Johns Hopkins University

Department of Biology Seminar Series

Thursdays, 4:00pm

For more information go to: *https://bio.jhu.edu/events*

Zoom link: *https://zoom.us/j/97925356454?pwd=bjNuTlY1dU9BcXcvRFdleis2TVNadz09*

Mudd Room 100 - October 13th, 2022

Phillip Cleves

Carnegie Institution for Science

Department of Embryology

Host: Mark Van Doren

"Molecular and cellular bases of coral symbiosis and its breakdown"

The symbiosis between corals and dinoflagellate algae is essential to the energetic requirements of coral-reef ecosystems. However, coral reefs are in danger due to elevated ocean temperatures and other stresses that lead to the breakdown of this symbiosis and coral "bleaching". Despite the importance of coral reefs, the molecular basis of how corals maintain a healthy symbiosis and avoid bleaching is poorly understood, in part because of the lack of a tractable genetic model system. The small anemone Aiptasia is symbiotic with algal strains like those in reef-building corals but has many experimental advantages, making it an attractive laboratory model for cnidarian symbiosis. To explore the transcriptional basis of heat-induced bleaching, we used RNAseq to identify genes that are differentially expressed during a time course of heat stress of symbiotic and aposymbiotic Aiptasia strains. We observed a strong upregulation of hundreds of genes at times long before bleaching begins in symbiotic anemones. The putative promoters of these early stress-response genes are enriched for binding sites for the NFkB and HSF1 transcription factors, suggesting that many of these genes share core transcriptional control. The overall expression patterns were similar between the symbiotic and aposymbiotic anemones, indicating that many of the expression changes are not specific to the presence of the algae. Nonetheless, reducing HSF1 activity with a pharmacological inhibitor resulted in more severe bleaching, suggesting that this symbiont-independent stress response is protective against bleaching.

Genetic tools are needed to allow rigorous functional testing of the roles of candidate genes in symbiosis and bleaching. Recently, we have developed methods for knocking down and overexpressing genes of interest in Aiptasia. Meanwhile, we have successfully used the CRISPR/Cas9 technology to create genetic changes in embryos of the coral *Acropora millepora*. We used this technology to knock out HSF1 and demonstrated its role in coral heat tolerance. Through the establishment of both gain-of-function and loss-of-function methods in both Aiptasia and corals, it will be possible to exploit the year-round spawning of Aiptasia to perform initial tests of gene function in cnidarian-algal symbiosis and then further test the discoveries made using similar technologies in corals.