Opsin 5 as a deep brain photoreceptive molecule to regulate seasonal reproduction.

Yusuke Nakane[1], Keisuke Ikegami[1], Hiroko Ono[1], Naoyuki Yamamoto[1], Shosei Yoshida[2], Kanjun Hirunagi[3], Shizufumi Ebihara[1], Yoshihiro Kubo[4], and Takashi Yoshimura[1]

[1]Graduate School of Bioagricultural Sciences, Nagoya University, [2]Division of Germ Cell Biology, National Institute for Basic Biology, [3]Nagoya University Museum, [4]Division of Biophysics and Neurobiology, National Institute for Physiological Sciences, Japan.

Non-mammalian vertebrates detect light through deep brain photoreceptors that lie outside of the retina and pineal organ to regulate photoperiodism such as seasonal reproduction. however, the identity of these photoreceptors has remained unknown. Here we suggest that opsin 5 is one of the deep brain photoreceptive molecules in Japanese quail (*Coturnix japonica*), an excellent model to study seasonal reproduction. Comprehensive expression analysis of the opsin superfamily revealed the expression of the opsin 5 gene in the paraventricular organ (PVO), an area long believed to be capable of photoreception. Opsin 5-immunoreactivity was observed not only in the cell bodies of the PVO but also in the fibers extending to the external zone of the median eminence, adjacent to the pars tuberalis (PT) of the pituitary gland. The PT is known as a key organ for the relay of photoperiodic information. Heterologous expression of opsin 5 in *Xenopus* oocytes resulted in light-dependent activation of membrane currents and its action spectrum showed high sensitivity at short wavelengths. In addition, we found that short-wavelength light induced the development of gonads in eye-patched, pinealectomized quail. Thus, opsin 5 is proposed to be one of the deep brain photoreceptive molecules that regulate seasonal reproduction in birds.