Pearl-like bacteria are largest ever found

Look closely at the period ending this sentence. Scientists have discovered a bacterium similar in size to that punctuation mark, making it the biggest ever observed. In terms of cell volume, some copies of the bacterium are more than 100 times larger than the previous record holder.

"I'm stunned by how big this thing is. This goes orders of magnitude beyond what I thought was possible," remarks microbiologist Mitch Sogin of the Marine Biological Laboratory in Woods Hole, Mass.

Residing in the greenish ooze of ocean sediment off the coast of Namibia, the spherical bacteria have diameters ranging from 100 to 750 micrometers. Since the bacteria often form strands of a dozen or so cells and glisten white from light reflecting off sulfur inside them, scientists named the microbe *Thiomargarita namibiensis,* or sulfur pearl of Namibia.

The behemoth bacterium was discovered in African sediment samples obtained in 1997 by Heide Schulz of the Max Planck Institute for Marine Microbiology in Bremen, Germany. On a previous visit to the coast of South America, she and her colleagues had identified bacteria that oxidized sulfur for energy. The scientists then decided to investigate whether similarly sulfur-rich sediments off the Namibia coast might harbor the same microbes.

T. namibiensis was much more abundant than the South American bacterium, the researchers report in the April 16 SCIENCE. Because of their light-reflecting properties and size, the microbes are visible to the naked eye. Schulz's coworkers had to be convinced these huge spheres were bacteria. "They didn't believe me initially," she laughs.

Careful studies of the microorganisms eventually confirmed that they are indeed bacteria. Analysis of their DNA, for example, indicated that they are relatives of the bacteria that Schulz and her colleagues had found earlier. This analysis wasn't easy, notes study coauthor Andreas Teske of the Woods Hole (Mass.) Oceanographic Institution, because *T. namibiensis* is so large that smaller bacteria colonize the mucus sheath enveloping the microbe. Consequently, the team often detected other DNA along with that of *T. namibiensis*.

Schulz et al./ Science

Thiomargarita namibiensis *(white sphere) is comparable in size to the head of a fruit fly. The smaller spheres above it are dead* T. namibiensis.

The new bacterium steals the size record from *Epulopiscium fishelsoni*, which is found in surgeonfish guts. If an ordinary bacterium were mouse-size, *E. fishelsoni* would be the equivalent of a lion, and *T. namibiensis* might equal the world's largest animal, the blue whale.

The key to the new microbe's large size, and to its life, is a huge fluid-filled sac, or vacuole, that takes up about 98 percent of the bacterium's interior. Within this vacuole, the bacterium stores large quantities of nitrate, which it uses to oxidize sulfur and garner energy. The amount of nitrate in the bacteria's surroundings fluctuates considerably, so the vacuoles enable the microbes to endure months of lean times. "They can survive and just wait for new nitrate," says Schulz.

The rest of *T. namibiensis*' interior consists primarily of sulfur globules dispersed throughout a thin layer of cellular fluid, or cytoplasm, that surrounds the vacuole. The overall amount of cytoplasm is roughly normal for a bacterium, notes Schulz. Researchers have previously suggested that the volume of cytoplasm through which a bacterium can efficiently move proteins and other molecules limits its size.

The scientists haven't yet learned how to grow *T. namibiensis* outside its sedimentary environment, and they want to tease out how the bacterium packs in so much nitrate. Schulz is also curious about whether the microbe has multiple sets of genes, since proteins made by a single set of genes would have to travel a considerable distance across the cell.

Schulz and her colleagues, scheduled to return to Namibia next month, hope to uncover new bacterial treasures. "The microbial world is still the least explored of all," notes Teske. —*J. Travis*

Digging bait worms reduces birds' food

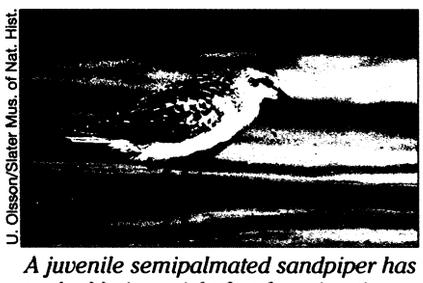
People who collect too many bloodworms for fishing make life tough for migrating shorebirds.

When commercial harvesters dug worms from a mudflat in Canada's Bay of Fundy, the disruption destroyed other creatures that semipalmated sandpipers eat, researchers report in the April CONSERVATION BIOLOGY.

Trouble in this bay could have a huge impact on the species, warn coauthors Philippa C.F. Shepherd of Simon Fraser University in Burnaby, British Columbia, and J. Sherman Boates of Acadia University in Wolfville, Nova Scotia. At least half the semipalmated sandpipers in the world—some estimates say 95 percent—gather at the Bay of Fundy as their last-chance feeding ground before a southward, nonstop migration of some 2,400 kilometers.

"Whenever you have an organism that's concentrated in one place, it's vulnerable," Boates frets.

New Englanders have long harvested the worms *Glycera dibranchiata* to sell to fishing enthusiasts. As U.S. bloodworm supplies dwindled, collecting moved north. In 1985, harvests began in the Bay of Fundy's sandpiper habitat.



U. Olsson/Slater Mus. of Nat. Hist.

A juvenile semipalmated sandpiper has to double its weight fast for migration.

Shepherd studied a mudflat evenly populated by the birds' main prey, the mud shrimp *Corophium volutator*. After just one season of commercial worm digging, the harvested section had only 62 percent as many mud shrimp as the intact mud did.

By counting birds' pecks and captures, Shepherd found that the sandpipers had to work harder when they strayed onto the digging grounds. She points out that the birds have only 10 days to 2 weeks to gain 20 grams of fat, approximately doubling their weight.

The idea that the bait frenzy could ruin the Bay had occurred to some of the harvesters. "When I first started, it was every man for himself," remembers Arthur Purchase of Kentville, Nova Scotia. After he heard about the research's preliminary results, he helped form the Kings County Bait Fishermen's Association. Members leave parts of flats undug and harvest only mature worms.

Sandpipers still funnel through the Bay in relatively good numbers, says Peter Hicklin of Environment Canada's Canadian Wildlife Service in Sackville, New Brunswick. He praises Shepherd and Boates for giving credibility to the ongoing conservation effort to protect delicate ecosystems and prevent worm overharvesting.

"What happened in the New England states won't happen here because of this work," Hicklin says. —*S. Milius*