lar to Flake's. And they are heartened by the fact that the chair of the spending subcommittee who wrote the Senate version of the bill, Senator Barbara Mikulski (D–MD) offered a vigorous and successful defense of the field the last time it came under attack in 2009 from Senator Tom Coburn (R–OK). "The real challenge is to find someone on the other side of the aisle," Brintnall acknowledged, adding that it's even harder to recruit champions "when they don't know what they would be opposing."

The initial debate over ACS was about whether to make it voluntary. In March, a House panel held a hearing on a bill (H.R. 931) by Representative Ted Poe (R–TX) that would erase the criminal penalty for not responding to ACS, and Poe's amendment to the spending bill to achieve that goal was approved by a voice vote. But when Webster proposed axing ACS entirely, his motion carried by a vote of 232 to 190.

Senator Rand Paul (R–KY) introduced a bill (S. 3079) last month that would make every one of the 48 questions on ACS voluntary except for the name, address, and the number of people living in the dwelling. Although that measure has not advanced, ACS supporters fear that Paul could propose a similar amendment to the Commerce and Justice appropriations bill.

A Paul staffer wouldn't speculate on what he might do once the spending bill came up for debate. "It's not on the top of his list," the aide said. "But they should be worried," the aide added, referring to those who support the survey. "Nobody knew that it would pass the House, and I don't see why it would be off the table [in the Senate]." **–JEFFREY MERVIS**

MARINE ECOLOGY

Seagrasses Partner With Clams to Stay Healthy

Not much to look at and sometimes quite mucky, seagrass beds have been called the ugly ducklings of marine conservation. They lack the charisma of coral reefs, yet like reefs, these beds form a highly productive and diverse ecosystem, acting as the nursery for many kinds of fish as well as a home to sea turtles, manatees, birds, and a host of other sea creatures. Seagrasses help cycle nutrients, and experts estimate they provide $1.9 trillion in ecosystem services per year worldwide. At the heart of seagrasses' success—and the secret to efforts to restore the increasingly threatened ecosystem—may be a small clam.

On page 1432, marine ecologist Tjisse van der Heide of the University of Groningen in the Netherlands and colleagues describe a three-way partnership—between seagrasses, lucinid clams, and bacteria living in the clams—that likely keeps toxic sediments from building up and killing the seagrass. An appreciation of this partnership could lead to better success in seagrass restoration, Van der Heide suggests. "This study pointedly reminds us that we cannot study species in isolation. … Symbiosis is one of the fundamental mechanisms by which ecosystems become productive and robust," says Geerat Vermeij, an evolutionary biologist at the University of California, Davis.

Hidden workers. Tiny clams living in the roots of seagrass help keep the sediment a healthy environment.

Seagrasses are saltwater flowering plants that grow along coasts and make up 0.2% of the ocean's ecosystems. They produce an amount of biomass that beats that of the Amazonian rain forest and is on par with that of corn and sugar cane crops. Their roots and stems trap organic matter and sediment, causing buildups of rich mud that can be waist deep.

This muck is a potential threat to the grass: Decaying organic matter produces a lot of sulfide, creating what could be an unhealthy environment for plant roots. Researchers had assumed that the oxygen released from seagrass roots combined with enough of the surrounding sulfide to neutralize this toxic element. Not so. "We found that in most seagrass beds, it's much more complex," Van der Heide says. "They have a trick to speed up oxidation" that relies on a symbiotic relationship with bacteria that consume sulfides.

Van der Heide first began to suspect that the seagrass depended on bacteria while doing fieldwork in Mauritania. He and his colleagues found thousands of 1-centimeter lucinid clams living among the seagrass roots. Gills make up much of the clam's innards: That's where sulfide-oxidizing bacteria live. They sustain the clam by providing nutrients much in the way that zooxanthellae sustain coral.

Following up their clam observation, the researchers took 110 samples of seagrass beds with a 15-centimeter-wide tube that cut cores 20 centimeters deep into the sediment. They filtered out and weighed all the organisms in the sediment and dried and weighed the seagrass in each core. "The more bivalves we found in the core, the more seagrass we found in the core," suggesting a beneficial partnership, Van der Heide says.

Wondering if this cohabitation was unique to Mauritania, the researchers combed the literature for studies describing the communities inside other seagrass beds, finding 84 covering tropical, subtropical, and temperate sites on six continents. Lucinid clams were found associated with 11 of 12 seagrass genera, the one exception being a seagrass that grew on bare rock.

Next, Van der Heide explored the potential of this relationship in the lab. He grew seagrass alone, clams alone, and the two organisms

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together under different conditions, including one in which he and his colleagues injected sulfide into the sediment semiweekly. On its own, the seagrass was able to process some of the sulfide, but sulfide gradually increased in concentration and interfered with seagrass growth. The clams alone got rid of the introduced sulfide but didn't get any bigger. But both the clam and the seagrass thrived when together, getting rid of the sulfide and growing as well, Van der Heide's team reports. The roots seemed to provide the clams with more ready access to oxygen, which "was necessary for the bivalves to consume that sulfide in an efficient manner," Van der Heide explains.

"The elegant experimental design provides compelling evidence for the benefits of the interaction between seagrasses and the associated bivalve," says Carlos Duarte, a marine ecologist at the University of Western Australia in Perth.

