A Giant Microbe: *Thiomargarita*

While microorganisms are by definition small, they come in many sizes and shapes. Viruses are the smallest microorganisms, followed by bacteria. Dr. Heide Schulz of the Max Planck Institute for Marine Microbiology recently discovered a giant bacterium in the sea sediment off the coast of Namibia. She found cells of this bacterium as large as ¾ mm in diameter, although most are 0.1-0.3 mm wide. This is about 100 times bigger than the average bacterial cell. She named the organism *Thiomargarita namibiensis*, which means, "sulfur pearl of Namibia."

The sea sediment off the coast of Namibia is rich in nutrients, but is not hospitable to most living organisms. Both the lack of oxygen and the high concentrations of hydrogen sulfide, which is toxic to most animals, make this an extreme environment. *Thiomargarita* grows by using nitrate from seawater to oxidize the hydrogen sulfide that is produced in the ocean sediment. The sulfide is oxidized first to sulfur granules that are stored inside the cell. The sulfur granules inside the cell look white because they reflect light. Since the cells are held together in a chain by a sheath that surrounds all the cells, they give an impression of a string of tiny pearls; hence, the name that means, "sulfur pearl of Namibia."

In order to oxidize sulfide the bacterial cells store nitrate from seawater in a large vacuole that almost completely fills these giant cells. The nitrate in the vacuole is 10,000 times more concentrated than it is in seawater. The storage of nitrate allows these bacteria to further oxidize sulfur to sulfate, a process that provides energy to the cells. The ability of these bacteria to couple the reduction of nitrate to the oxidation of sulfide provides them with an energy source that few other bacteria can use.

Thiomargarita namibiensis thrive in large numbers in the unstable sea floor, which is normally rich in sulfide but poor in nitrate. When storms churn the water sending a supply of nitrate-rich water into the sediment, the bacteria take in the nitrate and store it in the vacuole. These cells can survive for months on their internal reserves of nitrate and sulfur, waiting for new nutrient supplies from the ever-changing environment of the sea.

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