Non-Visual Photoreception in Vertebrates

Daisuke Kojima
Department of Biophysics and Biochemistry, Graduate School of Science, The University of Tokyo, Japan; PRESTO, Japan Science and Technology Agency, Japan.

Vertebrates have photoreceptor cells not only in the retina but also in the extra-retinal tissues such as pineal complex, deep brain and skin. These extra-retinal photoreceptor cells as well as non-rod non-cone retinal photoreceptor cells are thought to play important roles in a variety of light-dependent, "non-visual" physiological responses including body color changes. In the first part of my talk, I introduce our recent work on light-dependent body color change of teleosts, which is mediated by ocular photoreception though it has been still unknown which photoreceptor cells in the eyes are responsible for this response. To identify the photoreceptor cells regulating this behavior, we employed the nitroreductase (NTR)-metronidazole (Mtz) system, a recently developed technique for the conditionally targeted cell ablation in zebrafish. A newly established transgenic zebrafish line expressing NTR protein in rods and cones was treated with Mtz, a prodrug substrate for NTR, resulting in specific cell death of these photoreceptor cells. The rod-less, cone-less larvae exhibited no significant difference in the light-induced body color change from the intact animals. The result strongly suggested that this light-induced behavior should be mediated non-rod non-cone retinal photoreceptor neurons, possibly expressing non-visual opsins. In the second part, I will present our recent finding on a mammalian non-visual opsin, which could mediate UV photoreception in mammalian species including human beings.