squid fisheries —worth up to $1 billion in good years— since record keeping began in 1987. That's dismal news for squid fishers and calamari

CREDITS: T. KAEBERLEIN