Calcium-regulated photoproteins of ctenophores

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Abstract

Calcium-regulated photoproteins are found in and are responsible for the light emission of a variety of bioluminescent marine organisms. The best known and studied of these are aequorin and obelin from *Aequorea victoria* and *Obelia longissima*, respectively. All photoproteins are single-chain polypeptide globular proteins of approx. 22 kDa having a hydrophobic cavity in which a peroxy-substituted coelenterazine is tightly bound. Thus, photoprotein can be regarded as a luciferase containing a stabilized reaction intermediate. Bioluminescence is triggered on adding calcium ions, the binding of which to protein induces oxidative decarboxylation of 2-hydroperoxycoelenterazine with generation of the protein-bound product, coelenteramide, in its excited (fluorescent) state. Excited coelenteramide relaxes to the ground state with the production of blue light, a broad spectrum with a maximum within the range 465-495 nm.

Ctenophores are found in oceans worldwide and practically all species are bioluminescent. The bright bioluminescence of ctenophores is also determined by calcium-regulated photoproteins. These photoproteins are functionally identical to and share many properties with jellyfish photoproteins. However, in contrast to hydromedusan photoproteins, the ctenophore photoproteins are extremely sensitive to light, i.e. lose the ability to bioluminescence on exposure to light over the entire absorption spectrum and this inactivation cannot be reversed by keeping the inactivated protein in the dark. Recently, cDNA genes encoding several ctenophore photoproteins have been cloned. These are berovin from *Beroe abyssicola*, bolinopsin from *Bolinopsis infundibulum*, mnemiopsin from *Mnemiopsis leidyi*, and the photoprotein from *Bathocyroe foster*. This step has provided significant progress in studying these photoproteins. Here the advances in the studies of ctenophore photoproteins are discussed.

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