Photoreceptors in the cnidarian hosts allow symbiotic corals to sense blue moonlight

Gorbunov, Maxim Y., Paul G. Falkowski

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ABSTRACT: In many species of symbiotic corals, spawning occurs synchronously several nights after the full moon. This process is correlated with the level of lunar irradiance, but the mechanism by which these cnidarian/zooxanthellate symbioses can detect such low levels of light remains unknown. Here we report the first biophysical evidence that the host animal exhibits extraordinarily sensitive photoreception in the blue region of the spectrum. Using a high-resolution laser-induced signal to detect tentacle scattering, we measured the effect of low irradiance on the contraction of polyps in the corals that normally have their tentacles extended in darkness. Similar to most deep-sea invertebrates, the action spectra of coral photoreception reveal a maximum sensitivity in the blue, at 480 nm, with a spectral band width (at full-width half-maximum) of ca. 110 nm. The spectra closely overlap the maximal transparency of oligotrophic tropical waters, thus optimizing the perception of low light at depth. The detected threshold of photoreception sensitivity is ~1.2 X 10^{15} quanta m^{-2} s^{-1} in the blue region. This makes corals capable of sensing the blue portion of lunar irradiance, as evidenced from the recorded slight contractions of polyp tentacles under variations in moonlight intensity.