CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Angela N. Pogson

Project Number

S2211

Project Title

The Relationship between Anemone Color and the Abundance and Diversity of Their Endosymbionts

Abstract

Objectives/Goals

Anemones and other cnidarians contain microscopic photosynthetic endosymbionts called zooxanthellae, with which they have a symbiotic relationship. Anemones are also incredibly variable in their coloration patterns. I investigated if there was a relationship between the color of anemones (Anthopleura xanthogrammica and A. sola) and the abundance and diversity of their endosymbionts (Symbiodinium muscatinei). Prior to my study, marine biologists assumed that the coloration of anemones was not related to endosymbionts but by the production of their own pigments and green fluorescent proteins.

Methods/Materials

I sampled tentacles from 42 anemones at Davenport Landing, CA and recorded their size and coloration. I extracted total DNA and constructed PCR primers that amplified regions of the mitochondrial cytochrome b (cytb) gene from both endosymbionts and anemones. PCR products were sequenced, edited using the APe program, and aligned using CLUSTAL. I also used the MEGA5 program to build phylogenetic trees. I also estimated the ratio of anemone to symbiont DNA using quantitative PCR. I tested if the relative abundance of endosymbionts to host differed between five anemone color groups (ranging from pale to dark green) using SYSTAT.

Results

I found no genetic differences between the S. muscatinei cytb sequences (N = 15), or between the A. xanthogrammica (N = 5) or A. sola (N = 17) sequences. The two anemone species were very similar, differing by only a single mutation at the cytb gene. I was able to quantify the relative concentrations of endosymbiont to host DNA using quantitative PCR in 26 animals. I observed significant differences in the relative concentrations of endosymbionts between five anemone color groups ($F(4, 21) = 5.103$, $P = 0.005$). This was a result of cream-colored anemones having 23% less endosymbionts than the darkest green/gray anemones.

Conclusions/Discussion

I found a surprising lack of genetic diversity in both endosymbionts and anemones. This suggests that there is no cryptic diversity within endosymbionts as found, for example, in tropical corals. However, I did find that the abundance of endosymbionts differed between anemones from different color groups. This suggests that the abundance of the endosymbionts is related to color but indirectly through different levels of sun exposure and the production of the anemone#s own pigments.

Summary Statement

I investigated if the diversity and abundance of an anemone#s endosymbionts was related to the color of the host.

Help Received

I used the Camps lab at UCSC under the supervision of Dave Alexander and the Pogson lab at UCSC under the supervision of Grant Pogson