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Researchers uncover a ‘treasure trove’ of bioactive molecules in coral reefs

Could the next big antibiotic or cancer therapy be found on the nearest coral reef? Researchers have found that reefs are home to a vast array of previously unknown bioactive metabolites — small biomolecules that have the biotechnological potential to provide the basis for new drugs, and a host of other products.

“There’s a huge treasure trove of genomic potential,” said UC Santa Barbara marine biologist [Rebecca Vega Thurber](#), who was one of the scientists on the 2016-2018 [Tara Pacific](#) expedition, a two-year scientific exploration of the coral reefs of the Pacific Ocean. The expedition team studied 32 archipelagos and took a total of 58,000 samples; it was the first research voyage of this scale to examine these fragile ecosystems.

“The mission was to try to characterize the total biodiversity that existed on these pretty unexplored reefs and open water systems,” said Thurber, who directs UCSB’s Marine Science Institute and is a co-author of a paper in the [journal Nature](#).

The expedition’s research dove into various aspects of the coral reef microbiome — the many, diverse microorganisms that live in and around corals. Thurber’s team was especially interested in the bacteria associated with these reefs.

“In the past, a lot of people looked at bacteria associated with the water, and there’s a lot of really interesting biodiversity associated with the water bacteria, but no one had really taken a deep dive into coral-specific bacteria,” she said.

Taking a genomic approach, which characterizes organisms’ DNA, the researchers examined the bacteria found in two types of stony coral and one type of fire coral. The latter are actually colonial marine organisms more closely related to jellyfish than they are to their stony distant cousins.

The team reconstructed more than 13,000 metagenome-assembled microbial genomes from reef-building coral samples taken during the expedition.

“Ninety percent of what we found had never been found before,” Thurber said. “That’s a total of 3,700 new bacteria we discovered through this approach.” Virtually all of the newly discovered bacteria were specific to their hosts, and not found in the water, she added.

This discovery adds a wealth of possibilities for finding and synthesizing important products, using the bioactive molecules these bacteria produce as a result of their metabolisms. Small compounds the bacteria use to grow, communicate, defend themselves and adapt could be converted for a variety of purposes, from medicine to industry.

“They can be used for drugs, or for industrial purposes,” she pointed out. “They could be used in laundry detergents, or in the development of concrete, for example. If you’re developing new biotechnology materials, these biomolecules are really important for allowing scientists to create new synthetic products.” Among the newly found bacteria they identified were new groups of Acidobacteriota, a ubiquitous and metabolically versatile group that encodes previously unknown enzymology, which could play a promising role in protein engineering.

Furthermore, the team found that the biosynthetic potential of reef-building coral microbiomes rivaled or surpassed that of sponges, a well-known and prolific source of bioactive metabolites. Sponges have been a primary focus for bioactive product discovery, Thurber explained, but corals had never really been explored in terms of their bioactive compounds.

And this is only scratching the surface — the researchers looked at just three species of coral out of hundreds. “What could we discover if we looked at all corals?” she asked.

All of this potential, unfortunately, exists in fragile ecosystems at the front lines of ocean warming, which has already bleached many coral reef systems in the Pacific. “It underscores the importance,” the researchers said, “of conserving coral reefs as vital reservoirs of molecular diversity.”

“Coral reefs are doing really badly right now,” Thurber said. “We really wanted a better understanding of what these creatures are capable of and what we could potentially be missing when they’re destroyed.”

Tags

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