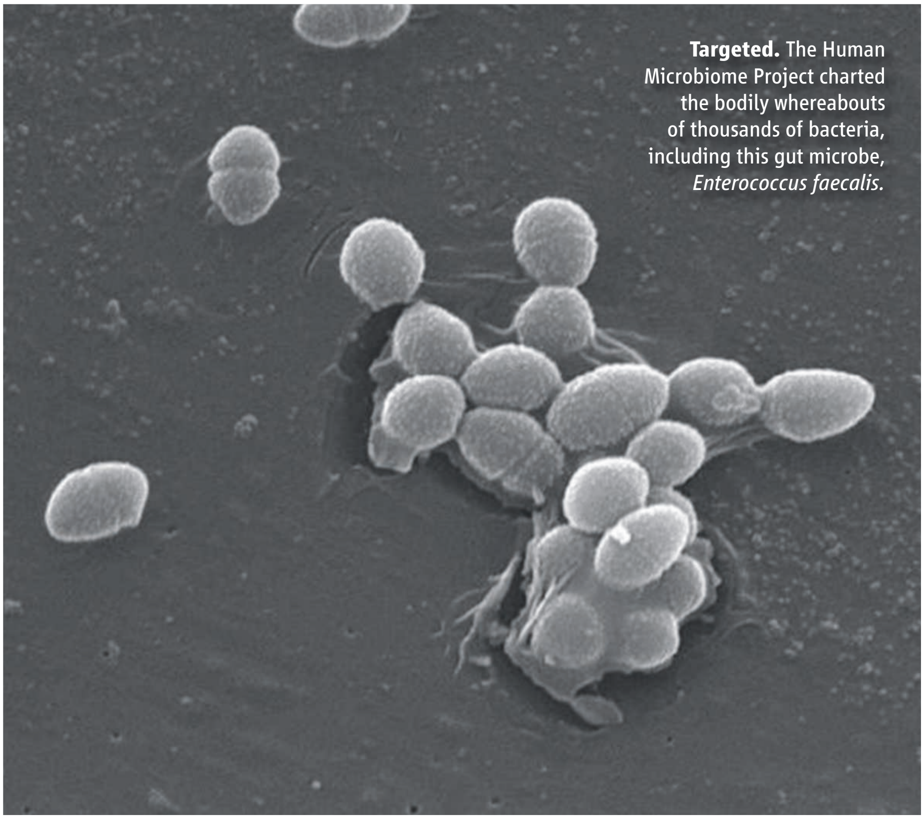
The new understanding comes at a crucial time as seagrasses are in trouble. About 7% of seagrass beds disappear per year, a rate comparable to the loss of tropical rainforest. Yet the amount of carbon seagrasses sequester can be more permanent, in part because forest fires can eventually release the carbon from forests, while carbon stays buried in seagrass sediments for millennia, Duarte and his colleagues reported online 20 May in *Nature Geoscience*.

Coastal development, dredging, and declining water quality are mostly to blame for the current woes of seagrasses, though epidemics, severe weather, and destructive fishing practices have also contributed to their decline. Rising water temperature due to climate change is also taking a toll, Duarte says. Warming in the Mediterranean Sea could result in the functional extinction of a dominant seagrass there by mid-century, he and his colleagues reported online 20 May in *Nature Climate Change*.

Seagrass restoration is expensive, as large areas must be hand-planted, and less than a third of attempts succeed. In evaluating an area in decline, "it's probably smart not just to look at these plants but also to look at the bivalves present," says Van der Heide, who advocates transplanting the entire community.

Duarte is not completely convinced that adding lucinid bivalves in seagrass restoration programs will increase their success. But he values Van der Heide's study because it draws attention to the importance of considering biological interactions in planning seagrass recovery. "The discovery of this three-way symbiosis provides evidence for the key importance of biotic components."

–ELIZABETH PENNISI



Targeted. The Human Microbiome Project charted the bodily whereabouts of thousands of bacteria, including this gut microbe, *Enterococcus faecalis.*

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MICROBIOLOGY

Microbial Survey of Human Body Reveals Extensive Variation

Though perhaps less contemplated than the navel, the inside of the elbow seems nonetheless comfortingly familiar. Don't be fooled. Our bodies are home to trillions of microbes, and that patch of skin hosts an invisible ecosystem whose microbial members were virtually unknown until now. This week, a consortium involving 200 investigators from a variety of disciplines describes that elbow-dwelling microscopic community as well as more than a dozen others as part of the most thorough look ever at the microbial world on and within us.

By the time it is completed next year, this Human Microbiome Project (HMP) will have spent $170 million cataloging the microorganisms—and to a lesser extent, their genes—that live on 18 human body sites, sequencing 3000 relevant bacteria, and determining differences between the microbiomes of healthy and unhealthy people. "It's a great framework, reference, and tool to really understand the microbiome," says microbial ecologist Maria Gloria Dominguez-Bello of the University of Puerto Rico in San Juan.

The U.S. National Institutes of Health (NIH) started HMP in 2007 to jump-start a young field. When the effort was first conceived, researchers had hopes of generating a reference healthy microbiome, on par with the reference human genome, that the community could use to assess the role of microbes in health and disease. Two reports this week in *Nature* and 15 others in *PLoS ONE* and other journals, all from the HMP consortium, speak to the naïveté of that idea. "There's not a single reference human microbiome that we can compare everybody to," says George Weinstock, an HMP researcher at Washington University in St. Louis in Missouri. "You can have two healthy people whose microbiomes are fairly different."

The research released this week comes just as NIH is debating whether to launch an HMP follow-up and European nations are considering a successor to their own ambitious human gut microbiome effort, Metagenomics of the Human Intestinal Tract (MetaHIT) (*Science*, 8 June, p. 1246). For the HMP studies just published, researchers took samples from more than a dozen body sites covering the skin, nose, mouth, and gut in 242 healthy

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