

How a simple aquarium can awake a passion for exploring the changes in coral reef microbiome: Q&A with PhD Candidate, Maite Ghazaleh Bucher



Photo courtesy of Nancy Evelyn

The underwater world, even after so many years of exploring, still contains so many mysteries for scientists to explore. The full breadth of the diversity of animals, plants and microorganisms living under the ocean surface has not been fully discovered. Rapid environmental changes are destroying the opportunity to explore this diversity further in the future. The coral reef ecosystem, with the highest biodiversity on the planet, is extremely sensitive to those changes. Fortunately, there are still people who are fighting for its survival. As a part of our Microbiome research interview series, we spoke with Maite Ghazaleh Bucher, Environmental Health Sciences PhD Candidate from the University of Georgia. Bucher is exploring the environmental influence on microbiome of the corals.

Her passion for ocean life research started with a simple aquarium standing in her family house.

How did you first become interested in science and microbiome research?

I always had an aquarium at home growing up. I could sit in front of it and watch it for hours. Over the years, the aquarium sparked my curiosity for living things underwater.

In high school, I took many biology classes and science electives. As a college student at UNC Chapel Hill, I expanded my curiosity for science in environmental science and oceanography classes. During a semester program at the UNC Institute of Marine Science, I began my adventure studying aquatic microorganisms in Dr. Rachel Nobel's laboratory. At the time, I was studying *Vibrio* bacteria in estuaries, which are ecosystems that border with fresh- and salt-water environments. Since some species of *Vibrio* cause disease, I decided to use my experience in Dr. Nobel's lab to study *Vibrio* bacteria and other microorganisms in salt-water environments, particularly coral reefs. In 2015, I moved to Dr. Erin Lipp's laboratory at University of Georgia to begin my doctorate program studying the microorganisms associated with coral animals.

Can you give a summary of your project?

The focus of my doctorate program is to explore changes in coral microbiomes. Corals are animals excrete calcium carbonate skeletons which build the reefs and support thousands of marine species. Corals, just like human guts, have their own microbiome which can be influenced by variety of different factors. Just like in our guts, the coral microbiome has a huge impact on coral functioning and health. It's important for coral scientists to understand the interactions between the coral and its microorganisms, especially since environmental stress, such as increasing seawater temperatures and pollution, can cause an imbalance of the microbiome. For example, I study how the microbiome associated with corals shifts towards a dysbiotic state when nutrients increase in the seawater. This could potentially increase the corals' chances of getting sick. I also study how the microbiome changes when the coral is diseased.



Photo courtesy of Jason Westritch

Are you working on any other new projects in the field of microbiome research? If so, can you tell us a little about these?

Yes! I am also studying the microbiome of seawater that surrounds the animals. I am working with a team to better understand how seawater microbial communities change when atmospheric Saharan dust concentrations increase in Looe Key Reef, FL. For example, we are investigating how the microorganisms' transcriptomes changes with the dust nutrient influx.

What will be a typical day for you in the lab?

The answer to this question would vary by which phase of my research I am in! Last year, I spent most of my time collecting and processing coral samples. I used the [DNeasy PowerSoil Kit](#) to extract the bacterial DNA from my samples for sequencing. Right now, I'm mostly on the computer using R (statistical software) and my Mac terminal to process the sequences and create figures. This part is actually fun because I get to piece together a microbiome story and determine whether my hypotheses were right or wrong.

What do you find most interesting about your project? What is the most interesting or surprising result you have found?

Coral health is delicate, and the relationship between the coral host, their microbiome, and the environment is critical to maintaining coral health. However, understanding the complex processes that happen within a coral is challenging. Better understanding these processes is very important to increasing coral resilience to environmental stress and disease, and this is the part I find most interesting! Microbes could be good guys, bad guys, neutral members of the communities, manipulators, or opportunists depending on the host and environmental condition – this might not be surprising in other ecosystems, but it is very interesting to coral ecologists! With QIAGEN's products, I'm working at the vanguard of science that seeks to understand how microorganisms shape and contribute to life on earth.

What kind of microbiome research do you perform and how does it impact health and disease? Where do you see this heading in the next five years?

I extract and sequence the 16S ribosomal DNA of microbial communities of coral animals. By determining which members are present in healthy and diseased states (or under stressful environmental conditions), we can understand disease starting points and microbiome succession patterns. Coral disease research is shifting its focus from defining disease as a one pathogen-one disease relationship to understanding disease as a dysbiosis. In the next five years, it will be critical for us to define what healthy and dysbiotic microbiome states actually looks like.

What are your hobbies?

I thoroughly enjoy SCUBA diving, especially since this is how I collect my samples. I also recently became a SCUBA instructor, so I can teach other people about the oceans and show them it's wonders. I enjoy reading about space and going to deep water fitness classes, too. In my free

time, I like going to the movies, watching UNC Chapel Hill basketball games, and going out dancing with my husband, Justin Bucher.



Photo courtesy of Madelyn Roycroft

What are the major challenges you face in your research with regards to sample collection, nucleic acid isolation and data analysis?

One major challenge I face in my everyday research is extracting DNA from coral mucus. In general, extraction of bacterial DNA from coral samples can be difficult because the coral mucus is very rich in PCR inhibitors, which decreases the quality of my DNA during amplification steps and causes low yield.

Which MO BIO or QIAGEN products do you use/have you used in the past and what did you like about the products?

After comparing a few kits, I found that the [DNeasy PowerSoil Kit](#) yielded the cleanest DNA with highest concentrations. The spin columns were efficient, and the protocol only took about two hours per 24 samples.