

Project description: Coral bleaching is the result of heat stress that causes corals to expel their symbiotic algae and subsequently die. One of the newest methods for coral-reef conservation is the development of probiotics to administer to corals. Probiotics are simply beneficial microorganisms. Because little is known about the other microbes—such as bacteria—that exist within corals and whether they contribute to coral health, we are interested in identifying bacteria that exhibit specific functions and properties that may be beneficial to the host. We hypothesize that some bacteria can reduce bleaching and pathogen infection in the host. [REDACTED] will use (1) PCR to screen diverse bacterial isolates ([REDACTED]) for genes that encode for enzymes involved in nitrogen fixation and removal of reactive oxygen species, and (2) growth-inhibition assays to determine the capacity of these bacterial isolates to fight off pathogens. If there are bacterial candidates that exhibit all these capabilities, then they may be promising as probiotics. To test whether these bacterial candidates benefit the host, [REDACTED] will subsequently select a subset (~3) to inoculate into [REDACTED] and assess its impacts on bleaching. This is done through quantification of algal symbionts remaining in the host after exposure to heat stress and pathogens. This project is suitable for [REDACTED] for multiple reasons. The amount of time he had previously dedicated to course-based research was only ~100 hours. He had learned how to do PCR, use a hemocytometer, and conduct a protein assay, but he did not have the opportunity to put these lab skills into a complete story in a hypothesis-driven manner. This BURST experience will allow him to do that, with straightforward and achievable objectives. He will develop new skills in microbial analyses, interpret real results, and articulate how this research solves a global problem.

Student mentorship: My mentoring philosophy involves building genuine connections with my mentees by providing them with thoughtful guidance, fostering a growth mindset, and holding them to high standards. I have an individualized mentoring plan for each student after (1) getting to know them through a series of frequent conversations (to obtain a thorough comprehension of their educational/career goals) and (2) assessing their skill set, strengths and weaknesses, and their academic journey to date (noting any gaps in equity and inclusion). I have known [REDACTED] since August 2023; through a class that meets 8 hours a week and visits to office hours, I have had ample time to know him well. He had no opportunities to do research in his earlier years, and BURST is his last and only chance to do original research as an undergraduate. [REDACTED] are still underrepresented in environmental microbiology specifically. He sees this project as an avenue in creating change to save the environment. [REDACTED] is very bright, but his current lab skills and grasp on concepts are still disparate; he has enormous potential to put the pieces together if he gets a chance to build a story out of these disparate skills in a cohesive project. Regularly writing and speaking about his project will enhance his scientific-communication skills. With an interest in graduate studies and becoming an environmental microbiologist, he will also receive guidance on how to seek out potential graduate advisors, evaluate and apply to different graduate programs. To encourage him to constantly make connections between his project and long-term goals, I have factored in time for him to reflect on this through written deliverables throughout the summer. This is a metacognition strategy for him to convey the bigger purpose of his research, tell his story, and build confidence.

Detailed plan: The training I will provide to [REDACTED] takes on a growth trajectory towards independence. I will spend less time on skills he already has from previous course work (e.g., PCR) and more time developing skills he has yet to master (e.g., growth-inhibition assays). His

active role in experimental design involves drafting up the proper treatments, controls, sample sizes, and standard variables while I provide feedback on them. He will have more autonomy as we move into the second half of the summer in which he will run his experiments on his own and consult me as needed. We will have daily facetime and weekly meetings, alternating between one-on-one and lab-group meetings. Each meeting has a purpose such as troubleshooting experiments, brainstorming next steps, interpreting data, discussing journal papers, and peer-evaluating other student work. [REDACTED] will attend the AAAS meeting in June 2024 to learn and network. At the end of summer, [REDACTED] will present his research progress to our lab group and make plans to present at SACNAS in October 2024 for him to see that representation matters.