New fluorescent proteins from the sea

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Project Summary

The research on the fluorescent proteins (FP) in marine organisms is a transverse field, being of great interest for technological and molecular aspects, for the study of cellular processes, for the development of techniques for acquisition and analysis of imaging data. In addition, the biology and ecology of organisms with luminescent and fluorescent bodies are still largely unexplored. Furthermore, while the already known FPs are increasingly fine-tuned, for example to make them more stable and bright and with a broader spectrum of light, the number of FP available for analytical applications is still too low, leaving many spectral classes of FPs yet to be identified. It is noteworthy that the bulk of information about FPs comes from the Cnidaria phylum. Therefore, it is very active the search for new proteins expressed in different marine organisms. Here we propose to enlarge the scenario and extend the search to phylogenetically distant organisms with the aim to identify FPs with "fluorescence characteristics" completely and/or slightly different from those already known. The study will exploit the painted expertises of the Stazione Zoologica Anton Dohrn and will include unicellular and multicellular planktonic organisms (e.g. tunicates, diatoms, copepods, ctenophors, scyphozoans), benthic (e.g., macroalgae, sea slugs, anthozoans, tunicates) and nektonic (fish) species.

PhD Project Description

The biofluorescence is a special case of luminescence that occurs when a specific wavelength of light is absorbed by fluorescent proteins (FP) that convert it into less energy with longer wavelengths, producing a different color light. The discovery and cloning of green fluorescent protein (GFP) have led to a paradigm shift in the life sciences: the fluorescent proteins are a crucial means of making visible otherwise invisible processes. The centrality of this tool is also demonstrated by the Nobel Prize for chemistry awarded in 2008 to Shimomura, Chalfie and Tsien for the discovery and refinement of the GFP. The fluorescent proteins are used in a variety of contexts ranging from simple vital visualization of cell morphology, to their engineering to create optical probes for the study of intracellular parameters.

A wide variety of marine organisms is biofluorescent. The bio fluorescence has an important role in intra- and inter-species communication, in meetings for reproductive purposes, for the predator-prey interactions, on extended vertical migration of plankton and, ultimately, with effects on the trophic and biogeochemical flows at sea. Where it was believed that only certain marine organisms, such as corals and jellyfish, they had the ability to emit light into fluorescence, it was recently discovered that far more numerous are the groups of animals and plants that own this property. In some organisms, such as jellyfish *Aequorea*, biofluorescence and bioluminescence coexist.