The Epigenetic Effects of Climate Change on Aiptasia

Wray, Shelby (School: North Carolina School of Science and Mathematics)

Acute temperature fluctuations due to climate change pose a threat to many aquatic species, yet it remains unknown how adaptive aquatic life is to such changes. Recent studies have demonstrated that DNA methylation patterns - typically associated with repressing gene expression - can be heritable and confer evolutionary advantages. Using the sea anemone, Aiptasia, it is hypothesized that methylation levels in Aiptasia will shift and physical health decline in response to heat stress because it is a significant external stressor. Aiptasia was used as the model aquatic organism because of their lab practicality and significance to the health of aquatic ecosystems. The first goal was to recapitulate the effects of climate change on aquatic life. Heat stress was applied (~ 27 ºC) to Aiptasia for 4 weeks and anemone health was measured via the CoralWatch Health Chart color matching system as well as mortality. Anemone health significantly decreased in higher temperatures and mortality rates increased, confirming the aquatic model of climate change. Next, global DNA methylation was measured on the genomic DNA of the surviving Aiptasia via colorimetric assay. Results showed that DNA methylation does not significantly change due to heat stress, suggesting that only a few genes change methylation under heat stress. One gene in particular, MAPK8IP1, was analyzed for methylation levels via McrBC restriction enzyme digest, PCR, and a gel electrophoresis, and was unmethylated in all groups. Determining whether stress alters the epigenome of aquatic life is essential to understanding the genetic effects of climate change on this vital ecosystem. Such research may provide insight into detecting or generating heat-resistant organisms as an intervention for climate change.