Wide-scale climatic changes are projected for the world’s oceans over the next century, fundamentally changing the habitat and environment for marine organisms. Environmental stressors rarely occur in isolation, and exposure to a novel environmental stress can deplete an invertebrate’s ability to launch an effective defense against a second stressor. Among the projected changes, ocean acidification is expected to be one of the more dramatic alterations. Marine invertebrates are adversely affected by ocean acidification in terms of primary effects and in how they are able to cope with subsequent stressors. Many invertebrates have physiological mechanisms to acclimate to ocean acidification to a certain degree, but the response can be energetically costly. By assessing an organism’s response to ocean acidification at the molecular level – RNA and protein – we can better understand the underpinnings of the stress response and the potential physiological impacts of a pervasive environmental threat.

The objective of this study is to elucidate the physiological effects of ocean acidification in the Pacific oyster, *Crassostrea gigas*, and, specifically, how ocean acidification affects the response to a second stressor. Juvenile *C. gigas*, were exposed to a range of *p*CO2 (400-1400 µatm) for 1 month. After exposure to ocean acidification, oysters were challenged with either mechanical or heat stress. The effects of ocean acidification alone and in combination with mechanical stress will be assessed using transcriptomics and proteomics approaches. Shotgun proteome sequencing using tandem mass spectrometry will be used to compare global proteomic changes across treatments. Ideally, 4 biological replicates from 4 treatments will be compared (16 samples): control, control + mechanical stress, highest *p*CO2, highest *p*CO2 + mechanical stress. Two technical replicates will also be run for each sample. The results from this experiment will shed light on how exposure to a primary stressor (ocean acidification) can affect an organism’s ability to launch an effective physiological response to a secondary stressor (mechanical stress).