A RANGE OF PHOTOTRANSFORMATION PROPERTIES OF NOVEL GFP-TYPE PROTEINS USEFUL IN LIVE CELL BIO-IMAGING APPLICATIONS.

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Key words: GFP-like proteins, FRET, photoconversion, live cell imaging, coral.

In recent years, a variety of Green Fluorescent Protein (GFP)-like pigments have been discovered from corals and other marine organisms[1]. They are widely used to expand the range of available GFP-type proteins in imaging applications, such as *in vivo* markers for gene expression and protein localization studies, FRET-based (Förster resonance energy transfer) multicolor imaging and biosensors. We investigated micro-cellular and optical properties of the diverse GFP-like proteins in corals of the Great Barrier Reef, Australia. Intra-cellularly, they were found organized into spectral donor-acceptor pairs tuned for energy transfer via radiative and FRET mechanisms[2,3]. The study identified a range of photoactivatable phenomena[4,5] of GFP-like proteins in live cells that included four main types of light induced transformations: (1) photoactivation – the rapid intensification of fluorescence upon irradiation by certain wavelengths; (2) "greening" - red to green spectral transition following irradiation; (3) "reddening" - green to red color conversion upon irradiation by UVA and multi-photon wavelengths; and (4) protein "kindling", during which low fluorescent, blue-purple chromophoric proteins attained red fluorescence following irradiation by green light. The widespread distribution of these proteins in corals[2], the tuning for energy transfer and their unique phototransforming spectral properties suggest that they perform important functions in marine organisms. We have shown that one function is related to photoprotection. Other biological roles of GFPs in marine organisms are as yet unknown but they may be related to photosensitivity or amelioration of oxidative stress. The discovery of GFP-like proteins with novel optical properties expands the scope of the available bio-imaging techniques for studying cellular and protein dynamics and in their applications in biotechnology.

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