Charactrization of Fluorescent Proteins In Marine Organisms

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LONG-TERM GOAL

My principal goal is to understand the function, evolution, and taxonomic distribution of flourescent proteins in marine organisms. Several hypotheses have been postulated regarding the function of these ubiquitous proteins including protection from the damaging effects of ultraviolet radiation and the augmentation of photosynthesis by fluorescent resonance energy transfer. I hope to be able to ascertain the function of these proteins and provide new data to answer these important questions.

OBJECTIVES

This project is directed at understanding the optical properties of coastal benthic communities in general, and in particular, coral reefs. Coral reefs have been a focus of study on fluorescent proteins and almost all corals examined to date contain one or more of these compounds. The role of green fluorescent protein (GFP) in the ecology of marine organisms and the potential commercial utility of these, and other, fluorescent proteins is presently undergoing a renaissance of interest as more fluorescent proteins are identified in the marine environment. The scientific objectives of my project are:

1. to make comprehensive taxonomic collection of marine organisms in tropical, temperate, polar, and deep sea environments to examine various taxa for fluorescent proteins.
2. to understand the evolutionary relationship between fluorescent proteins of different taxa
3. to understand the function of fluorescent proteins in those taxa expressing them
4. to understand what environmental variables affect the expression of fluorescent proteins in those taxa expressing them

APPROACH

The approach is is similar to that taken for two scleractinian corals from the Bahamas; *Montastraea faveolata* and *Montastraea cavernosa*. Collections are made and samples archived for biophysical and molecular analyses of the fluorescent proteins. Differential expression of these proteins under different environmental conditions will also be examined (see Fig. 1 for example of different GFP concentrations with depth).

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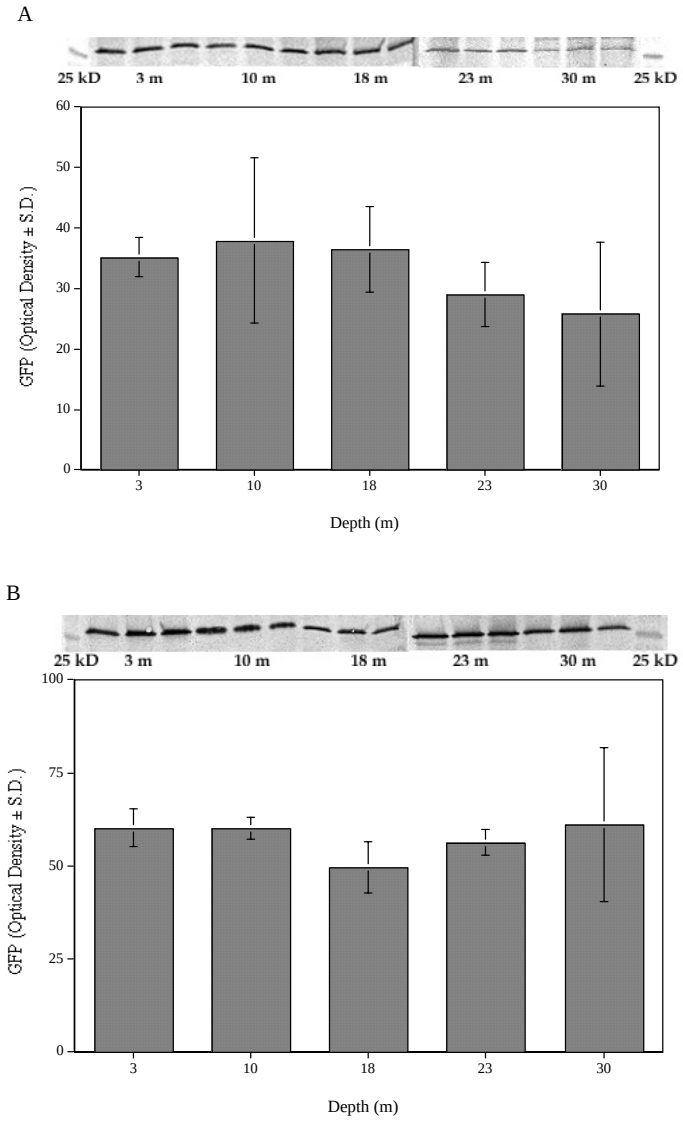

Figure 1. Bathymetric westerns against GFP for Montastraea faveolata and Montastraea cavernosa. A) Optical density (± SD) of immunoblots for GFP from field samples of M. faveolata. B) Optical density (± SD) of immunoblots for GFP from field samples of M. cavernosa. No significant effect of depth was detected for either species.

WORK COMPLETED

Extensive collections of marine organisms have been made in the Bahamas down to a depth of 300 fsw. We have also just completed a cruise aboard the Seward Johnson II using the Johnson Sea-Link II for fluorescence discovery in the deep ocean to depths >2000 fsw. Additional collections have been made in the Gulf of Maine and Hawaii and are planned for Antarctica, hydrothermal vents, and the Pacific Northwest. We have begun to isolate RNA from these samples to synthesize cDNA and eventually sequence fluorescent protein genes.

RESULTS
Our most recent cruise using the submersible Johnson Sea-Link II has shown that GFP-like fluorescent proteins are present in deep-sea cnidarians, mainly cup corals and tube dwelling sea anemones. In the absence of any available solar radiation explaining the presence of these proteins in this location will be an important area of research in the immediate future. I will also be going to the Antarctic again to contiue our fluorescence discovery in that unique habitat.

IMPACT/APPLICATIONS
In addition to understanding the evolution and function of these proteins there is the possibility of discovering new fluorescent proteins with spectral properties desired by the biotechnology community and therefore the potential for commercialization exists.

TRANSITIONS
No data from this project is presently being used by others.

RELATED PROJECTS
Charlie Mazel-ONR, CoBOP

PUBLICATIONS
None