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.

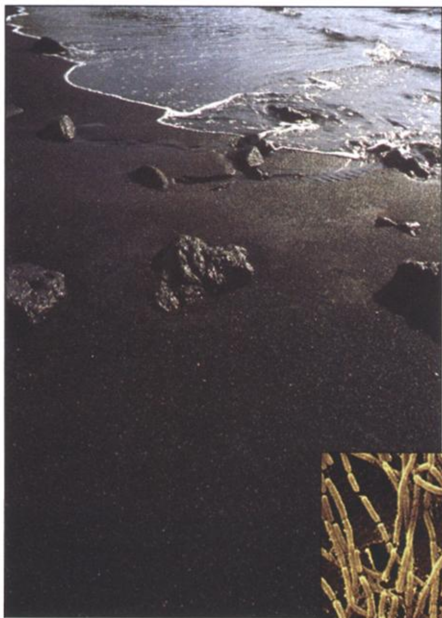
The key to their success: transplanting not just the organisms but their whole sandy neighborhood along with them. "If we recreate the natural conditions," says microbial ecologist and team leader Slava Epstein, "the bacteria will never know they've been moved."

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 Kaeberlein, 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.



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

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