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**Extra-retinal photoreceptors and their regulation in the brain of reef fishes**

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It is known that most non-mammalian vertebrates have extra-retinal photoreceptors in the pineal gland and deep brain. They are believed to be essential for physiological regulation of daily and annual events such as reproduction and migration. Although photoperiodic response in photoreceptors in the retina have been extensively confirmed in many animals, it is not still clear how the extra-retinal photoreceptors perceive and transduce photoperiodic signals in order to exert rhythmic activities of fish. The aim of the present study was to examine involvement of the extra-retinal photoreceptors in exertion of rhythmic activities in the orange-spotted spinefoot *Siganus guttatus* and the sapphire devil *Chrysiptera cyanea*, which are common species in coral reefs. Analyses by real-time quantitative RT-PCR revealed that the mRNA of exo-rhodopsin and vertebrate ancient long (VAL) opsin was highly expressed in the brain during the dark phase, when the fish were reared under light-dark (LD12:12) conditions. A similar pattern of exo-rhodopsin mRNA expression was observed in the brain of the fish reared under constant darkness conditions, suggesting existence of circadian regulation. When the fish was exposed to 1-hr light during nighttime, the expression of the exo-rhodopsin mRNA significantly decreased. In addition, rearing the fish under light regimes of LD10:14, LD12:12 and LD14:10 for 30 days seemed to alter expression patterns of exo-rhodopsin mRNA. Exo-rhodopsin mRNA was also expressed in the pineal gland. This result suggests that its expression is regulated by an endogenous clock and entrained to photoperiodic signals.