DEEP-SEA SCIENTIST SPOTLIGHT

JOHN PAUL BALMONTE

MICROBIAL ECOLOGIST & BIOCHEMIST

Dr. JP Balmonte is an Assistant Professor at Lehigh University in Pennsylvania, USA. He earned his dual Bachelor of Science degrees in Molecular Biology and Environmental Systems at the University of California, San Diego and his Masters and PhD from the University of North Caroline at Chapel Hill. He and his research team use integrative methods in microbiology and biochemistry to understand how nutrients move through ecosystems.

What do you study? What kinds of techniques do you use in your research?

Broadly, I study the **biogeography** and **biogeochemical function** (especially carbon cycling) of marine microbial communities. In the context of the deep sea, I try to understand: 1) the function and viability of microbial communities in response to the high pressures of the deep sea, and 2) the differences as well as vertical connectivity of surface and deep ocean microbial communities. To carry out our work, we conduct fieldwork on oceanographic cruises, carry out lab-based incubations – especially with our high-pressure instruments – and perform DNA- and RNA-based analyses using bioinformatics.

What made you want to become a scientist? How did you find your field?

I don't think there was any one factor that made me want to be a scientist. In fact, I don't think this was a career that I had ever envisioned for myself, likely because I didn't know anyone else growing up who was a scientist or a professor. What I have come to appreciate the most about being a scientist is the **curiosity** and inquiry-driven work, as well as the **freedom to pursue new questions and ideas**. I also appreciate that the work relies on intrinsic (rather than extrinsic) motivation, which aligns very well with my values. I also enjoy the dynamic nature of my work: One day I can be sitting in front of a laptop analyzing data or writing a proposal, and the next day I might be packing for a research cruise; then, the next week, I might be working extended hours in a cold room on the back deck of a research vessel, or I could be in a cozy lab facing a fjord. I knew that I was interested in environmental sciences going into college, and I found rocks and minerals to be exquisite. But, when I took my college courses, I found that organisms that respond to environmental stimuli were more my cup of tea. I also learned about molecular biology in college, and the molecular-level/cell-deep perspective was fascinating: organisms are just the product of a bunch of genes that turn on and off in response to the environment. Hence, I ended up double-majoring in environmental science and molecular biology. How did I end up in oceanography? My entry way was a seminar talk that I attended (to get extra credit points for a Microbial Genetics class I was taking at the time) about microbial diversity in hadal trenches by Douglas Bartlett at Scripps. Subsequently, there was an opening in his lab for an undergrad intern, and he and his PhD student eventually became my undergrad lab mentors, and now he and I collaborate on a project that investigates the pressure effects on microbial degradation of organic matter.

ADVICE & LESSONS FROM DR. BALMONTE

Other than your studies in Marine Biology, what life experiences, course work, or other jobs you've held helped you build skills that you use to study the deep oceans?

Working three jobs while pursuing two college degrees. I think the most important skill or lesson that I learned was to **view challenges as temporary and surmountable.** This ability isn't specific to studying the deep sea, but much more broadly applicable to science and research. Stressful moments – for various reasons (such as competing deadlines, lack of experience performing a necessary analysis, juggling many balls) – are inevitable and knowing that we will come out relatively unscathed is self-fulfilling: it helps us **weather the storm**.

Clarifying Misconceptions

I think scientists are perceived by many as scholars sitting in their ivory tower, completely removed from society and reality. On behalf of many scientist friends and colleagues, I'd like to affirm our commitment to the broader public, through knowledge acquisition, dissemination, mentorship, and general education. In addition, the work that we do may sound esoteric, but **in order to understand the way nature works, we have to investigate it in detail**. And only after many years/decades devoted to studying details can we understand the bigger picture.

My Advice to Future Scientists

If mystery, novelty, discovery, and sustainability align with your interests in a career, then deep-sea research could be for you. And I would encourage you to consider specific topics of interest, because the deep sea has a wide range of different habitats that host such unique organisms and processes—from spreading centers, to subduction zones, to abyssal plains. **Rocks, chemistry, organisms, and processes all tell different stories- so there's likely to be something in the deep sea for you.**

For more on Dr. Balmonte's work, visit:
https://www.lehighoceans.org/microbial-ecology

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What was your first science experiment?

Training a rat to perform a behavior on cue. This rat – a class project turned pet – was named Blu, and she was a fast learner. I guess this first experiment laid the foundation for deeply thinking how an organism interacts with its environment.

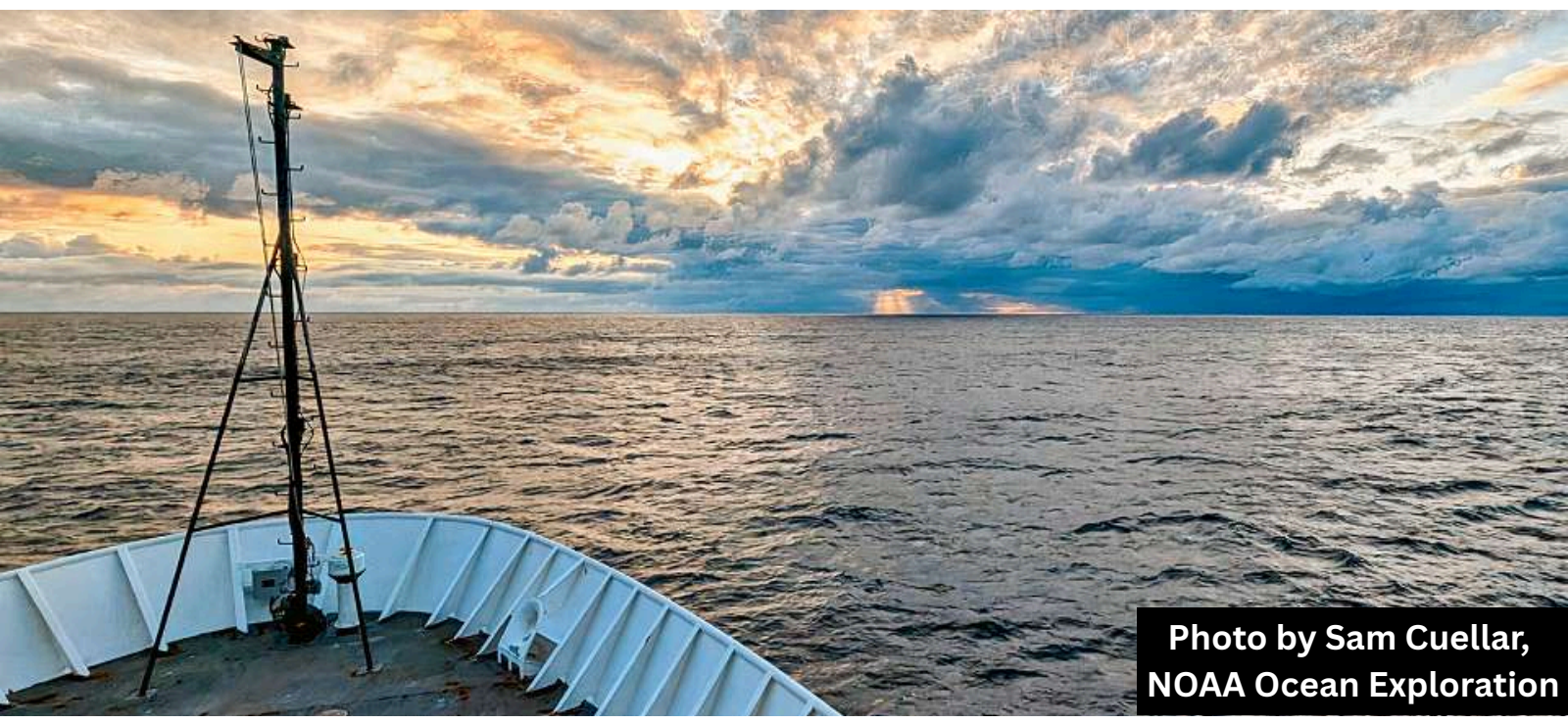

Photo by Sam Cuellar, NOAA Ocean Exploration

Is there a research project, moment of discovery, or science experience that you're most proud of being a part of?

Two come to mind. First, I was proud of the outcome of my first cruise as Chief Scientist last year on R/V Atlantic Explorer. I had just finished my first year as faculty, and to bring two graduate students and an undergraduate from my lab on a research vessel – along with international collaborators – was surreal (and of course challenging). But, we pulled through, and we are now in the midst of analyzing data from that cruise.

Second, I was part of the year-long MOSAiC Arctic Drift Expedition from 2019-2020 (though the cruise leg in which I participated was from June to August 2020). The work happened in the middle of the pandemic, and despite global challenges, we were able to continue the time-series work looking at the year-round variability of the Arctic ecosystem, from physical, chemical, atmospheric, and biological perspectives. Seems like there's a theme that emerges: **the greater the challenge, the greater the feeling of accomplishment after overcoming the challenge.**

Why is it important to study the deep seas? What motivates you in your work?

The foundation of my work is to gain fundamental understanding of microbial systems in various systems: I love knowledge for the pure sake of knowledge and understanding. **Part of living is knowing**, and key to appreciating is understanding. And then there's the undercurrent of knowing and understanding to protect, and also protecting so we still have the opportunity to know and understand. Both are tied to **sustainability: we need to learn how to best protect our environment,** and in many habitats, we need to protect because we haven't yet had the chance to fully understand. That last part is especially true for the deep seas.

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